Texas High Plains Vegetable & Weed Control Research Program

Research Summary Reports

2006

Texas A & M University

Department of Horticultural Sciences
Texas Cooperative Extension &
Texas Agricultural Experiment Station

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INTRODUCTION:

The High Plains Vegetable & Weed Control Research Program is located at the Texas A & M University Research & Extension Center in Lubbock. The primary objective of the program is to evaluate herbicides and other weed control options for vegetables and field-grown ornamentals produced on the High Plains of Texas, as well as leafy green vegetables in the Wintergarden Region of Texas, and to assist with vegetable research in cooperation with other universities through the United States.

This program would not be as successful without the support of many support staff, private companies and other volunteers. Many thanks to: Alisa K. Petty, Research Technician with Texas Agricultural Experiment Station at Lubbock and to summer assistants Dan Fouts, Mark McCallister, Michael Adams and Heath Spear for their assistance with field work and data collection during the season and to Texas Tech Univeristy graduate student Amy Thiel Jones for her work on the research project on guar crop rotation and green manuring. The assistance and expertise of Debbie Kline and Roy Riddle with vegetable trials conducted at the Carolyn Lanier Youth Farm supported by the South Plains Food Bank is greatly appreciated. Also, many thanks to Wendy Durrett, Extension Secretary for her office support.

Note:

This report is not intended as a book of recommendations for using unregistered pesticides on vegetables or field-grown ornamental crops in Texas.

***Growers should always read and follow label directions of any pesticides or other chemicals used in production of vegetables and ornamentals*.**

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High Plains Vegetable Website*:* http://lubbock.tamu.edu/horticulture/

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CHEMICALS USED FOR HERBICIDE TRIALS

PRODUCT	CHEMISTRY	COMPANY
Alanap-L 2EC	Naptalam	Chemtura
Barricade 4FL	Prodiamine	Syngenta
Basagran 4L	Bentazon	UAP
Bolero 8EC	Thiobencarb	Valent
Buctril 4EC	Bromoxynil	Bayer Cropsciences
Callisto 4SC	Mesotrione	Syngenta
Caparol 4L	Prometryn	Syngenta
Chateau 51WDG	Flumioxazin	Valent
Cobra 2EC	Lactofen	Valent
Command 3ME	Clomazone	FMC
Dacthal 6F	DCPA	AMVAC
Define 4SC	Flufenacet	Bayer Cropsciences
Dimension T & O 1EC	Dithiopyr	Dow AgroSciences
Dinamic 70G	Amicarbazone	Arvesta
Dual Magnum 7.62E	s-Metolachlor	Syngenta
Envoke 75WDG	Trifloxysulfuron	Syngenta
Eptam 7E	EPTC	Gowan
Eradicane 6.7-E	EPTC + safeners	Gowan
Everest 70WG	Flucarbazone-sodium	Arvesta
Exceed 57WG	Prosulfuron	Syngenta
Far-Go 4E	Triallate	Gowan
FireStorm 3E	Gramoxone	Chemtura
Gallery 75DF	Isoxaben	Dow AgroSciences
Goal 2XL	Oxyfluorfen	Dow AgroSciences
GoalTender 4L	Oxyfluorfen	Dow AgroSciences
Gramoxone Max 3EC	Paraquat	Syngenta
Gramoxone Inteon 2E	Paraquat	Syngenta
Grasp 2SC (GF-443)	Penoxsulam	Dow AgroSciences
Guardsman Max	Dimethenamid-p + Atrazine	BASF
KIH-485 60WDG		Kumai Chem. Ind.
Kerb 50W	Pronamide	Dow AgroSciences
Linex 50DF	Linuron	Griffin
Mandate 2EC	Thiazopyr	Dow AgroSciences
Matrix 25DF	Rimsulfuron	Dupont
Nortron 4SC	Ethofumesate	Bayer Cropsciences
Option 35WG	Foramsulfuon	Bayer Cropsciences
Outlook 6E	Dimethenamid-P	BASF
Paramount 75DF	Quinclorac	BASF
Poast 1.5EC	Sethoxydim	Mico Flo
Prefar 4E	Bensulide	Gowan
Progress 1.8EC	Etho. + Phen. + Desmed.	Bayer Cropsciences
Prowl H20 (3.8 ACS)	Pendimethalin	BASF
Pyramin 65DF	Pyrazon	Mico Flo
Python 80WDG	Flumetsulam	Dow AgroSciences
Raptor 1AS	Imazamox	BASF
Regiment 80WP	Bispyribac-sodium	Valent
Reflex 2L	Fomesafen	Syngenta
Rely 1EC	Glufosinate-ammonium	Bayer Cropsciences

PRODUCT	CHEMISTRY	COMPANY
Ro-Neet 6E	Cycloate	Helms-Agro
Roundup Original Max	Glyphosate	Monsanto
Sandea 75WDG	Halosulfuron	Gowan
Select 2EC	Clethodim	Valent
Sencor 75DF	Metribuzin	Bayer Cropsciences
Solicam DF	Norflurazon	Syngenta
Spartan 75WDG	Sulfentrazone	FMC
Spin-Aid 1.3EC	Phenmedipham	Bayer Cropsciences
Starane 1.5EC	Fluroxypyr	Dow AgroSciences
Stinger 3EC	Clopyralid	Dow AgroSciences
Strategy	Ethalfluralin + Clomazone	UAP
Suprend 80WDG	Prometryn + Trifloxysulfuron	Syngenta
Surflan A.S.	Oryzalin	Dow AgroSciences
Targa	Quizalafop	Gowan
Target 6Plus	MCPA	
Thistrol 2EC	MCPB	Nu-Farm Americas
UltraBlazer 2EC	Acifluorfen-sodium	BASF
UpBeet 50DF	Triflusulfuron-methyl	Dupont
V-10142 75WDG	Imazosulfuron	Valent
V-10146 3.3SC	Unknown	Valent
Valor 51WDG	Flumioxazin	Valent
Valor SX 51WDG	Flumioxazin	Valent

PRODUCT	CHEMISTRY	COMPANY
SURFACTANTS		
Activator 90	NIS	UAP
Herbimax	COC	UAP
Superb HC	COC	Agriliance
Class Act Next Gen.	Corn-based NIS + Amm. Sulf.	Agriliance
Preference	Soybean NIS	Agriliance
Prime Oil	Petroleum-based COC	Agriliance
Interlock	Penetrant/Drift Reduction	Agriliance

Maximum Daily High Temperatures and Monthly Rainfall at the Lubbock Agricultural Research & Extension Center

Day of the Week	March	April	May	June	July	August	Sept.	October	November
1	89.4	79.8	88.1	83.0	92.1	93.2	80.3	85.5	53.8
2	67.5	80.9	96.2	85.8	93.2	91.6	68.8	89.6	54.4
3	56.3	69.3	91.9	91.4	93.4	92.9	61.7	86.7	62.6
4	68.6	79.2	73.2	99.0	89.6	90.7	67.1	85.2	74.2
5	77.7	92.6	66.4	102.5	84.5	93.2	76.0	81.7	63.5
6	83.9	75.5	65.3	102.0	88.2	96.0	75.6	82.8	71.1
7	88.2	73.7	71.4	96.9	89.7	94.6	77.9	78.4	79.2
8	73.1	68.5	93.1	92.5	92.6	92.5	80.4	77.5	88.1
9	65.6	82.7	90.5	96.8	95.9	94.3	81.2	61.3	90.3
10	73.0	89.4	69.6	96.5	98.5	98.3	88.8	68.6	62.9
11	75.7	84.0	74.2	103.8	100.3	93.3	79.1	79.4	58.7
12	75.7	90.7	92.7	98.8	100.3	95.0	78.0	55.3	73.5
13	59.7	90.9	99.4	97.3	101.1	89.6	79.8	71.2	57.9
14	65.1	92.9	84.8	98.7	98.5	90.1	80.6	66.3	76.8
15	71.2	91.6	75.8	101.1	96.4	85.3	85.8	69.9	53.2
16	67.2	89.7	83.8	99.4	97.1	83.4	91.1	72.9	68.6
17	51.1	94.1	87.7	95.7	100.1	88.2	73.8	80.6	70.9
18	45.2	90.0	95.0	98.9	100.9	92.8	76.3	59.7	64.8
19	54.7	73.9	100.1	100.0	99.5	94.4	79.7	64.4	64.1
20	56.1	62.2	100.7	97.7	100.0	91.9	86.7	75.4	61.8
21	49.1	74.6	97.5	99.0	90.9	88.7	81.1	59.0	74.2
22	35.5	84.7	89.8	90.3	94.2	87.1	87.1	58.0	82.3
23	41.6	90.2	100.0	86.6	96.9	93.5	75.2	68.7	79.1
24	59.0	88.7	100.0	88.4	97.7	97.1	69.3	70.0	69.7
25	69.4	69.0	99.3	88.6	98.9	97.6	76.4	80.2	69.4
26	82.1	72.3	97.2	82.4	99.6	87.3	87.1	67.1	63.1
27	62.6	73.8	95.3	86.4	92.3	88.8	87.7	66.8	69.6
28	70.6	85.7	97.1	89.7	92.5	83.7	70.0	78.9	69.4
29	75.3	66.2	98.1	90.1	92.5	83.5	87.9	80.4	55.3
30	74.4	87.3	92.0	93.3	95.1	86.4	90.9	79.4	30.8
31	81.2		79.6			90.7		56.1	57.3
Total Rainfall (inches)	1.58	0.53	1.91	0.55	0.23	1.64	5.2	1.07	0.06

Trial Results for the Texas High Plains

Evaluation of Firestorm 3E (Gramoxone) Applied Delayed Preemergence and Post-Directed in Tomatoes, Eggplant and Pumpkins

Final Report

Objective: To evaluate and compare the effects of Firestorm 3E to Gramoxone Inteon 2E applied delayed preemergence or postemergence (hooded) in vegetables grown on black plastic (eggplant and tomatoes) or direct-seeded (pumpkins) for crop injury and control of Palmer amaranth, sandbur, and morningglory.

Materials & Methods: The trials were conducted at two locations including the Texas A & M University Agricultural Research & Extension Center (LREC), and at the Carolyn Lanier South Plains Food Bank Farm (SPFB), both located in Lubbock. Pumpkins were grown at the LREC on an Acuff clay loam soil with an average pH of 7.6 and 1.1% organic matter, while at the SPFB location, both eggplant and tomatoes were grown on sandy loam soils with a pH of 7.2 and 1.5% organic matter. In both locations the trial sites were plowed in the spring and soil beds prepared for planting. Tomatoes and eggplants were seeded in the greenhouse and transplanted into silver plastic mulch in the field on May 9, while pumpkins were direct-seeded at the LREC on June 5. Herbicide treatments were applied using a CO_2-charged backpack hooded-sprayer equipped with 2 flat fan nozzles that delivered 20 GPA at 35 psi (Table 1). In the eggplant and tomato trials, herbicides were applied to the sides of the silver plastic, except where no plastic was used. In pumpkins, herbicide treatments were applied following planting and directed to that base of the plants at approximately 4 weeks after emergence. All trial sites were monitored for pest control and fertility to ensure optimum growing conditions. Eggplant and tomatoes were irrigated using a drip system, while the pumpkins were furrow irrigated as needed. Crop injury and weed control were recorded at 7 and 14 days after treatment (DAT). The trials were conducted as RCB designs with treatments replicated 4 times in plots measuring 6.7’ x 15’ (eggplant and tomatoes) or 16.7’ x 30’ (pumpkins). All data were subjected to ANOVA using SAS procedures and means separated at the 5% level.

Results and Discussion: In this trial, percent crop injury rated 2 and 4 weeks after application showed no symptoms for any of the three vegetable crops tested. No symptoms of drift from any herbicide treatment or timing were observed. Weed control varied, however, depending on location. At the SPFB farm, Palmer amaranth control was 85% or higher, regardless of herbicide treatment. Sandbur control was poor to good and was likely a factor of plant size at time of spray applications. Sandbur was able to outgrow contact injury, indicating that the growing points for most plants were not hit with the sprays. Morningglory control was good to excellent with all treatments. Crop yields were generally low for commercial production, largely due to the extremely hot and dry weather conditions that occurred during the growing season. In addition, theft of tomatoes and eggplant occurred at the SPFB farm in several of the replications, and as a result, only 4 – 5 picking dates were recorded for the tests. Yields were lowest for eggplant and tomatoes in Treatment 3, where no silver plastic was used. This yield reduction was likely a result of the influence of not having silver plastic within the crop system, rather than any effect of the herbicide treatments. All other treatments within the silver plastic system showed no significant differences between yields for eggplant and tomatoes.

Palmer amaranth was the only weed present within the pumpkin test site at the LREC. Weed control in pumpkins was 99% for all herbicide treatments evaluated, and indicated equivalent control for both herbicide products and formulations. Similar to eggplant and tomatoes, pumpkin yields were very low, approximately 1/3 of typical production, and this was largely due to the extremely high temperatures and poor pollination of the pumpkin flowers. However, yields were not different between any herbicide treatments for this test. Results of these tests indicate that the performance of Firestorm 3E is equivalent to Gramoxone Inteon 2E at the applied rates for vegetable production.

Table 1. **Environmental information for individual herbicide applications during the study**

Application: Post Transplant (Eggplant & Tomatoes)

Location	SPFB	**Wind speed / direction**	0 – 3 mph / E
Date	May 22, 2006	**Crop**	Eggplant, tomatoes
Time of day	9:30 a.m.	**Variety**	Black Bell,, Spitfire
Type of application	Broadcast, hooded	**Crop stage**	6 – 12”
Carrier	Water	**Air temp. (^oF)**	74
Gas (if not CO_2)	CO_2	**Soil temp. (^oF)**	72
GPA	20	**Soil beneath**	Moist
PSI	35	**Soil surface**	Moist
Nozzle tips	8002	**% Relative humidity**	High
Nozzle spacing	18”	**Sky conditions**	Overcast
Boom width (“)	3.5’	**# Replications**	4
Boom height (“)	18”	**Sprayed by**	RWW
Weeds present: Palmer amaranth (2 – 8 leaves), Sandbur (2 – 3 leaves), Morningglory (2 – 4 leaves)			

Application: Delayed Preemergence (Pumpkins)

Location	LREC	**Wind speed / direction**	10 – 15 mph / S
Date	June 12, 2006	**Crop**	Pumpkins
Time of day	2:00 p.m.	**Variety**	Aspen
Type of application	Broadcast	**Crop stage**	Seed
Carrier	Water	**Air temp. (^oF)**	102
Gas (if not CO_2)	CO_2	**Soil temp. (^oF)**	88
GPA	20	**Soil beneath**	Moist
PSI	35	**Soil surface**	Dry
Nozzle tips	8002	**% Relative humidity**	Low
Nozzle spacing	18”	**Sky conditions**	Clear / Sunny
Boom width (“)	3.5’	**# Replications**	4
Boom height (“)	18”	**Sprayed by**	RWW
Weeds present: Palmer amaranth (6 – 8”)			

Application: Postemergence Directed (Pumpkins)

Location	LREC	**Wind speed / direction**	5 – 10 mph / S
Date	July 12, 2006	**Crop**	Pumpkins
Time of day	8:30 a.m.	**Variety**	Aspen
Type of application	Broadcast, hooded	**Crop stage**	12 – 15”, prior to vine run
Carrier	Water	**Air temp. (^oF)**	80
Gas (if not CO_2)	CO_2	**Soil temp. (^oF)**	78
GPA	20	**Soil beneath**	Moist
PSI	35	**Soil surface**	Dry
Nozzle tips	8002	**% Relative humidity**	Moderate
Nozzle spacing	18”	**Sky conditions**	Clear / Sunny
Boom width (“)	3.5’	**# Replications**	4
Boom height (“)	18”	**Sprayed by**	RWW
Weeds present: None			

Table 2. The Effects of Firestorm 3E on Crop Injury and Weed Control in Transplanted Tomatoes Grown on Black Plastic

Trt #	Treatment	Rate Lbs a.i./A	6/3 Crop Injury	6/20 Crop Injury	6/3 Palmer Amaranth	6/3 Sandbur	6/3 Morning -glory	Yield
			--------------- % ---------------		--------------- % Control ---------------			lbs/plot
1	*Untreated*		0	0	0	0	0	23.1
2	*Firestorm 3E*	0.5	0	0	91.3	70.0	93.0	38.8
3	*Firestorm 3E (Bareground)*	0.5	0	0	95.0	61.3	87.5	13.3
4	*Gramoxone Inteon 2E*	0.5	0	0	91.3	90.0	87.0	32.3
		LSD (0.05)	**0**	**0**	**5.8**	**41.6**	**18.7**	**25.4**

Table 3. The Effects of Firestorm 3E on Crop Injury and Weed Control in Transplanted Eggplant Grown on Black Plastic

Trt #	Treatment	Rate Lbs a.i./A	6/3 Crop Injury	6/20 Crop Injury	6/3 Palmer Amaranth	6/3 Sandbur	6/3 Morning -glory	Yield
			--------------- % ---------------		--------------- % Control ---------------			lbs/plot
1	*Untreated*		0	0	0	0	0	10.2
2	*Firestorm 3E*	0.5	0	0	95.8	87.5	97.0	12.4
3	*Firestorm 3E (Bareground)*	0.5	0	0	85.0	85.0	95.0	7.2
4	*Gramoxone Inteon 2E*	0.5	0	0	95.5	88.8	95.5	11.9
		LSD (0.05)	**0**	**0**	**8.0**	**16.0**	**3.5**	**6.6**

Table 4. The Effects of Firestorm 3E on Crop Injury and Weed Control in Direct-Seeded Pumpkins in Texas

Trt #	Treatment	Rate Lbs a.i./A	7/3 Crop Injury	7/19 Crop Injury	Emergence	7/3 Palmer Amaranth	7/19 Palmer Amaranth	Yield
			------------ % ------------		No. / plot	----------- % Control ---------		lbs/A
1	*Untreated*		0	0	20.8	0	0	12,811
2	*Firestorm 3E* *Firestorm 3E*	1.0 PRE 0.5 EPOST	0	0	22.0	99.0	99.0	10,990
3	*Firestorm 3E*	1.0 PRE	0	0	21.3	99.0	99.0	14,181
4	*Gramoxone Inteon 2E* *Gramoxone Inteon 2E*	1.0 PRE 0.5 EPOST	0	0	20.8	99.0	99.0	13,933
5	*Gramoxone Inteon 2E*	1.0 PRE	0	0	20.8	99.0	99.0	14,401
		LSD (0.05)	**0**	**0**	**3.4**	**0**	**0**	**4,494**

Evaluation of V-10142 Applied Postemergence on Direct-Seeded and Transplanted Pepper Varieties

Final Report

Objective: To evaluate the effect of V-10142 (imazosulfuron) applied at three rates and two timings on crop injury to selected varieties of direct-seeded and transplanted hot peppers.

Materials & 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 in the spring a pre-plant fertilizer (80 lbs/A nitrogen) was injected into the soil. Following fertilization, the soil listed into 40" rows, followed by use of a bed shaper which formed 80" wide beds for seeding and transplanting of the peppers. Transplanted peppers (tabasco, pimento, ancho, and bell peppers) were started in the greenhouse approximately 6 weeks prior to transplanting in the field (on May 19 for tabasco, and July 10 for pimentos). Eight other varieties (serrano, habanero, jalapeño M, cayenne M, AZ #20, NuMex R Naky, LB-25, and Joe E Parker. Peppers were direct-seeded in single rows on June 13. Ancho and bell peppers were found to be favorites of the local rabbit population, and both varieties were stripped clean from their plots within 48 hours of transplanting. For all other varieties, herbicide treatments were applied using a CO_2-charged backpack sprayer equipped with 2 flat fan nozzles that delivered 20 GPA at 35 psi (see Table 1 for application data). Crop injury was recorded at 7, 21 and 28 days after treatment. The trial was conducted as an RCB design with treatments replicated 3 times in plots measuring 3.5' x 15', and all data subjected to ANOVA and means separated at the 5% level.

Results and Discussion: Crop injury in transplanted pimento and tabasco peppers was 15% or less at both ratings, regardless of rate (Table 2). Crop injury was noted generally as leaf chlorosis with no spotting or necrosis observed with any V-10142 treatments. Injury with either pimento or tabasco was higher at the earlier ratings for both crops, and chlorosis decreased to less than 5.0% by 7 days later. With tabasco peppers, injury from Envoke continued to be 13% at the later rating, and this was significantly higher compared to all V-10142 rates. However, in pimentos, injury was not observed at that timing.

In direct-seeded peppers (Table 3), crop injury observed on July 12 showed that some differences between pepper varieties, though this was mostly with Sandea and Envoke. Only habanero peppers had significantly higher injury (0.3 lb a.i. rate) with V-10142 when compared to other rates and pepper varieties. Other than habanero peppers, injury with V-10142 was 6.7% or less at all three rates. By July 26, crop injury was 0% with all rates of V-10142 at both timings (Table 4). All pepper varieties appeared to be more tolerant to injury from V-10142 when applied at the 5-6 leaf stage. However, both Sandea and Envoke caused significant injury (6.7 – 20.0%) when applied at the 5 – 6 leaf stage in all varieties tested. Crop ratings on July 28 (Table 5) showed that Sandea and Envoke continued to cause significant injury. However, at this rating time, chlorosis was not observed, but injury was noted as crop stunting, and ranged from 5.0 to 30.0% across the varieties. Cayenne L and Jalapeno M appeared to be the most susceptible to stunting, while AZ #20 and LB-25 showed less stunting. Finally, an observation of the pepper plants during late September show no crop stunting or chlorosis, suggesting that yields should not be influenced by any of the herbicide treatments applied in this study.

The results of this research suggest that post-transplant and postemergence applications of V-10142 on hot peppers is safe, though some initial transitory leaf chlorosis may appear within 7 days following application. Leaf chlorosis may increase with increasing rates of V-10142. Additionally, V-10142 appears to cause less chlorosis and stunting when compared to postemergence Sandea and Envoke applications, at least with the varieties tested.

Table 1. Environmental information for individual herbicide applications during the study

Application: Post Transplant (Tabasco)

Location	LREC	**Wind speed / direction**	5 – 10 mph / S
Date	June 20, 2006	**Crop**	Tabasco
Time of day	8:00 a.m.	**Variety**	
Type of application	Broadcast	**Crop stage**	4 – 6" (6 – 10 leaves)
Carrier	Water	**Air temp. (^oF)**	74
Gas (if not CO_2)	CO_2	**Soil temp. (^oF)**	76
GPA	20	**Soil beneath**	Moist
PSI	35	**Soil surface**	Moist
Nozzle tips	8002	**% Relative humidity**	Moderate
Nozzle spacing	18"	**Sky conditions**	Clear / Sunny
Boom width (")	3.5'	**# Replications**	3
Boom height (")	18"	**Sprayed by**	RWW
Weeds present: Palmer amaranth (2 – 6 leaves), Goathead (2 – 5")			

Application: Post Transplant (Pimento)

Location	LREC	**Wind speed / direction**	10 – 15 mph / S
Date	July 31, 2006	**Crop**	Peppers
Time of day	9:00 a.m.	**Variety**	Pimento
Type of application	Broadcast	**Crop stage**	5 – 6" (5 – 8 leaves)
Carrier	Water	**Air temp. (^oF)**	75
Gas (if not CO_2)	CO_2	**Soil temp. (^oF)**	77
GPA	20	**Soil beneath**	Moist
PSI	35	**Soil surface**	Moist
Nozzle tips	8002	**% Relative humidity**	Low
Nozzle spacing	18"	**Sky conditions**	Partly cloudy / Sunny
Boom width (")	3.5'	**# Replications**	3
Boom height (")	18"	**Sprayed by**	RWW
Weeds present: None			

Application: Direct-seeded varieties (2 – 3 leaf stage)

Location	LREC	**Wind speed / direction**	5 mph / E
Date	July 5, 2006	**Crop**	Peppers
Time of day	10:00 a.m.	**Variety**	8 Varieties
Type of application	Broadcast	**Crop stage**	2-leaf
Carrier	Water	**Air temp. (^oF)**	80
Gas (if not CO_2)	CO_2	**Soil temp. (^oF)**	79
GPA	20	**Soil beneath**	Moist
PSI	35	**Soil surface**	Moist
Nozzle tips	8002	**% Relative humidity**	High
Nozzle spacing	18"	**Sky conditions**	Overcast
Boom width (")	3.5'	**# Replications**	3
Boom height (")	18"	**Sprayed by**	RWW
Weeds present: Palmer amaranth (4 – 5 leaves)			

Application: Direct-seeded varieties (5 – 6 leaf stage)

Location	LREC	**Wind speed / direction**	5 - 10 mph / SW
Date	July 18, 2006	**Crop**	Peppers
Time of day	10:00 a.m.	**Variety**	8 Varieties
Type of application	Broadcast	**Crop stage**	5 – 8 leaves
Carrier	Water	**Air temp. (^oF)**	85
Gas (if not CO_2)	CO_2	**Soil temp. (^oF)**	82
GPA	20	**Soil beneath**	Moist
PSI	35	**Soil surface**	Moist
Nozzle tips	8002	**% Relative humidity**	Low
Nozzle spacing	18"	**Sky conditions**	Clear / sunny
Boom width (")	3.5'	**# Replications**	3
Boom height (")	18"	**Sprayed by**	RWW
Weeds present: None			

Table 2. The Effects of V-10142, Sandea and Envoke on Crop Injury in Transplanted Pimento and Tabasco Peppers on the Texas High Plains

Trt #	Treatment	Rate lbs a.i./A	Timing	Pimento		Tabasco	
				August 7	August 14	June 28	July 5
				------------------------- % Crop Injury ------------------------			
1	*Untreated*			0	0	0	0
2	*V-10142 75WDG*	0.1	4 WAT	0	0	5.0	0
3	*V-10142*	0.2	4 WAT	3.3	0	15.0	1.7
4	*V-10142*	0.3	4 WAT	6.7	0	15.0	5.0
5	*Sandea 75WDG*	0.024	4 WAT	10.0	0	6.7	0
6	*Envoke 75WDG*	0.007	4 WAT	15.0	1.7	16.7	13.3
			LSD (0.05)	**4.4**	**2.1**	**6.6**	**5.3**

Table 3. The Effects of V-10142, Sandea and Envoke applied at Two Crop Growth Stages on Crop Injury on July 12 in Selected Pepper Varieties

Trt #	Treatment	Rate lbs a.i./A	Timing	Serrano	Habanero	Jalapeño M	Cayenne L	AZ #20	NuMex R Naky	LB-25	Joe E Parker
				% Crop Injury							
1	*Untreated*			0	0	0	0	0	0	0	0
2	*V-10142 75WDG*	0.1	1 -2 true leaves	0	1.7	0	0	0	0	0	0
3	*V-10142*	0.2	1 -2 true leaves	6.7	8.3	3.3	3.3	3.3	3.3	3.3	1.7
4	*V-10142*	0.3	1 -2 true leaves	5.0	15.0	1.7	3.3	0	0	0	0
5	*Sandea 75WDG*	0.024	1 -2 true leaves	3.3	13.3	5.0	3.3	0	0	0	0
6	*Envoke 75WDG*	0.007	1 -2 true leaves	0	15.0	6.7	6.7	3.3	1.7	3.3	1.7
7	*V-10142*	0.1	5 – 6 leaves	NA	NA	NA	NA	NA	NA	NA	NA
8	*V-10142*	0.2	5 – 6 leaves	NA	NA	NA	NA	NA	NA	NA	NA
9	*V-10142*	0.3	5 – 6 leaves	NA	NA	NA	NA	NA	NA	NA	NA
10	*Sandea*	0.024	5 – 6 leaves	NA	NA	NA	NA	NA	NA	NA	NA
11	*Envoke*	0.007	5 – 6 leaves	NA	NA	NA	NA	NA	NA	NA	NA
			LSD (0.05)	**5.7**	**4.3**	**4.5**	**5.7**	**3.9**	**3.2**	**3.9**	**2.0**

Table 4. The Effects of V-10142, Sandea and Envoke applied at Two Crop Growth Stages on Crop Injury on July 26 in Selected Pepper Varieties

Trt #	Treatment	Rate lbs a.i./A	Timing	Serrano	Habanero	Jalapeño M	Cayenne L	AZ #20	NuMex R Naky	LB-25	Joe E Parker
				----------	----------	----------	% Crop Injury	----------	----------	----------	----------
1	*Untreated*			0	0	0	0	0	0	0	0
2	*V-10142 75WDG*	0.1	1 -2 true leaves	0	0	0	0	0	0	0	0
3	*V-10142*	0.2	1 -2 true leaves	0	0	0	0	0	0	0	0
4	*V-10142*	0.3	1 -2 true leaves	0	0	0	0	0	0	0	0
5	*Sandea 75WDG*	0.024	1 -2 true leaves	0	0	0	0	0	0	0	0
6	*Envoke 75WDG*	0.007	1 -2 true leaves	0	0	0	0	0	0	0	0
7	*V-10142*	0.1	5 – 6 leaves	0	0	0	0	0	0	0	0
8	*V-10142*	0.2	5 – 6 leaves	0	0	0	0	0	0	0	0
9	*V-10142*	0.3	5 – 6 leaves	0	0	0	0	0	0	0	0
10	*Sandea*	0.024	5 – 6 leaves	18.3	13.3	16.7	20.0	13.3	11.7	10.0	15.0
11	*Envoke*	0.007	5 – 6 leaves	20.0	8.3	20.0	13.3	8.3	8.3	6.7	15.0
			LSD (0.05)	**6.1**	**2.1**	**7.1**	**3.9**	**4.2**	**4.1**	**6.1**	**8.8**

Table 5. The Effects of V-10142, Sandea and Envoke applied at Two Crop Growth Stages on Crop Injury on August 3 in Selected Pepper Varieties

Trt #	Treatment	Rate lbs a.i./A	Timing	Serrano	Habanero	Jalapeño M	Cayenne L	AZ #20	NuMex R Naky	LB-25	Joe E Parker
				% Crop Injury							
1	*Untreated*			0	0	0	0	0	0	0	0
2	*V-10142 75WDG*	0.1	1 -2 true leaves	0	0	0	0	0	0	0	0
3	*V-10142*	0.2	1 -2 true leaves	0	0	0	0	0	0	0	0
4	*V-10142*	0.3	1 -2 true leaves	6.7	5.0	0	0	0	0	0	0
5	*Sandea 75WDG*	0.024	1 -2 true leaves	0	11.7	0	0	0	0	0	0
6	*Envoke 75WDG*	0.007	1 -2 true leaves	0	0	0	0	0	0	0	0
7	*V-10142*	0.1	5 – 6 leaves	0	0	0	0	0	0	0	0
8	*V-10142*	0.2	5 – 6 leaves	0	0	0	0	0	0	0	0
9	*V-10142*	0.3	5 – 6 leaves	0	0	0	0	0	0	0	0
10	*Sandea*	0.024	5 – 6 leaves	13.3	18.3	20.0	25.0	5.0	6.7	8.3	10.0
11	*Envoke*	0.007	5 – 6 leaves	20.0	16.7	31.7	30.0	13.3	16.7	11.7	13.3
			LSD (0.05)	**11.1**	**14.7**	**14.3**	**10.8**	**6.2**	**7.4**	**3.2**	**8.3**

Evaluation of Selected Herbicides for Use in Spinach, Beet Greens and Swiss Chard

Final Report

Objective: To evaluate the effects of selected herbicides applied to spinach (var. "DMC 66-16), beet greens (var. "Detroit Dark Red") and Swiss chard (var. "Fordhook Giant") and their effects on crop injury and yield of chenopod crops.

Materials & Methods: The trial was conducted at the Texas A & M University Agricultural Research & Extension Center in Lubbock on an Acuff clay loam soil with a pH of 7.7 and 1.1% organic matter. The site was treated with liquid nitrogen (80 lbs N/A) in the spring and planted to snap beans. Immediately following the snap beans, the site was reworked for the planting. Ro-Neet (cycloate) was applied preplant incorporated (PPI) at 3.0 lbs a.i./A using a CO_2 backpack sprayer equipped with a four nozzle boom and 8002 TeeJet tips that sprayed 20 GPA at 30 psi. Swiss chard, beets and spinach were planted into two-row plots measuring 6.7' by 20' on September 21 using a single-row hand-push Earthway seeder. Immediately following planting, preemergence (PRE) herbicide treatments were applied and the entire test site was irrigated. Crop growth was monitored weekly for irrigation, diseases and insects and treated appropriately. Crop injury was recorded from individual plots, and yields were taken from one row/plot on November 29 (69 days after planting). No weeds were found within the test site; therefore, no weed control data is available. The trial was conducted as a RCB design with each treatment replicated four times. All data were subjected to ANOVA using SAS procedures and means separated using Fisher's Protected LSD at the 5% level.

Results and Discussion: Crop injury (Tables 1 – 3) was generally moderate to low with all herbicide treatments for all three chenopod crops except when Starane was applied early postemergence (EPOST). Injury from Starane was 39 – 50% five days after treatment, and this injury increased an average 36% across all crops when observed four weeks later on November 14. Injury with PRE-applied Define was observed to be 16 – 26% in all 3 crops, though this injury decreased 50% or more four weeks after the initial observation.

Overall yields of each of the three crops were low due to the late planting and early harvest. All crops were harvested early on November 29 due to an impending cold front with extremely low temperatures (12 – 15 degrees) and snowfall predicted for the next day. However, yields were observed to generally follow crop injury ratings in that those treatments which had high injury also had lower yields (Tables 1 – 3). In Swiss chard, only Dual Magnum + Starane had yields that were significantly lower than the untreated control. However, average yields of Swiss chard with all herbicide treatments (except Starane) were 24% lower showing that the use of any herbicide treatment would have caused a yield loss. Beet green yields also followed similar trends in that a treatment of Dual Magnum + Starane significantly reduced beet green biomass. Although not as severe, and not observed with crop injury ratings at either date, Far-Go treatments reduced beet green yields by 37%. Finally, spinach yields were reduced significantly only when Starane was applied following PRE applications of Dual Magnum. In those plots, Starane reduced spinach yields by 50%.

The results of this research suggest that Pyramin, Ro-Neet, Dual Magnum, Outlook, and Eptam have potential for use as PRE-applied herbicides in chenopods crops such as Swiss chard, beet greens and spinach. Far-Go appears to be visually safe on all crops, though it may cause some yield reduction in beets. Define applied PRE resulted in some early crop stunting, but yields were generally within the range of all other herbicide treatments evaluated in this test. More research is needed to determine efficacy and crop injury at other locations and states in order to better assess these products for future registration in chenopod crops.

Table 1. The Effects of Selected Herbicide Treatments on Crop Injury and Yield of Swiss Chard

Trt #	Treatment	*Rate* *lbs a.i./A*	Timing	% Injury	% Injury	Yield
				Oct. 18	Nov. 13	Lbs/ A
1	*Untreated*			0	0	10,065
2	*Pyramin 65DF*	5.00	PRE	0	0	7,590
3	*Ro-Neet 6E*	3.00	PPI	0	3	8,085
4	*Dual Magnum 7.62E*	0.65	PRE	0	0	8,250
5	*Dual Magnum +* *Stinger 3EC*	0.65 0.125	PRE EPOST	3	3	7,590
6	*Dual Magnum +* *Starane 1.5EC*	0.65 0.094	PRE EPOST	39	69	2,310
7	*Dual Magnum +* *Nortron 4SC*	0.65 0.164	PRE EPOST	3	3	7,260
8	*Outlook 6E*	0.50	PRE	8	5	8,580
9	*Nortron*	1.00	PRE	0	4	7,590
10	*Define 4SC*	0.60	PRE	26	14	6,930
11	*Eptam 7-E*	3.06	PPI	8	3	7,590
12	*Far-Go 4E*	3.00	PPI	0	0	7,425
			LSD (0.05)	**9.1**	**9.2**	**2,993**

Table 2. The Effects of Selected Herbicide Treatments on Crop Injury and Yield of Beet Greens

Trt #	**Treatment**	***Rate lbs a.i./A***	**Timing**	**% Injury**	**% Injury**	**Yield**
				Oct. 18	**Nov. 13**	**Lbs/ A**
1	*Untreated*			0	0	8,910
2	*Pyramin 65DF*	5.00	PRE	2.5	2.5	9,240
3	*Ro-Neet 6E*	3.00	PPI	2.5	5.0	8,250
4	*Dual Magnum 7.62E*	0.65	PRE	0	2.5	7,260
5	*Dual Magnum +* *Stinger 3EC*	0.65 0.125	PRE EPOST	3.8	6.3	7,590
6	*Dual Magnum +* *Starane 1.5EC*	0.65 0.094	PRE EPOST	50.0	82.5	1,155
7	*Dual Magnum +* *Nortron 4SC*	0.65 0.164	PRE EPOST	0	0	9,405
8	*Outlook 6E*	0.50	PRE	0	0	7,920
9	*Nortron*	1.00	PRE	0	0	8,580
10	*Define 4SC*	0.60	PRE	17.5	10.0	6,600
11	*Eptam 7-E*	3.06	PPI	0	2.5	7,755
12	*Far-Go 4E*	3.00	PPI	0	0	5,610
			LSD (0.05)	**4.4**	**8.7**	**2,933**

Table 3. The Effects of Selected Herbicide Treatments on Crop Injury and Yield of Spinach

Trt #	Treatment	*Rate lbs a.i./A*	Timing	% Injury	% Injury	Yield
				Oct. 18	**Nov. 13**	**Lbs/ A**
1	*Untreated*			0	0	7,590
2	*Pyramin 65DF*	5.00	PRE	0	0	6,900
3	*Ro-Neet 6E*	3.00	PPI	0	0	8,250
4	*Dual Magnum 7.62E*	0.65	PRE	0	0	7,065
5	*Dual Magnum +* *Stinger 3EC*	0.65 0.125	PRE EPOST	2.5	0	9,735
6	*Dual Magnum +* *Starane 1.5EC*	0.65 0.094	PRE EPOST	41.3	52.5	3,765
7	*Dual Magnum +* *Nortron 4SC*	0.65 0.164	PRE EPOST	6.3	0	7,425
8	*Outlook 6E*	0.50	PRE	5.0	2.5	6,735
9	*Nortron*	1.00	PRE	7.5	3.8	8,415
10	*Define 4SC*	0.60	PRE	16.3	7.5	7,260
11	*Eptam 7-E*	3.06	PPI	3.8	3.8	7,065
12	*Far-Go 4E*	3.00	PPI	0	0	8,250
			LSD (0.05)	**10.2**	**11.2**	**2,094**

Application: PPI

Location	Lubbock	**Wind speed / direction**	5 – 10 / SW
Date	September 20, 2006	**Crop**	Chenopods
Time of day	9:00 a.m.	**Variety**	
Type of application	Broadcast	**Crop stage**	None
Carrier	Water	**Air temp. (°F)**	65
Gas	CO_2	**Soil temp. (°F)**	65
GPA	20	**Soil beneath**	Moist
PSI	30	**Soil surface**	Moist
Nozzle tips	8002	**% Relative humidity**	Low
Nozzle spacing	18”	**Sky conditions**	Clear/Sunny
Boom width (“)	6.5’	**# Replications**	4
Boom height (“)	18”	**Sprayed by**	RWW

Weeds present: None

Application: PRE

Location	Lubbock	**Wind speed / direction**	5 – 10 / SW
Date	September 21, 2006	**Crop**	Chenopods
Time of day	7:00 a.m.	**Variety**	
Type of application	Broadcast	**Crop stage**	Seed
Carrier	Water	**Air temp. (°F)**	61
Gas (if not CO_2)	CO_2	**Soil temp. (°F)**	68
GPA	20	**Soil beneath**	Moist
PSI	30	**Soil surface**	Semi-moist
Nozzle tips	8002	**% 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: Carelessweed (cotyledon – 1 leaf)

Application: EPOST

Location	Lubbock	**Wind speed / direction**	5 – 10 / S
Date	October 13, 2006	**Crop**	Chenopods
Time of day	9:00 a.m.	**Variety**	
Type of application	Broadcast	**Crop stage**	2 -5 leaves
Carrier	Water	**Air temp. (°F)**	58
Gas (if not CO_2)	CO_2	**Soil temp. (°F)**	55
GPA	20	**Soil beneath**	Moist
PSI	30	**Soil surface**	Semi-moist
Nozzle tips	8002	**% 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

Evaluation of Tank-Mix Low-Rate Herbicide Applications in Processing Spinach

Final Report

Objective: To evaluate the effects of four herbicides tank-mixed and applied at low rates to spinach (var. 'DMC 66-16') and the effects on crop injury, weed control, weeding costs and yield of spinach.

Materials & Methods: The trial was conducted at the Texas A & M University Agricultural Research & Extension Center in Lubbock on an Acuff clay loam soil with a pH of 7.7 and 1.1% organic matter. The site was treated with liquid nitrogen (80 lbs N/A) in the spring and planted to snap beans. Immediately following the snap beans, the site was reworked for the spinach planting. Ro-Neet (cycloate) was applied at 3.0 lbs a.i./A and incorporated on August 29, following which spinach was planted on August 30 using a Monosem 2-row vacuum planter into 2-row plots measuring 6.7 by 25'. Dual Magnum (*s*-metolachlor) was applied PRE at 0.65, 0.325 and 0.163 lbs a.i./A, Outlook (dimethenamid-p) at 0.50, 0.25 and 0.125 lbs a.i./A, and Nortron (ethofumesate) applied at a single rate of 1.0 lb a.i./A on August 31, and the entire test site was irrigated. Spinach growth was monitored weekly for irrigation, diseases and insects and treated appropriately. A week after planting, the site received 5.2" of rain. Crop injury and weed counts were recorded from individual plots, and yields were taken from one row/plot on November 29 (92 days after planting). Prior to harvest, all plots were hand weeded and the time recorded. The trial was conducted as a RCB design with each treatment replicated four times. All data were subjected to ANOVA using SAS procedures and means separated using Fisher's Protected LSD at the 5% level.

Results and Discussion: Spinach emergence was significantly decreased (compared to the untreated control) when Outlook was applied alone at the high rate, or when Dual Magnum or Outlook where tank-mixed with Nortron. Similarly, Ro-Neet PPI followed by Nortron PRE reduced spinach emergence by 25%, though not significantly. Nortron and Ro-Neet by themselves did not decrease spinach emergence. Though an average 17% lower, plots treated with Dual Magnum alone, regardless of rate were not different from the untreated control. All herbicide treatments significantly reduced the numbers of weeds/plot (except for Outlook applied at 0.25 lbs a.i./A). Weed pressures were lowest where Outlook or Dual Magnum was applied at the highest rate, either alone or in combination. Crop injury was greatest in treatments where Outlook was applied at 0.5 lbs a.i./A, followed by tank-mixes with Nortron and Ro-Neet. Dual Magnum applied alone at the high rate (standard for growers) caused 17.5% stunting, which was significantly greater than the untreated control. Crop injury generally was reduced as the rate of either Dual Magnum or Outlook was reduced. By November 13, crop injury was 15% or less for all treatments, regardless of rate or herbicide. The number of man-hours to hand weed individual treatments was generally associated with the numbers of weeds present within the plots. The highest number of man-hours required was observed in the untreated plots and this was significantly greater than all herbicide treatments, and this pattern was similar to the dollars spent per acre on hand-weeding costs. Obviously herbicides reduced the need for hand weeding in most treatments, but there was a cost associated with grower profits as yields were significantly reduced in 14 of the 21 herbicide treatments. Even the standard rate of Dual Magnum reduced yields by 29%. The high amount of rainfall following the initial irrigation likely reduced stands in plots treated with Dual Magnum and Outlook, causing yield reductions. Nortron and Ro-Neet applied alone did not reduce spinach stands, neither did the lowest applied rates of Outlook and Dual Magnum, and yields were not reduced in those treatments. The results of this study suggest that under these conditions, Dual Magnum and Outlook may reduce spinach stands, increase stunting and decrease yields at rates needed to control weeds. In addition, this study demonstrates that tank-mixtures of at least 2 herbicides may actually increase the potential for stunting and yield reduction in spinach. More research is needed to improve safety and yield potential for herbicides to be registered in spinach.

Table 1. Evaluation of PRE Herbicide Applications on Spinach and Weed Emergence and Spinach Injury

Treatment	Rate	Timing	No. of Spinach Emerged/Plot	No. of Weeds/Plot	% Injury	% Injury
	lbs a.i./A		Oct. 11	Oct. 11	Oct. 11	Nov. 13
Untreated			73.5	22.8	0	0
Dual Magnum 7.62E	0.65	PRE	59.0	5.3	17.5	2.5
Dual Magnum	0.325	PRE	56.8	10.5	5.0	0
Dual Magnum	0.1625	PRE	67.8	13.8	2.5	0
Dual Magnum + *Nortron 4SC*	0.65 1.0	PRE PRE	49.5	5.5	31.3	15.0
Dual Magnum + *Nortron*	0.325 1.0	PRE PRE	48.3	12.3	22.5	6.3
Dual Magnum + *Nortron*	0.1625 1.0	PRE PRE	53.8	9.8	27.5	8.8
Outlook 6E	0.50	PRE	35.5	4.8	33.8	12.5
Outlook	0.25	PRE	56.8	23.0	16.3	0
Outlook	0.125	PRE	65.3	13.3	6.3	2.5
Outlook + *Nortron*	0.50 1.0	PRE PRE	42.0	6.0	30.0	8.8
Outlook + *Nortron*	0.25 1.0	PRE PRE	49.8	7.3	25.0	7.5
Outlook + *Nortron*	0.125 1.0	PRE PRE	54.5	5.5	25.0	7.5
Ro-Neet 6E + *Dual Magnum*	3.00 0.65	PPI PRE	45.5	6.8	25.0	6.3
Ro-Neet + *Dual Magnum*	3.00 0.325	PPI PRE	56.0	12.0	12.5	0
Ro-Neet + *Dual Magnum*	3.00 0.1625	PPI PRE	57.3	16.5	12.5	6.3
Ro-Neet + *Outlook*	3.00 0.50	PPI PRE	32.3	4.3	35.0	11.3
Ro-Neet + *Outlook*	3.00 0.25	PPI PRE	51.5	10.3	18.8	3.8
Ro-Neet + *Outlook*	3.00 0.125	PPI PRE	78.3	12.0	5.0	0
Nortron	1.00	PRE	74.0	10.8	13.8	2.5
Ro-Neet	3.00	PPI	74.0	15.5	2.5	0
Ro-Neet + *Nortron*	3.00 1.00	PPI PRE	55.5	13.5	15.0	6.3
		LSD (0.05)	**21.9**	**8.5**	**12.6**	**8.3**

Table 2. Evaluation of PRE Herbicide Applications on the Number of Man-Hours Weeding, Cost/A and Yield of Spinach

Treatment	Rate	Timing	Time to Hand Weed One Acre	Hand-weeding Costs	Total Estimated Costs of Control*	Spinach Yield
	lbs a.i./A		Man-Hours	$/A	$/A	lbs/A
Untreated			25.8	180.85	180.85	11,825
Dual Magnum 7.62E	0.65	PRE	13.8	96.22	105.17	8,342
Dual Magnum	0.325	PRE	12.0	84.28	88.76	8,434
Dual Magnum	0.1625	PRE	14.7	99.35	101.59	9,075
Dual Magnum + *Nortron 4SC*	0.65 1.0	PRE PRE	6.5	45.65	82.10	5,317
Dual Magnum + *Nortron*	0.325 1.0	PRE PRE	13.0	90.95	122.33	6,600
Dual Magnum + *Nortron*	0.1625 1.0	PRE PRE	10.4	73.04	102.78	6,142
Outlook 6E	0.50	PRE	9.7	67.77	79.60	5,500
Outlook	0.25	PRE	16.6	116.24	122.16	9,075
Outlook	0.125	PRE	11.5	95.87	98.83	10,633
Outlook + *Nortron*	0.50 1.0	PRE PRE	6.0	42.14	81.47	5,317
Outlook + *Nortron*	0.25 1.0	PRE PRE	8.4	59.00	92.42	6,233
Outlook + *Nortron*	0.125 1.0	PRE PRE	8.9	62.51	92.97	6,233
Ro-Neet 6E + *Dual Magnum*	3.00 0.65	PPI PRE	7.6	53.30	94.75	6,600
Ro-Neet + *Dual Magnum*	3.00 0.325	PPI PRE	12.4	86.74	123.72	9,259
Ro-Neet + *Dual Magnum*	3.00 0.1625	PPI PRE	12.9	90.60	125.34	8,433
Ro-Neet + *Outlook*	3.00 0.50	PPI PRE	6.1	42.84	87.17	4,767
Ro-Neet + *Outlook*	3.00 0.25	PPI PRE	9.5	66.72	105.14	7,884
Ro-Neet + *Outlook*	3.00 0.125	PPI PRE	11.2	78.31	113.77	12,008
Nortron	1.00	PRE	12.1	84.63	112.13	8,892
Ro-Neet	3.00	PPI	17.4	121.86	154.36	12,009
Ro-Neet + *Nortron*	3.00 1.00	PPI PRE	12.9	90.25	150.25	9,167
	LSD (0.05)		**5.8**	**40.94**	**-----**	**3,009**

* Includes the price of herbicide + hand-weeding. Approximate herbicide cost/gallon: s-Metolachlor = $105; Ethofumesate = $110; Dimethenamid-p = $142; Cycloate = $65. Herbicide prices obtained from 2006 North Dakota State University Weed Control Guide.

Application: PPI's

Location	LREC	**Wind speed / direction**	0
Date	August 29, 2006	**Crop**	Spinach
Time of day	3:00 p.m.	**Variety**	DMC 66-16
Type of application	Broadcast	**Crop stage**	Seed
Carrier	Water	**Air temp. (^oF)**	80
Gas (if not CO_2)	CO_2	**Soil temp. (^oF)**	78
GPA	20	**Soil beneath**	Moist
PSI	35	**Soil surface**	Moist
Nozzle tips	8002 VS	**% Relative humidity**	Moderate
Nozzle spacing	18"	**Sky conditions**	Clear/Sunny
Boom width (")	6.5'	**# Replications**	4
Boom height (")	18"	**Sprayed by**	RWW
Weeds present: None			

Application: PRE's

Location	LREC	**Wind speed / direction**	0
Date	August 31, 2006	**Crop**	Spinach
Time of day	10:00 a.m.	**Variety**	DMC 66-16
Type of application	Broadcast	**Crop stage**	Seed
Carrier	Water	**Air temp. (^oF)**	81
Gas (if not CO_2)	CO_2	**Soil temp. (^oF)**	76
GPA	20	**Soil beneath**	Moist
PSI	35	**Soil surface**	Dry
Nozzle tips	8002 VS	**% Relative humidity**	Moderate
Nozzle spacing	18"	**Sky conditions**	Clear/Sunny
Boom width (")	6.5'	**# Replications**	4
Boom height (")	18"	**Sprayed by**	RWW
Weeds present: None			

Evaluation of Herbicides on Leafy Brassicas (Kale, Collards, Mustard and Turnips) in Texas

Final Report

Background: Few broad-spectrum herbicides are available for use in leafy brassica crops, limiting leafy greens growers to relatively few choices, including older chemistries than are listed as potential candidates for cancellation due to the FQPA requirements with the EPA. In addition, weed control with current standard herbicides is often inadequate, resulting in growers employing hand laborers to control weeds at a high cost. The objective of this research was to identify possible herbicide candidates for potential registration by evaluating crop safety, weed control and yield potential in four leafy brassica crops.

Materials and Methods: The trials at the Texas A & M University Research & Extension Center located in Lubbock, and were conducted on an Acuff clay loam soil with a pH of 7.7 and 1.8% organic matter. Test plots measured 3.3' by 15' and consisted of one bed with two lines seeded 15 cm apart. Herbicide treatments were applied using a CO_2-charged backpack sprayer and hand-held boom equipped with four nozzles calibrated to spray 20 GPA at 35 psi. Varieties planted included mustard greens (Southern Giant Curled), turnip greens (Seven Top), leafy kale (Dwarf Blue Curled Scotch) and collard greens (Vates). The trials were planted on August 30, 2006 with mustard and turnip greens harvested at 45 days; and leafy kale and collard greens at 60 days after planting. Yields were recorded by cutting a 5' section from each individual plot and weighing. Individual crop trials were designed as randomized complete blocks with treatments replicated 4 times. All data were subjected to analysis of variance and means separated using Fischer's Protected LSD at the 5% level.

Results and Discussion: Twenty herbicide treatments were evaluated on each of the four leafy brassica crops previously described. Grower standards used for comparison included DCPA (7.5 lbs ai) and bensulide (6.0 lbs ai). Weed pressure was extremely low in these tests, and prohibited an accurate assessment of weed control. However, data including percent crop injury (mostly stunting), yield and description of symptomology for all 4 crops can be found in Tables 1 – 4. In all crops, preemergence (PRE) applications of isoxaben and pronamide caused 50 – 99% injury (stunting) at 4 weeks after treatment (WAT). Other PRE herbicide treatments causing significant crop injury 4 WAT in at least 3 of the 4 crops tested included s-metolachlor (0.65 lb ai), dimethenamid-p (0.5 lb ai), ethofumesate (1.0 lb ai) and KIH 485 (0.04 lb ai) which had an average 29 – 48% stunting. While ethofumesate injury included stunting, leaf injury was also observed to be severe malformations in turnip greens, and loss of cuticular waxes in kale and collard greens. By 8 WAT, crop injury had decreased to tolerable levels with s-metolachlor and dimethenamid-p. Early postemergence (EPOST) treatments of flucarbazone caused significant injury in all crops, while pronamide and clopyralid had less than 6% at both ratings. Fluroxypyr caused an average 24% injury 4 WAT, however, all crops quickly outgrew the injury and by 8 WAT it was less than 10% stunting.

Crop yields recorded at harvest followed trends associated with crop injury in all four brassicas evaluated. Highest yields were generally found in the untreated plots, and even the grower standards (DCPA and bensulide) showed an average yield reduction of 20%, compared to the untreated. Herbicides that should be considered for further investigations include triallate (applied PPI), s-metolachlor, dimethenamid-p, sulfentrazone, pendimethalin, thiobencarb applied PRE, and pronamide, clopyralid and fluroxypyr EPOST.

Acknowledgements: Thanks to USDA-CSREES Pesticide Management Alternatives Program for the funding that supported this project.

Table 1. 2006 Herbicide Screen for Mustard Greens (Lubbock) USDA/CSREES - PMAP Project

	Treatment	Rate lbs a.i./A	Timing	Sept. 27	Oct. 11	Yield	Symptoms
				----- % Crop Injury -----		lbs / A	
1	*Untreated*			0	0	23,320	None
2	*Dacthal 6L*	7.5	PRE	20.0	10.0	15,400	Moderate stunting
3	*Prefar 4E*	6.0	PRE	21.3	5.0	16,335	Moderate stunting
4	*Far-Go 4EC*	3.0	PPI	2.5	0	23,925	Mild stunting
5	*Dual Magnum 7.62E*	0.65	PRE	43.8	18.8	11,530	Stunting
6	*Dual Magnum*	0.325	PRE	8.8	6.3	19,800	Mild stunting
7	*Outlook 6E*	0.5	PRE	40.0	16.7	12,320	Stunting
8	*Outlook*	0.25	PRE	18.8	8.8	16,830	Mild stunting
9	*Spartan 75WDG*	0.1	PRE	6.3	0	21,120	Mild early stunting
10	*Spartan*	0.05	PRE	8.8	3.3	18,260	Mild early stunting
11	*Prowl H_2O 3.8AS*	0.5	PRE	8.8	12.5	15,345	Moderate stunting
12	*Nortron 4SC*	1.0	PRE	31.3	17.5	13,860	Stunting + leaf curl
13	*Bolero 8EC*	1.0	PRE	7.5	0	21,285	Mild stunting
14	*KIH 485 85WDG*	0.04	PRE	45.0	33.8	12,210	Stunting
15	*Gallery 75WDG*	0.66	PRE	99.0	99.0	0	Plant death
16	*Kerb 50W*	1.0	PRE	67.0	61.0	7,425	Severe stunting
17	*Dacthal +* *Kerb*	7.5 1.0	PRE EPOST	8.8	12.5	19,800	Mild stunting
18	*Dacthal +* *Everest 70WG*	7.5 0.03	PRE EPOST	53.8	99.0	0	Stunting + plant death
19	*Dacthal +* *Stinger 3EC*	7.5 0.187	PRE EPOST	12.5	5.0	16,005	Mild stunting
20	*Dacthal +* *Starane 1.5EC*	7.5 0.094	PRE EPOST	23.8	7.5	13,365	Mild stunting, leaf curl
		LSD (0.05)		**25.9**	**23.9**	**7,094**	

Table 2. 2006 Herbicide Screen for Turnip Greens (Lubbock) USDA/CSREES - PMAP Project

	Treatment	Rate lbs a.i./A	Timing	Sept. 27	Oct. 11	Yield	Symptoms
				----- % Crop Injury -----		lbs / A	
1	*Untreated*			0	0	21,120	None
2	*Dacthal 6L*	7.5	PRE	18.3	0	18,040	Mild stunting
3	*Prefar 4E*	6.0	PRE	24.5	6.7	18,040	Moderate to mild stunting
4	*Far-Go 4EC*	3.0	PPI	5.0	0	21,780	Mild stunting
5	*Dual Magnum 7.62E*	0.65	PRE	25.0	5.0	15,400	Moderate to mild stunting
6	*Dual Magnum*	0.325	PRE	13.3	8.3	17,820	Mild stunting
7	*Outlook 6E*	0.5	PRE	27.5	18.8	14,520	Moderate stunting
8	*Outlook*	0.25	PRE	15.0	10.0	14,850	Mild stunting
9	*Spartan 75WDG*	0.1	PRE	0	0	19,800	Mild stunting
10	*Spartan*	0.05	PRE	8.3	5.0	18,480	Mild stunting
11	*Prowl H_2O 3.8AS*	0.5	PRE	15.0	26.7	14,520	Moderate stunting
12	*Nortron 4SC*	1.0	PRE	43.8	45.0	18,480	Stunting, severe leaf curl
13	*Bolero 8EC*	1.0	PRE	13.3	0	22,000	Mild stunting
14	*KIH 485 85WDG*	0.04	PRE	68.5	56.0	7,260	Severe stunting
15	*Gallery 75WDG*	0.66	PRE	99.0	99.0	0	Plant death
16	*Kerb 50W*	1.0	PRE	79.8	72.3	4,400	Severe stunting, death
17	*Dacthal +* *Kerb*	7.5 1.0	PRE EPOST	0	6.3	23,100	Mild stunting
18	*Dacthal +* *Everest 70WG*	7.5 0.03	PRE EPOST	53.3	94.5	0	Stunting then plant death
19	*Dacthal +* *Stinger 3EC*	7.5 0.187	PRE EPOST	8.3	8.3	14,960	Mild stunting
20	*Dacthal +* *Starane 1.5EC*	7.5 0.094	PRE EPOST	33.8	11.3	19,470	Mild stunt, early leaf curl
		LSD (0.05)		**17.0**	**20.4**	**8,925**	

Table 3. 2006 Herbicide Screen for Leafy Kale (Lubbock) USDA/CSREES - PMAP Project

	Treatment	Rate lbs a.i./A	Timing	Sept. 27	Oct. 11	Yield	Symptoms
				----- % Crop Injury -----		lbs / A	
1	*Untreated*			0	0	18,810	None
2	*Dacthal 6L*	7.5	PRE	3.3	3.3	17,600	Mild stunting
3	*Prefar 4E*	6.0	PRE	27.5	20.0	14,850	Stunting
4	*Far-Go 4EC*	3.0	PPI	13.8	5.0	17,490	Mild stunting
5	*Dual Magnum 7.62E*	0.65	PRE	20.0	11.3	14,520	Moderate stunting
6	*Dual Magnum*	0.325	PRE	25.0	21.3	10,890	Stunting
7	*Outlook 6E*	0.5	PRE	28.8	17.5	15,180	Stunting
8	*Outlook*	0.25	PRE	18.8	15.0	11,220	Stunting
9	*Spartan 75WDG*	0.1	PRE	3.3	5.0	13,200	Mild stunting
10	*Spartan*	0.05	PRE	0	6.3	14,190	Mild stunting
11	*Prowl H_2O 3.8AS*	0.5	PRE	18.8	12.5	13,530	Stunting
12	*Nortron 4SC*	1.0	PRE	16.3	6.3	18,480	Stunting with leaf curl, change in leaf wax
13	*Bolero 8EC*	1.0	PRE	6.8	6.3	15,510	Mild stunting
14	*KIH 485 85WDG*	0.04	PRE	26.3	18.8	12,540	Stunting
15	*Gallery 75WDG*	0.66	PRE	99.0	99.0	0	Plant death
16	*Kerb 50W*	1.0	PRE	52.3	46.0	7,260	Severe stunting
17	*Dacthal +* *Kerb*	7.5 1.0	PRE EPOST	5.0	2.5	16,500	Mild stunting
18	*Dacthal +* *Everest 70WG*	7.5 0.03	PRE EPOST	20.0	38.8	7,590	Stunting and chlorosis
19	*Dacthal +* *Stinger 3EC*	7.5 0.187	PRE EPOST	2.5	3.8	14,190	Mild stunting
20	*Dacthal +* *Starane 1.5EC*	7.5 0.094	PRE EPOST	20.0	11.3	14,850	Mild stunting, moderate to severe early leaf curl
		LSD (0.05)		**21.9**	**20.3**	**5,932**	

Table 4. 2006 Herbicide Screen for Collard Greens (Lubbock) USDA/CSREES - PMAP Project

	Treatment	Rate lbs a.i./A	Timing	Sept. 27	Oct. 11	Yield	Symptoms
				----- % Crop Injury -----		lbs / A	
1	*Untreated*			0	0	15,180	None
2	*Dacthal 6L*	7.5	PRE	40.0	16.7	12,320	Stunting
3	*Prefar 4E*	6.0	PRE	15.0	16.3	13,530	Stunting
4	*Far-Go 4EC*	3.0	PPI	16.5	18.8	10,560	Mild stunting
5	*Dual Magnum 7.62E*	0.65	PRE	36.8	36.3	7,755	Stunting
6	*Dual Magnum*	0.325	PRE	17.5	6.3	13,200	Moderate stunting
7	*Outlook 6E*	0.5	PRE	20.0	13.8	13,200	Stunting
8	*Outlook*	0.25	PRE	8.8	0	14,520	Mild stunting
9	*Spartan 75WDG*	0.1	PRE	8.3	6.3	15,840	Mild stunting
10	*Spartan*	0.05	PRE	8.3	5.0	14,960	Mild stunting
11	*Prowl* H_2O *3.8AS*	0.5	PRE	18.8	10.0	12,540	Moderate stunting
12	*Nortron 4SC*	1.0	PRE	52.5	43.8	9,570	Stunting with leaf curl, changes in leaf wax
13	*Bolero 8EC*	1.0	PRE	33.8	15.0	10,230	Stunting
14	*KIH 485 85WDG*	0.04	PRE	52.5	38.8	7,920	Stunting
15	*Gallery 75WDG*	0.66	PRE	99.0	99.0	0	Plant death
16	*Kerb 50W*	1.0	PRE	71.3	62.3	9,570	Severe stunting
17	*Dacthal +* *Kerb*	7.5 1.0	PRE EPOST	6.3	0	13,530	Mild stunting
18	*Dacthal +* *Everest 70WG*	7.5 0.03	PRE EPOST	50.0	71.3	5,940	Stunting, chlorosis, leaf curl and finally death
19	*Dacthal +* *Stinger 3EC*	7.5 0.187	PRE EPOST	0	0	11,880	No visible injury
20	*Dacthal +* *Starane 1.5EC*	7.5 0.094	PRE EPOST	18.8	3.8	17,160	Mild stunting, moderate to severe early curling
		LSD (0.05)		**25.0**	**23.5**	**6,294**	

Stinger Evaluation for Crop Injury and Yield in Processing Spinach Varieties

(Full Paper Accepted for Publication in Weed Technology in 2007 Under Different Title)

Objective: To evaluate the effects of clopyralid (Stinger) tank mixes applied to 8 spinach varieties on crop injury and yield.

Materials and Methods: Two trials were conducted in an experimental greenhouse located at the Texas A & M University Research & Extension Center in Lubbock during the summer and early fall of 2006. All spinach varieties were seeded on July 7 and July 17 into 11.5 cm pots containing a soil-less media. After emergence, the spinach plants were thinned to 2 per pot. Eight processing spinach varieties were evaluated including Padre (savoy leaf type); AR 415, Avon and 157 (semi-savoy); 17047 (flat to semi-savoy); and DMC 66-07, DMC 66-09 and DMC 66-16 (flat, smooth leaf types). When the spinach had reached the 2 – 5 leaf stage, the herbicide treatments were applied using an enclosed cabinet, CO_2-charged greenhouse track sprayer equipped with a single nozzle calibrated to spray 75.6 L/ha at 242 kPa.

Herbicide treatments included an untreated control, clopyralid alone (0.14 kg ai/ha) and clopyralid mixed with one of the following additives: non-ionic surfactant (0.25% v/v), crop oil concentrate (1.0% v/v), *s*-metolachlor (0.36 kg ai/ha.), sethoxydim (0.31 kg ai/ha), clethodim (0.14 kg ai/ha), and phenmedipham (1.10 kg ai/ha). The experiments were monitored daily to ensure optimum spinach growth including fertility, watering and pest control. Temperatures within the greenhouse averaged 32/21 C day/night throughout the course of the experiments. Leaf injury ratings were recorded 10, 20 and 35 days after treatment (DAT), and spinach plants were harvested 35 DAT by clipping them at the soil surface, drying and weighing plants from each individual pot. Clopyralid injury was noted as slight to severe leaf curling and crinkling (malformations) of the treated leaves, as well as leaf distortion on newly emerged leaves. Leaf injury was ranked as follows: 0 = no visible injury; 1 = mild injury (slight leaf curling, leaf crinkling); 2 = moderate injury (moderate leaf curl/crinkling with misshapen leaves); 3 = severe injury (some stunting with severely crinkled and/or misshapen leaves); 4 = plant death.

Both trials were designed as randomized complete blocks with 8 varieties sprayed with 8 herbicide treatments replicated 4 times. All data were subjected to analysis of variance and means separated using Fischer's Protected LSD at the 5% level. Analyses indicated that the two trials were different only for leaf injury at 10 DAT ($\alpha = 0.01$) for both variety and herbicide comparisons, but not for other ratings or yield. As a result, data for leaf injury at 10 DAT is presented as Trial 1 and Trial 2, while for all other variables the data is presented as combined from both trials.

Results: Greenhouse research was conducted to evaluate the effects of POST-applied clopyralid and clopyralid plus additives (surfactants and/or herbicides) on eight processing spinach varieties for leaf injury and yield. Results demonstrate that when applied alone, clopyralid caused mild injury in the form of slight to moderate leaf malformations and crinkling in all tested spinach varieties. Leaf injury increased significantly 10, 20 and 35 days after treatment (DAT) when additives were mixed with clopyralid compared to when clopyralid was applied alone. Applications of clopyralid + phenmedipham increased leaf injury over clopyralid applied alone and all other clopyralid + additive treatments. Within varieties, spinach yields recorded 35 DAT were generally not reduced with any clopyralid + additive treatment, except when phenmedipham was added to the mixture. The leaf injury associated with clopyralid in this study, though consistent across varieties, generally appears to be cosmetic, and may not be detrimental to spinach yields or to the quality of spinach harvested for canning or freezing.

Table 1. The effects of clopyralid applications averaged across all treatments on leaf injury to processing spinach varieties and leaf types.

Variety	Leaf type	Trial 1 10 DAT	Trial 2 10 DAT	Combined 20 DAT	Combined 35 DAT	Combined Average
		------ % Leaf injury ------				
Padre	Savoy	1.41	1.83	1.68	0.94	1.41
F415	Semi-Savoy	1.41	1.94	2.04	1.55	1.75
Avon	Semi-Savoy	1.30	1.53	1.79	1.23	1.48
157	Semi-savoy	0.80	1.20	0.90	0.80	0.90
17047	Flat, Semi-Savoy	1.11	1.56	1.35	1.31	1.33
DMC 66-09	Flat, Smooth	1.30	2.05	1.81	1.21	1.57
DMC 66-16	Flat, Smooth	0.64	1.55	1.25	1.06	1.14
DMC 66-07	Flat, Smooth	0.61	1.25	1.04	1.06	1.01
	LSD (0.05)	**0.27**	**0.20**	**0.20**	**0.17**	**0.11**

[a] Injury ranking: 0 = no visible injury; 1 = mild injury (slight leaf curling, leaf crinkling);
2 = moderate injury (moderate leaf curl/crinkling with misshapen leaves); 3 = severe injury (stunting with severely crinkled and/or misshapen leaves); 4 = plant death

Table 2. The effects of clopyralid applied alone or tank-mixed with additives averaged over eight spinach varieties.

Treatment	Rate kg ai/ha	Trial 1 10 DAT	Trial 2 10 DAT	Combined 20 DAT	Combined 35 DAT	Combined Dry weight yield 35 DAT
		% Leaf injury				g/pot
Untreated	0	0	0	0	0	7.39
Clopyralid	0.14	0.70	1.50	1.11	1.00	7.56
Clopyralid + NIS	0.14 0.25% v/v	0.93	1.81	1.86	1.21	7.58
Clopyralid + COC	0.14 1.0% v/v	1.14	1.86	1.76	1.42	7.59
Clopyralid + s-Metolachlor	0.14 0.36	1.17	2.02	1.73	1.41	6.90
Clopyralid + Sethoxydim + COC	0.14 0.31 1.0% v/v	1.13	1.69	1.66	1.45	7.44
Clopyralid + Clethodim + COC	0.14 0.14 1.0% v/v	1.05	1.73	1.64	1.41	7.01
Clopyralid + Phenmedipham	0.14 1.10	2.45	2.30	2.11	1.25	5.27
	LSD (0.05)	**0.27**	**0.20**	**0.21**	**0.17**	**0.86**

[a] Injury ranking: 0 = no visible injury; 1 = mild injury (slight leaf curling, leaf crinkling); 2 = moderate injury (moderate leaf curl/crinkling with misshapen leaves); 3 = severe injury (stunting with severely crinkled and/or misshapen leaves); 4 = plant death

Table 3. The effects of clopyralid applied alone or tank-mixed with additives combined across trials on processing spinach yield 35 DAT.

Treatment	Rate (kg a.i. / ha)	F415	Padre	DMC 66-09	17047	157	Avon	DMC 66-16	DMC 66-07
		Yield (g/pot)**							
Untreated	0	8.47	7.13	8.24	8.30	8.56	5.43	5.66	7.35
Clopyralid	0.14	7.69	8.56	8.63	7.49	8.62	5.70	6.83	7.00
Clopyralid + *NIS*	0.14 0.25% v/v	9.98	8.51	7.11	8.19	9.18	5.02	5.69	7.00
Clopyralid + *COC*	0.14 1.0% v/v	7.16	8.13	8.40	8.58	10.36	4.68	6.83	6.55
Clopyralid + *s-Metolachlor*	0.14 0.36	6.52	6.49	6.16*	8.83	8.89	5.61	5.67	7.06
Clopyralid + *Sethoxydim +* *COC*	0.14 0.31 1.0% v/v	8.14	7.82	7.77	8.14	8.06	5.70	6.39	7.50
Clopyralid + *Clethodim +* *COC*	0.14 0.14 1.0% v/v	7.29	6.32	7.46	8.30	9.80	5.73	5.80	5.41*
Clopyralid + *Phenmedipham*	0.14 1.10	7.19	4.97*	5.13*	5.15*	6.61*	3.11*	4.76	5.22*

** Means within columns followed by an asterisk are significantly different when compared to the untreated control at α = 0.05 according to

Fischer's Protected LSD.

Evaluation of Watermelon Varieties for Yield and Quality on the Texas High Plains

Final Report

Objective: To evaluate watermelon varieties for yield and quality and determine appropriate varieties for growing on the Texas High Plains.

Materials and Methods:

All varieties were seeded in the greenhouse on April 10, 2006, and when at the appropriate size where placed outside to harden. The test site was pre-irrigated and fertilized (80 lbs/A nitrogen plus 20 lbs/A phosphorus), and one week prior to transplanting, the beds were shaped. The entire test site was treated with pre-transplant applications of Strategy (3.5 pints/A) plus Sandea (0.5 oz/A) for weed control. Drip tape was placed at the center on the bed surface just prior to transplanting. All varieties were transplanted by hand on May 11 at a spacing of 36" in-row and 80" between rows. Each plot measured 20' long by 6.7' wide, and contained 5 plants/plot. During crop growth, the entire site was scouted for insects, diseases, and weeds, and appropriate measures taken to control all pests. The test site was weeded by hand as needed during the course of the trial. There were no major outbreaks of disease or insects during the course of the study. All plots were harvested on July 27 and again on August 2.

Results: Temperatures during crop growth for the 2006 trial exceeded 95 ^{o}F for 51 days, and 15 of those days were at 100 ^{o}F or higher. Although drip-irrigated, overall vine growth was considerably poor compared to previous years, and the lack of fruit set appeared to be influenced by the high temperatures. In addition, the percentage of culls by variety was generally higher this year, indicating that the plants were likely under environmental stress. Only 2.41" of rainfall fell during the course of the trial, with 85% of that precipitation occurring prior to fruit set. The high temperatures and dry conditions likely influenced average overall yields (diploids = 24,401 lbs/A; triploids = 21,201 lb/A) for 2006. This relates to a 56% reduction in overall yields for 2006 compared to previous years.

The top three yielding diploid varieties included Summer Flavor 800 (a grower standard), followed by Summer Velvet and Diablo. Top three yielding triploid varieties included Matrix, Tri-X 313 (a grower standard) and Crunchy Red.

Table 1. Yield Data for Lubbock Watermelon Variety Trial

Entry	** Total Yield (lbs/A)	Harvested fruit (% fruit size grade) > 30	25-30	20-25	15-20	10-15	5-9	%culls
				Diploids				
Summer Flavor 800	32,850	2.5	2.5	21.7	56.7	---	---	16.6
Summer Velvet	30,227	---	---	27.8	15.6	---	---	56.5
Diablo	27,662	16.8	4.2	12.5	16.1	---	---	50.4
Ole	26,281	---	16.9	23.9	6.9	---	---	52.3
Redlicious	24,738	3.5	4.2	18.5	29.0	---	---	44.8
Chiquita *	24,435	---	---	5.9	31.7	20.8	12.7	28.9
WX 266 ***	21,707	---	6.3	9.4	28.1	---	---	31.2
Jamboree	20,938	6.3	6.3	11.5	37.5	---	---	38.4
Escarlett	19,452	6.3	---	33.7	15.0	---	---	45.0
Royal Sweet ***	15,718	---	---	25.0	16.7	---	---	33.3
				Triploids				
Matrix	30,693	---	3.1	6.3	59.8	17.5	---	13.3
Tri-X 313	27,409	---	---	6.4	25.3	35.6	---	32.7
Crunchy Red	25,955	---	---	---	25.0	45.8	---	29.2
Intruder	24,035	---	---	10.7	16.5	55.2	---	17.6
Sweet Slice	23,537	---	---	6.7	48.3	9.2	---	35.8
Tri-X Palomar	23,022	---	---	25.0	21.3	38.3	---	15.4
Sweet Delight	22,973	---	4.2	14.6	43.8	33.4	---	4.0
Candy	22,826	---	---	6.3	51.4	25.9	---	16.4
Tri-X 212	22,311	---	---	9.8	34.2	41.4	---	14.6
Sweet Slice Plus	21,331	---	---	12.5	35.3	36.7	---	15.5
HMX 4915	21,274	---	---	---	5.6	58.1	---	36.3
Tomcat	20,906	---	---	---	39.3	42.8	---	17.9
ACR 4674	20,734	---	---	---	25.0	48.8	---	26.2
ACR 4844	20,694	---	---	3.6	26.6	32.2	---	37.6
Tri-X Triple Threat	17,123	---	---	---	5.0	64.2	---	30.8
ACR 5534	16,870	---	---	---	35.4	18.8	---	45.8
Super Seedless #7167	16,225	---	---	---	18.3	34.3	---	47.4
Summer Sweet #5244	15,775	---	---	6.3	33.7	42.5	---	17.5
ACR 5624	15,735	---	---	6.3	25.0	56.3	---	12.4
Crisp N Sweet	14,591	---	---	5.0	31.8	27.5	---	35.7

*** Chiquita (WX 272) is selected to be a small seeded melon.**
****Total yield calculations are based on each variety planted in the entire field.**
***** WX 266 and Royal Sweet percentages add up to 75% due to one rep not setting.**

Snap Bean Variety On-Farm Yield Performance

Final Report

Objective: To evaluate eight snap bean varieties planted during 2006 for effects of heat on yield and quality characteristics when grown under grower conditions.

Material and Methods: The trial was planted on 30" rows in a grower's field on July 10, and crop growth was monitored weekly by the grower and consultants with Allen Canning Company. The beans were grown under center pivot irrigation and were irrigated immediately following planting with 1" followed every 2 -3 days with 0.6" of water until harvest. Beans were fertilized according to grower needs with 80 – 100 lbs nitrogen. There was no visible insect/worm damage on the bean pods, though some possible leaf defoliation from disease or verey slight hail damage to the crop. The entire test was harvested on September 11, 62 days after planting by taking 5' sub-samples from the specific varieties and counting the number of plants, weighing the entire plant, and removing the pods by hand to assess yield. All data was analyzed using Fischer's Protected LSD at the 0.05 level.

Results and Discussion: Snap bean yields were highest with BBL 156 (grower standard) followed by KSI-196 and Ulysses (Table 1). The lowest yield was found with Titan, and it was 55% less than BBL 156. Yield per plant followed similar trends associated with overall yield, in that the highest yield plants were found in BBL 156, and this was followed by GB-84. Lowest yielding plants were found with Titan at 1.8 oz yield/plant. Crop stands were not significantly affected by variety, with the exception of GB-84, which was significantly less compared to BBL 156. Average bean pod weight per plant was highest with BBL 156. When compared to BBL 156, KSI-196, GB-84, Igloo and Titan produced significantly less bean pod weight per plant. Finally, yield marketablilty measured by pod sieve size showed that BBL 156, KSI-196, Ulysses, GB-84 and Caprice had higher percentages of marketable bean pods (sieve sizes 2 – 5) compared to Igloo and Titan. Igloo failed to produce any #5 sieve beans, while KSI-196 and Caprice produced less than 10% #5 sieved pods. The highest weight for sieve sizes for all varieties within the test were found in sieve #'s 3 and 4, except for Ulysses which produced the highest percentage in sieve sizes 4 – 5.

The results of this study indicate that BBL 156 continues to be the highest yielding snap bean variety for the Texas High Plains, and outproduces all other varieties by 20% or more. However, other characteristics associated with BBL 156 (low pod set, lodging, etc.) continue to suggest the need for further yield and quality evaluations for other varieties in snap beans.

Grower Snap Bean Variety Trial: 2006

Cooperators: Sangu Angadi, New Mexico State University
Russ Wallace, Texas A & M University
Doug Dillon, Allen Canning Company
Grower: Recktor
Location: Hub, TX

Table 1. Yield and quality of snap beans grown under grower conditions on the Texas High Plains.

Variety	Yield	Seed Count	Germination	Yield/ plant	Crop Stand	Bean Pod Weight	Sieve # 1	Sieve # 2	Sieve # 3	Sieve # 4	Sieve # 5
	tons/A	*#/lb*	*%*	*oz.*	*plants/A*	*% of total plant*	-------------------- *% of total pod weight* --------------------				
BBL 156	10.2	NA	NA	4.0	89,801	56.5	8.0	12.9	26.4	29.8	22.9
KSI-196	8.1	NA	NA	3.3	77,738	47.5	6.9	15.9	34.2	34.0	9.0
Ulysses	7.2	1,433	95	3.5	69,696	50.0	3.5	3.9	11.3	47.6	33.7
GB-84	7.0	2,407	85	3.7	62,995	42.5	5.8	12.6	23.5	43.8	14.3
Igloo	6.6	2,157	85	2.3	97,843	40.0	10.9	23.8	46.0	19.3	0
Caprice	6.4	1,715	85	2.2	93,821	50.0	5.3	11.6	43.9	33.2	6.0
Titan	4.6	1,555	94	1.8	83,099	40.0	10.2	14.5	23.9	34.7	16.7
LSD (0.05)	**1.6**			**1.2**	**26,681**	**8.5**	**4.7**	**8.8**	**15.9**	**17.7**	**14.9**

Evaluation of Processing Snap Bean Varieties for Heat Tolerance

Final Report

Objective: To evaluate snap bean varieties planted at two timings for effects of heat on yield and quality characteristics.

Materials & 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 7.7 and 1.1% organic matter. The site was treated with liquid nitrogen (80 lbs N/A) and the soil listed into 40" beds for the planting. Snap bean varieties were planted on May 18 and June 14 into 2-row plots measuring 6.7 by 20', after which Dual Magnum was applied preemergence at a rate of 0.65 lbs a.i./A. The beans were monitored weekly for optimal growth, as well as for diseases, insects and weeds. Both tests were furrow-irrigated as needed (four to five times). The growing season had unusually high air temperatures during June, July and early August, and very little rain fell during this period. Varieties were assessed for growth characteristics, and harvested when mature. For yield data, whole plants were removed from 1.0 meter row sections, weighed and bean pods removed and sieved for assessing grade quality. The trial was conducted as a RCB design with each variety replicated 4 times. All data were subjected to ANOVA using SAS procedures and means separated using Fisher's Protected LSD at the 5% level.

Results and Discussion: Average bean emergence during the early planting (May 18) was 40% higher compared to the later (June 14) planting (Tables 1 and 3). Although both tests were irrigated within 24 hours following planting, high air and soil temperatures may have influenced germination and emergence in the later planting. Average crop vigor was 7% higher with the earlier planting compared to the later planting. Similarly, average plant height was 7% shorter in the later planting compared to earlier planting. Pod set (height) location within the bean canopies varied depending on variety, with SB 4285 and PLS 83 setting pods lower within the canopy than any other varieties, and this occurred at both planting dates. Pod set was highest in Ulysses, Roma II, Titan and Ambra when planted early; however, when planted later during June, pod set location was highest within the bean canopies with Diplomat, PLS 84, GR-1-04 and Igloo. The results indicate potential variety adaptations to varying temperatures during differing planting dates.

Yields differed significantly by variety, though some similar trends in the data were observed between planting dates. On average, yields were greatly reduced when compared to commercial production in West Texas and may have been the result of high air temperatures and low rainfall during the 2006 growing season, as well as the lack of consistent overhead irrigation. Embassy yielded higher than all other varieties at both plantings while significantly lower yields were found with Igloo, Caprice, Hayden and PLS 83 when planted at either date. In addition, average yields were higher with Ulysses, Diplomat and Titan for round varieties. With flat bean varieties, Roma II yields averaged higher than all other varieties followed by Herrera and Tapia. Yields with Ebro were consistently low.

When averaged over both trials, Embassy had an average 37% beans by weight (pods + stems, leaves and shoots) and was highest compared to all other varieties (Tables 2 and 4). This indicated that average bean production with Embassy was not likely affected by planting date. Percent bean weight was on average higher with varieties planted in May compared to the June planting, and this may have been a reflection of heat stress during flowering for the June planting. Sieve size varied somewhat between varieties and the responses were somewhat different between planting dates. In both planting, Embassy performed more uniformly than all other varieties, and the majority of beans fell within the 3 – 5 sieve categories. The results of this research indicate that Embassy is an excellent variety to plant when conditions of heat stress are expected, which is typical during the summer months on the Texas High Plains. Other varieties that performed well include Ulysses, Diplomat, Titan, Dart, Ambra, Roma II and Herrera, and these would be recommended for use by growers in the area.

Table 1. Snap Bean Variety Evaluation on Yield and Growth Parameters (Planted May 18)

Variety	Company	Yield	Emergence	Vigor*	Height	Pod Set**	Plants Harvested
		Tons/A	# 1.0 m row		Inches		# 1.0 m row
Round Types							
Embassy	Syngenta	3.08	19.8	4.1	13.4	2.7	18.0
Ulysses	Asgrow-Seminis	1.70	22.5	4.8	16.4	3.0	24.5
Diplomat	Syngenta	2.37	22.5	3.8	12.8	2.5	18.0
Titan	Asgrow-Seminis	1.73	18.8	4.3	16.3	2.8	16.5
Dart	Harris Moran	1.70	22.8	4.4	15.8	2.6	20.5
Ambra	Harris Moran	1.62	22.0	4.1	14.0	2.8	15.8
PLS 84	Pure Line Seed	0.72	15.3	4.3	15.4	2.5	13.5
SB 4285	Syngenta	1.38	20.0	2.9	11.4	1.3	21.3
Envy	Harris Moran	1.44	16.0	3.9	15.3	2.7	18.5
Gr-1-04	Pure Line Seed	0.84	22.3	3.6	15.1	2.6	16.0
Igloo	Pure Line Seed	0.28	18.3	3.1	11.7	2.6	12.8
Caprice	Harris Moran	0.48	21.0	3.1	14.0	2.7	18.3
Hayden	Syngenta	0.51	20.0	4.0	14.2	2.4	21.0
PLS 83	Pure Line Seed	0.17	13.0	3.3	13.3	1.9	14.0
Flat Types							
Roma II	Syngenta	2.16	17.8	3.6	15.6	2.9	14.8
Herrera	Syngenta	1.79	20.5	4.4	14.0	2.6	21.0
Tapia	Asgrow-Seminis	1.51	22.8	4.8	21.6	2.4	22.0
Ebro	Asgrow-Seminis	0.63	22.3	3.6	18.5	2.3	17.5
	LSD (0.05)	**0.95**	**8.0**	**1.0**	**2.5**	**0.4**	**7.0**

* Vigor Ranking: 1 = poor, 2 = fair, 3 = average, 4 = good, 5 = excellent
** Average Pod Set: 1 = in lower canopy, 2 = in mid canopy, 3 = high in canopy

Table 2. Snap Bean Variety Evaluation on % Bean Weight and Grade Quality (Planted May 18)

Variety	Company	% Beans by Weight*	Bean Grade Quality				
			Sieve 1	Sieve 2	Sieve 3	Sieve 4	Sieve 5
Round Types							
Embassy	Syngenta	38.7	5.1	11.3	33.5	35.9	14.2
Ulysses	Asgrow-Seminis	19.7	8.0	8.4	26.6	46.7	14.5
Diplomat	Syngenta	29.0	11.3	15.8	37.9	27.8	1.4
Titan	Asgrow-Seminis	20.1	10.9	21.5	26.5	30.0	11.1
Dart	Harris Moran	19.4	10.1	12.1	20.0	39.7	18.1
Ambra	Harris Moran	26.4	10.7	26.6	34.5	24.5	3.8
PLS 84	Pure Line Seed	9.7	14.5	14.0	16.2	33.0	22.4
SB 4285	Syngenta	30.5	9.0	6.5	19.2	36.7	28.6
Envy	Harris Moran	16.0	6.0	12.8	24.7	22.0	34.6
Gr-1-04	Pure Line Seed	11.7	5.7	35.9	29.7	20.5	8.3
Igloo	Pure Line Seed	4.3	13.6	20.0	25.1	31.2	10.0
Caprice	Harris Moran	7.1	3.2	14.7	21.3	56.1	4.8
Hayden	Syngenta	7.4	4.5	32.1	7.5	12.0	18.9
PLS 83	Pure Line Seed	2.9	4.8	3.6	0	26.7	40.0
Flat Types							
Roma II	Syngenta	28.5	3.9	14.1	38.9	28.3	14.8
Herrera	Syngenta	34.9	8.3	17.7	36.0	25.5	12.6
Tapia	Asgrow-Seminis	18.6	12.9	15.8	19.5	27.0	24.8
Ebro	Asgrow-Seminis	12.0	9.0	8.0	25.8	23.6	33.7
	LSD (0.05)	**9.6**	**9.3**	**23.9**	**17.3**	**17.1**	**19.5**

* Calculated from weight of the beans divided by the weight of the entire plants with beans.

Table 3. Snap Bean Variety Evaluation on Yield and Growth Parameters (Planted June 14)

Variety	Company	Yield	Emergence	Vigor*	Height	Pod Set**	Plants Harvested
		Tons/A	#/ 1.0 m row		Inches		#/1.0 m row
Round Types							
Embassy	Syngenta	3.68	12.5	4.3	15.3	2.6	13.3
Ulysses	Asgrow-Seminis	2.31	12.5	4.0	15.3	2.7	10.0
Diplomat	Syngenta	1.42	14.8	3.4	12.4	2.8	16.3
Titan	Asgrow-Seminis	1.57	9.3	3.5	13.8	2.6	9.8
Dart	Harris Moran	1.46	16.3	4.3	14.6	2.6	20.5
Ambra	Harris Moran	1.37	12.3	4.3	13.9	2.5	13.3
PLS 84	Pure Line Seed	1.47	8.5	3.9	13.6	2.8	10.0
SB 4285	Syngenta	0.73	15.0	2.3	10.4	1.0	16.5
Envy	Harris Moran	0.55	16.3	4.4	17.3	2.6	11.8
Gr-1-04	Pure Line Seed	1.13	7.8	2.9	12.1	2.8	12.5
Igloo	Pure Line Seed	0.92	11.8	3.8	12.0	2.8	10.8
Caprice	Harris Moran	0.72	15.8	4.3	15.4	2.4	21.5
Hayden	Syngenta	0.61	17.8	4.5	16.6	2.6	16.6
PLS 83	Pure Line Seed	0.88	8.3	3.0	13.4	1.9	10.8
Flat Types							
Roma II	Syngenta	1.44	12.3	3.0	12.9	2.6	11.8
Herrera	Syngenta	1.21	6.8	3.4	13.3	2.4	12.8
Tapia	Asgrow-Seminis	0.66	8.5	3.0	14.4	2.6	11.0
Ebro	Asgrow-Seminis	0.61	10.0	3.0	13.5	2.4	10.3
	LSD (0.05)	**1.60**	**7.4**	**1.7**	**3.4**	**0.3**	**7.3**

* Vigor Ranking: 1 = poor, 2 = fair, 3 = average, 4 = good, 5 = excellent
** Average Pod Set: 1 = in lower canopy, 2 = in mid canopy, 3 = high in canopy

Table 4. Snap Bean Variety Evaluation on % Bean Weight and Grade Quality (Planted June 14)

Variety	Company	% Beans by Weight*	Bean Grade Quality				
			Sieve 1	Sieve 2	Sieve 3	Sieve 4	Sieve 5
Round Types							
Embassy	Syngenta	36.3	2.0	8.5	28.6	47.3	13.6
Ulysses	Asgrow-Seminis	22.3	3.2	17.8	33.1	32.4	13.5
Diplomat	Syngenta	16.3	4.0	14.5	36.4	16.6	3.6
Titan	Asgrow-Seminis	14.3	6.1	11.0	50.0	27.9	5.0
Dart	Harris Moran	11.0	3.4	9.7	48.2	31.5	7.3
Ambra	Harris Moran	16.5	21.0	22.5	28.6	24.0	1.5
PLS 84	Pure Line Seed	15.5	7.3	15.8	36.9	35.9	4.1
SB 4285	Syngenta	14.5	31.6	9.1	28.1	19.7	11.6
Envy	Harris Moran	6.4	8.8	31.3	21.1	27.5	11.4
Gr-1-04	Pure Line Seed	9.0	1.7	6.7	27.1	10.2	4.4
Igloo	Pure Line Seed	9.0	15.0	18.5	47.3	18.2	1.0
Caprice	Harris Moran	8.1	15.7	14.7	24.0	39.4	6.3
Hayden	Syngenta	6.9	15.6	14.1	19.7	29.2	21.5
PLS 83	Pure Line Seed	8.0	0.7	7.8	19.3	24.3	22.9
Flat Types							
Roma II	Syngenta	14.3	16.4	12.0	31.4	27.3	13.0
Herrera	Syngenta	15.4	14.5	18.5	34.5	17.7	14.9
Tapia	Asgrow-Seminis	9.3	4.1	12.4	27.8	16.7	14.1
Ebro	Asgrow-Seminis	8.2	30.8	7.8	24.4	18.1	18.9
	LSD (0.05)	**12.1**	**23.5**	**11.9**	**24.3**	**18.7**	**17.8**

* Calculated from weight of the beans divided by the weight of the entire plants with beans.

Use of Guar [(*Cyamopsis tetragonolaba* (L.) Taub.] for Cover Crop Rotation and Green Manuring

Research Project

Amy T. Jones (Graduate Student, Texas Tech University)
Ellen Peffley (Professor, Texas Tech University)
Russ Wallace (Extension Vegetable Specialist, Texas A & M University)

What is the problem and how does it relate to the sustainability of agriculture in the South?

Sustainable practices help to maintain an owner- operated farming system by optimizing management of natural resources. Crops which have multiple uses (i.e. as cover crop rotations and green manure crops) are an integral part in sustainable farming systems allowing farms to be more efficient (Sullivan, 2003). Environmental and economic concerns for introducing new multi-use crops into production on the Texas High Plains are crop monoculture, soil erosion, limited water, and fields low in fertility and organic matter. An associated economic concern is limited income markets for the farmer.

The main crop on the Texas High Plains is cotton; annual production is approximately 3.7 million acres grown as cotton following cotton (Plains Cotton Cooperative Association, 2004). Monocultures contribute to disease and insect buildup. The lack of crop rotation with green manure crops increases soil erosion, leaves low organic matter, poor tilth, and increased salinity in the soil (Blackshaw et al., 2001).

Crops monocultured (without rotation) are usually fertilized with inorganic nutrient source. Anhydrous ammonia is a commonly used nitrogen source in the Texas High Plains. Prices of this fertilizer have risen consistently over the last five years from $80.00/ ton in 2000 to $240/ ton in 2005 (McQuaid, 2005). Because cost of inorganic Nitrogen (N) fertilizer is rising alternative sources of fertility are sought (Auld et. al., 1982). Inorganic fertilizers while adding nutrients to the plants do not add organic matter (OM) to the soil. Green manure crops meet this need; amending soil with green manure crops adds OM and nutrients to the soil. Organic matter improves soil tilth and maintains nutrients in an exchangeable form for plants while increasing water holding capacity. (McKaig et al., 1938).

Lubbock County is in a semiarid region receiving approximately 18 inches of rain yearly. Sandy soils of the High Plains have low water holding capacity. Expanding urban areas across the Southwest demand more of the available water. With limited water resources it is critical to identify agricultural crops tolerant to drought with low water requirements (Alexander et al., 1986).

The rising costs of fertilizers and other non-renewable resources and declining water are primary in the decreased income of farmers. Variability in production was lowest in crop rotations with the most diversity (Smolik, 1995). In summary, multi-use crops can stabilize income and stresses by opening alternative markets. Cover crop rotation and green manure crops not only add OM, improve soil tilth, increase water holding capacity, and replace lost fertility, they can also maximize profits in uncertain market cycles.

What is your answer to the problem?

An excellent alternative crop for the Texas High Plains is guar, Cyamopsis tetragonolaba (L.) Taub. (Undersander et al., 1991). The objective of this research is to examine if guar is suitable as a summer cover crop rotation or green manure crop and provide a marketable unit (dry bean or immature pod). A field trial will be conducted to test different ways of land management using guar. A common summer rotatation legume, southern pea [Vigna unguiculate (L.) Walp.] will be used as a comparison crop. It has been shown in previous studies that guar dry-weight yields (5,122 Kg/ha) are superior over southern pea (sometimes called cowpea) dry-weight yields (3,909 Kg/ha) (Whistler,1979).
Green manuring involves the incorporation of any crop for the purpose of soil improvement. A cover crop is grown to provide soil cover and does not have to be incorporated later. Guar can be used as a cover crop and green manure to improve organic matter and structure of the soil. Guar was identified as the most useful rotation with wheat and has increased yields in pearl millet and cotton (Kumar and Singh, 2002).

Guar (sometimes called clusterbean) is an annual plant in the Fabaceae family. It is a warm season crop and needs from 90 to 120 days for complete maturity (Whistler, 1979). Planting should occur when soil temperatures are above 70 F (Whistler, 1979). Proven to be drought resistant, pod yields of guar can increase with minimal supplemental irrigation (Whistler, 1979). Guar grows well under a wide range of soil conditions. It is shown to be tolerant of both salinity and alkalinity (Whistler, 1979). Guar has either a basal, erect, or erect and branching growth habit reaching 3 to 6 feet tall with pods originating six inches above the ground (Undersander et al., 1991). The pod of this legume is a valuable source of fodder and vegetable food, with significant nutraceutical and industrial applications (Undersander et al., 1991). The symbiotic relationship between guar and Rhizobium bacteria provides additional nitrogen to crops planted in a rotation after guar (Undersander et al., 1991). Guar as a cover crop can help to prevent soil erosion and act as a 'catch crop'. After pod harvest, organic matter is incorporated into the soil contributing to beneficial soil microbes and soil tilth. Recent reports revealed increased cotton production by greater than 12% following a guar rotation (Anderson, 2005).

State how the project and the expected results contribute to agricultural sustainability.

This project contributes to the sustainability of agriculture by alleviating some common challenges associated with farming in semi-arid regions, namely suggesting the drought and heat tolerant crop of guar as a cover crop rotation and green manure. In western, semi-arid climates OM averages less than 1% of the soil content (Western Fert. Handbook, 1985). Organic matter benefits the soil structure by the formation of soil aggregates which increases tilth and aeration allowing for increased water infiltration rates (Sullivan, 2003). The soil aggregates are formed when gums, waxes, and resins resistant to decomposition from guar and microorganisms are combined. Guar incorporated for OM improves the soil reducing cost of production most often absorbed by the farmer.

Guar is a nitrogen-fixing legume crop. Nitrogen production from legumes is a benefit of growing cover crops and green manures. Guar is known to fix approximately 30 Kg N per hectare (66 lbs. N/2.2 A) (Kumar and Singh, 2002). Forty to sixty percent of the fixed N is left in the field and is available to the following crop (Sullivan, 2003). The rapid nitrification of N from the leaves of guar has been sited as an immediate source of fertility (Whistler, 1979). Nitrogen fertilizer is 23K Btu's of the 47K Btu's of energy needed to produce a bushel of corn (USDA, as cited by Looker, 2005). With the rising cost of N fertilizers, legumes are an efficient, organic means of replacing fertility.

Guar is a drought toleratant annual. It conserves water with its deep taproot system, extracting moisture deep below the soil surface. Seed yields of guar are reduced with excessive applications of irrigation water during the growing season (Johnson et al, 1982). Alexander et al. (1988) suggests three irrigations are optimal over the growing season. An additional benefit of cover crops and green manure crops is decreased soil run-off, reduced soil surface evaporation and subsequent soil crusting (Sullivan, 2003). Because water is also a cost -inhibiting input for sustainable farming systems, reduced irrigation will provide increased revenue to growers.

Where and how will you tell others (producers, extension and/or researchers) about your results? What is your outreach plan? Outreach plans may include workshops, field days, fact sheets, journal articles, presentations at agriculture meetings and more.

The information derived from this research will be disseminated through written publications (a Masters Thesis) as well as in water conservation, farm bureau, and other statewide extension newsletters, agricultural field days and farm tours, a Texas Tech University on-campus seminar, and other agricultural meetings on the Texas High Plains. This information will also be presented at the Southern Region American Society of Horticulture Science meetings. The research will also be presented in a format suitable for publication on the local Texas Cooperative Extension website in order to allow searchable information to be readily available to interested growers.

Effects of Nitamin 30L and Nitamin 43G Fertilizers on Crop Growth and Yield in Snap Beans

Final Report

Objective: To evaluate the effects of Nitamin fertilizer products applied at two rates on crop vigor and yield in processing snap beans on the Texas High Plains.

Materials & 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 7.7 and 1.1% organic matter. The trial site was plowed in the fall and in the spring the soil was listed into 40” beds for seeding of snap beans (Var. “Envy”). The soil was sampled prior to the test to determine nitrogen levels within the soil zone and showed that NO_3 levels averaged 3.5 ppm or “very low” according to standardized soil tests from A & L Plains Agricultural Laboratories.

Nitamin 30L was applied using a CO_2-charged backpack spray rig equipped with a single nozzle that delivered the product at 35 psi into furrows placed 3” to the side and 3” below the seed zone. Nitamin 43G was weighed and measured for the appropriate rates and the granules were spread uniformly on the soil surface by hand and raked into the top 3” of soil. The crop was monitored weekly for growth, diseases, insects and weeds, and irrigated regularly. During the growing season, unusually high air and soil temperatures influenced snap bean pod set, resulting in significantly lower yields when compared to previous year averages. Yields in this study were measured from 5’ sub-samples taken from the individual plots. From those sub-samples, the beans were removed and categorized by sieve sizes according to processor standards. The trial was conducted as a RCB design with treatments replicated 4 times in plots measuring 3.5’ x 20’. All data were subjected to ANOVA using SAS procedures and means were separated using Fisher’s Protected LSD at the 5% level.

Results and Discussion: Snap bean stand counts recorded within 3 weeks following planting showed that there was no effect of individual fertilizer treatment on bean emergence (Table 1). Although there were trends for increased crop vigor from several ratings (June 20 and July 3), there were no significant differences. Bean yields were highly variable (likely due to the high air temperatures) and there were no differences between the untreated plots and any of those with fertilizer treatments. There was a general trend for snap beans fertilized with either nitrogen rate or with any of the three products to have higher yields, as would be expected. The highest yields were found in the plots treated with urea (45-0-0) at 80 lbs N/A, while the lowest yields were found in urea plots treated with 40 lbs N/A. There was a slight (4.2%) advantage of using Nitamin fertilizers (average of all four treatments) when compared to the standard urea, though again, yield data was too variable to determine whether this response was real.

Snap bean grade quality, as measured by percent sieve sizes (Table 2) showed that there were no major trends or shift in sieve quality with any of the fertilizer treatments. This suggests that the use of either Nitamin 30L or Nitamin 43G would not negatively influence snap bean sieve quality when snap beans are processed.

The results of this study suggest that as expected, snap beans fertilized with nitrogen, regardless of product formulation, will have yields higher than those not fertilized. In this study, product formulation had no significant positive impact on yields, and may be a factor that snap beans are generally harvested within 60 – 64 days following planting. It is also likely or possible that the high temperatures during the 2006 growing season impacted the results of this trial, negating any benefits of one formulation over another.

Table 1. Effects of Nitamin 30L and Nitamin 43G on Bean Emergence, Growth and Yield

Treatment	Nitrogen Rate (lbs/A)	Preplant application	Bean Emergence	Crop Vigor	Crop Vigor	Bean Yield
			# / meter	June 20	July 3	lbs/A
Untreated	0		25.5	3.63	3.75	751.8
Urea (45-0-0)	80	Broadcast	21.3	3.50	4.25	1875.5
Urea	40	Broadcast	20.5	3.88	3.63	604.8
Nitamin 30L	80	In-furrow	23.5	4.00	4.13	1015.5
Nitamin 30L	40	In-furrow	24.3	4.38	4.50	1487.3
Nitamin 43G	80	Broadcast	21.3	4.00	3.63	1326.0
Nitamin 43G	40	Broadcast	27.0	4.25	4.38	1346.0
		LSD (0.05)	**6.3**	**0.82**	**1.32**	**1716.7**

Vigor ranking: 0 = dead, 1 = poor, 2 = fair, 3 = average, 4 = good, 5 = excellent.

Table 2. Effects of Nitamin 30L and Nitamin 43G on Snap Bean Pod Size Distribution

Treatment	Nitrogen Rate (lbs/A)	Preplant application	Sieve 1	Sieve 2	Sieve 3	Sieve 4	Sieve 5
			---------- % Distribution for Individual Sieve Sizes -----------				
Untreated	0		0.9	19.9	27.4	41.6	10.2
Urea (45-0-0)	80	Broadcast	11.3	15.1	13.6	44.6	15.4
Urea	40	Broadcast	11.1	7.7	16.8	31.3	33.2
Nitamin 30L	80	In-furrow	5.5	14.3	15.3	52.6	12.4
Nitamin 30L	40	In-furrow	9.1	14.8	21.6	49.7	4.9
Nitamin 43G	80	Broadcast	10.2	16.8	26.0	35.7	11.4
Nitamin 43G	40	Broadcast	13.4	15.0	35.9	29.1	6.6
		LSD (0.05)	**8.3**	**8.4**	**15.2**	**15.4**	**11.7**

Effects of Nitamin 30L and Nitamin 43G Fertilizers on Crop Growth and Yield in Cantaloupes

Final Report

Objective: To evaluate the effects of Nitamin fertilizer products applied at two rates on the yield of direct-seeded cantaloupes grown on the Texas High Plains.

Materials & 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 7.7 and 1.1% organic matter. The trial site was plowed in the fall, and in the spring the soil was listed into 40" beds for the planting of cantaloupes (var. "Hales Best Jumbo"). The soil was sampled prior to the test to determine nitrogen levels within the soil zone, and these showed that NO_3 levels averaged 3.5 ppm or "very low" according to the standardized soil tests from A & L Plains Agricultural Laboratories. Nitamin 30L was applied at 50 and 100 lbs N/A using a CO_2-charged backpack spray rig equipped with a single nozzle that delivered the product at 35 psi into narrow furrows centered 3" below the transplant zone. Nitamin 43G and urea (45-0-0) were weighed out at rates of 50 and 100 lbs N/A, and the fertilizer granules were spread uniformly by hand on the soil surface and raked into the top 3" of soil. Fertilizer treatments were applied on May 23, and cantaloupes were seeded the same day into plots measuring 13.3' x 30'. The cantaloupe crop was monitored weekly for optimal growth, as well as for diseases, insects and weeds. The crop was irrigated regularly as needed. The growing season had unusually high air and soil temperatures during June, July and early August, but this did not seem to impact crop growth as it did with the other fertilizer trials. Cantaloupe yields were recorded by harvesting ripe fruit from each of the individual treatment plots, and plots were harvested a total of seven times during the study. Harvesting data was combined by week to facilitate yield analysis. The trial was conducted as a RCB design with treatments replicated 4 times. All data were analyzed using SAS procedures and means separated using Fisher's Protected LSD at the 5% level.

Results and Discussion: Yield analysis over the first 6 harvests (3 weeks) showed that there were no significant differences in fertilizer treatments for cantaloupe weights, including the untreated control (Table 1). Cumulative yields to date (CYTD) were also not different between fertilizer treatments within this study. Differences in cantaloupe yields were observed for the final harvest (week 4), and showed that significantly higher yields were obtained in plots fertilized with Nitamin 43G at 50 lbs N/A compared to all other treatments, except the untreated control. Total yields, cumulated for all seven harvests, showed that yields were highest in the Nitamin 43G 50 lbs N/A treatment when compared only to Nitamin 30L applied at 100 lbs N/A, which were 27% less. A trend did exist within the Nitamin formulations in that the average total yields for the 50 lb N/A rate was 20% higher when compared to 100 lbs N/A. When averaged across formulations, Nitamin 43G increased yields by 4 and 9% over urea and Nitamin 30L, respectively. Average cantaloupe fruit weight did not differ significantly between any of the treatments, and ranged from 3.92 to 4.09 lbs/fruit (Table 1). There were no differences in weekly or cumulative number of fruit/plot for any fertilizer treatment during any of the first three weeks evaluated (Table 2). By Week 4, there was a difference between the numbers of cantaloupe harvested in the Nitamin 43G 50 lb N/A rate and both Nitamin 30L rates, as well as Nitamin 43G at 100 lbs N. It is unclear why this response occurred in this test. Finally, total number of cantaloupes/plot was not different from the untreated control for any of the fertilizer treatments, though there were differences between individual fertilizer treatments. The number of cantaloupes harvested in plots treated with Nitamin 30L were significantly lower than those harvested in plots treated with Nitamin 43G at 50 lbs N. Those plots treated with either Nitamin product at 50 lbs N had higher numbers of fruit (18%) than those treated with 100 lbs N. The results of this test for 2006 are inconclusive, and no definitive response to increased N levels was apparent. There are perhaps differences between Nitamin formulations, with Nitamin 43G enhancing yields over plants treated with Nitamin 30L in this study, though this response is also unclear.

Table 1. Effects of Nitamin 30L and Nitamin 43G on Direct-Seeded Cantaloupe Yield by Weight

Treatment	Nitrogen Rate (lbs/A)	Preplant application	Cantaloupe Harvest Distribution							
			Total Week 1	Total Week 2	Total CYTD*	Total Week 3	Total CYTD*	Total Week 4	Total Yield	Ave. Fruit Weight
			----lbs / plot----							lbs / fruit
Untreated	0		17.8	79.5	97.3	28.2	125.5	68.5	195.3	3.96
Urea (45-0-0)	100	Broadcast	15.3	69.9	85.3	42.6	127.8	66.0	193.9	4.02
Urea	50	Broadcast	18.9	68.5	87.4	34.7	122.1	62.9	185.0	4.09
Nitamin 30L	100	In-furrow	17.3	50.4	67.7	45.6	113.3	42.3	158.2	3.93
Nitamin 30L	50	In-furrow	14.4	73.2	87.6	53.9	141.5	59.1	200.6	4.03
Nitamin 43G	100	Broadcast	20.0	76.9	96.7	36.2	132.9	45.1	178.0	3.92
Nitamin 43G	50	Broadcast	22.4	66.7	89.1	34.5	123.6	93.3	217.9	4.03
		LSD (0.05)	**18.1**	**44.5**	**44.6**	**31.9**	**42.2**	**25.4**	**44.7**	**0.40**

*** CYTD = Cumulative Yield to Date**

Table 2. Effects of Nitamin 30L and Nitamin 43G on Direct-Seeded Cantaloupe Fruit Numbers

Treatment	Nitrogen Rate (lbs/A)	Preplant application	Cantaloupe Fruit Number Harvest Distribution						
			Total Week 1	Total Week 2	Total CYTD*	Total Week 3	Total CYTD*	Total Week 4	Total Yield
			No. cantaloupes / plot						
Untreated	0		5.0	20.7	25.5	7.3	33.0	16.3	49.3
Urea (45-0-0)	100	Broadcast	4.0	17.7	21.7	10.0	31.7	16.0	47.7
Urea	50	Broadcast	4.7	16.7	21.3	8.0	29.3	14.7	45.3
Nitamin 30L	100	In-furrow	5.7	12.7	18.3	11.7	30.0	10.3	40.3
Nitamin 30L	50	In-furrow	4.3	18.0	22.3	13.0	35.3	14.3	49.7
Nitamin 43G	100	Broadcast	5.3	20.3	22.3	8.0	30.3	12.0	45.3
Nitamin 43G	50	Broadcast	5.7	18.0	23.7	8.0	31.7	22.3	54.0
		LSD (0.05)	**4.5**	**10.4**	**9.1**	**8.7**	**8.7**	**6.6**	**8.4**

*** CYTD = Cumulative Yield to Date**

Effects of Nitamin 30L and Nitamin 43G Fertilizers on Crop Growth and Yield in Watermelons

Final Report

Objective: To evaluate the effects of Nitamin fertilizer products applied at two rates on the yield of transplanted seedless watermelons grown on the Texas High Plains.

Materials & 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 7.7 and 1.1% organic matter. The trial site was plowed in the fall, and in the spring the soil was listed into 40" beds for the transplanting of watermelons (var. "Orange Sunshine"). The soil was sampled prior to the test to determine nitrogen levels within the soil zone, and these showed that NO_3 levels averaged 3.5 ppm or "very low" according to the standardized soil tests from A & L Plains Agricultural Laboratories. Nitamin 30L was applied at 50 and 100 lbs N/A using a CO_2-charged backpack spray rig equipped with a single nozzle that delivered the product at 35 psi into narrow furrows centered 3" below the transplant zone. Nitamin 43G and urea (45-0-0) were weighed out at rates of 50 and 100 lbs N/A, and the fertilizer granules were spread uniformly by hand on the soil surface and raked into the top 3" of soil. Fertilizer treatments were applied on May 23, and watermelons were transplanted the following day into plots measuring 6.7' x 30' with 10 plants/plot. The watermelon crop was monitored weekly for optimal growth, as well as diseases, insects and weeds. The crop was irrigated regularly as needed. Data included measuring early vine length growth weekly from June 16 to June 30, crop vigor and harvesting twice (August 8 and August 18). The growing season had unusually high air and soil temperatures during June, July and early August which slowed crop growth and likely reduced overall yields. Watermelon yields were recorded by harvesting ripe fruit from each of the individual treatment plots. The trial was conducted as a RCB design with treatments replicated 4 times. All data were subjected to ANOVA using SAS procedures and means separated using Fisher's Protected LSD at the 5% level.

Results and Discussion: Average vine length measured on June 16 indicated that plants in the untreated control grew at rates similar to that of the in-furrow Nitamin 30L treatment, while vine lengths for plants treated with either rate of urea or Nitamin 43G grew an average 37% slower (Table 1). It is not clear why the untreated control had crop vine lengths superior to all other treatments in this test, though this trend continued with other data parameters, including crop vigor and total yields. However, by June 30, vine length growth was reduced only with plants fertilized with Nitamin 43G at 50 lbs N/A. Crop vigor measurements recorded on June 20 indicated that average growth was best with Nitamin 30L, followed by the untreated control, urea, and Nitamin 43G. On average, there was significantly better crop vigor with Nitamin 30L compared to Nitamin 43G in this test, and is perhaps a result of fertilizer formulation. Distribution of individual yields (Table 2) showed no significant differences between the weights of fruit size categories for any of the fertilizer formulations or rates used in this trial. The greatest fruit distributions were found in the 15.0 – 19.9 lb/fruit and 10.0 – 14.9 lb/fruit categories, with an average 40.7% and 30.1% of watermelons found within those categories, respectively. Finally, total watermelon yields picked during the two harvests showed that on average, greater yields were harvested during the first picking with all fertilizer treatments when compared to the untreated control (Table 3). However, overall total yields showed no significant differences between the fertilizer treatments, especially when compared to the untreated control. When averaging across the fertilizer formulations, the greatest yields were found in plots treated with Nitamin 30L, possibly indicating that this formulation is superior to the other two, however, no definitive response can be determined due to the higher yields found in the untreated plots. The results of this study appear to be compromised by the fact the untreated control had both excellent growth and yield responses, and there is no reasonable explanation for this. However, it does appear that at least within the fertilizer treatments evaluated in this study, Nitamin 30L was superior to both urea and Nitamin 43G in regards to vine growth, crop vigor and overall yield performance.

Table 1. Effects of Nitamin 30L and Nitamin 43G on Seedless Watermelon Vine Growth and Crop Vigor

Treatment	Nitrogen Rate (lbs/A)	Preplant application	June 16 Vine Length	June 23 Vine Length	June 30 Vine Length	Crop Vigor
			---------------- inches	----------------		June 20
Untreated	0		16.5	27.4	38.3	4.6
Urea (45-0-0)	100	Broadcast	9.9	19.3	30.6	4.3
Urea	50	Broadcast	10.4	19.9	32.9	3.9
Nitamin 30L	100	In-furrow	16.1	27.4	38.3	4.9
Nitamin 30L	50	In-furrow	15.9	25.3	35.4	4.6
Nitamin 43G	100	Broadcast	10.5	21.1	32.7	3.5
Nitamin 43G	50	Broadcast	8.9	16.7	29.5	4.0
		LSD (0.05)	**4.0**	**5.0**	**8.2**	**0.9**

Crop Vigor Ranking: 1 = poor; 2 = fair; 3 = average; 4 = good; 5 = excellent

Table 2. Effects of Nitamin 30L and Nitamin 43G on Seedless Watermelon Fruit Size by Weight

Treatment	Nitrogen Rate (lbs/A)	Preplant application	25 – 30	20 – 24.9	15 – 19.9	10 – 14.9	Culls
			--------------------- % by Weight (lbs/fruit) -------------------------				
Untreated	0		6.3	12.4	37.2	30.9	13.2
Urea (45-0-0)	100	Broadcast	0	24.2	28.9	33.6	13.4
Urea	50	Broadcast	0	13.1	61.4	22.8	2.8
Nitamin 30L	100	In-furrow	2.1	21.7	39.3	30.7	6.3
Nitamin 30L	50	In-furrow	0	12.5	26.1	47.7	13.8
Nitamin 43G	100	Broadcast	0	20.8	45.8	25.0	8.3
Nitamin 43G	50	Broadcast	0	15.7	46.4	19.9	18.0
		LSD (0.05)	**7.5**	**28.7**	**33.8**	**27.9**	**18.1**

Table 3. Effects of Nitamin 30L and Nitamin 43G on Seedless Watermelon Yield Characteristics

Treatment	Nitrogen Rate (lbs/A)	Preplant application	Harvest One	Harvest Two	Total Yield	Average Fruit Weight
			-------- (lbs/plot) --------		lbs/acre	lbs/fruit
Untreated	0		32.9	67.1	39,191	16.9
Urea (45-0-0)	100	Broadcast	77.1	22.9	24,518	16.8
Urea	50	Broadcast	49.9	50.2	36,308	17.2
Nitamin 30L	100	In-furrow	47.1	53.2	40,007	17.4
Nitamin 30L	50	In-furrow	54.6	48.0	33,606	15.2
Nitamin 43G	100	Broadcast	71.7	28.3	28,850	17.3
Nitamin 43G	50	Broadcast	45.1	55.0	34,465	17.1
		LSD (0.05)	**27.3**	**27.7**	**16,455**	**2.4**

Effects of Nitamin 30L and Nitamin 43G Fertilizers on Crop Growth and Yield in Chile Peppers

Final Report

Objective: To evaluate the effects of Nitamin fertilizer products applied at two rates on the yield of long green chile peppers grown on the Texas High Plains.

Materials & 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 7.7 and 1.1% organic matter. The trial site was plowed in the fall, and in the spring the soil was listed into 40" beds for the transplanting of chile peppers (var. "Anaheim"). The soil was sampled prior to the test to determine nitrogen levels within the soil zone, and these showed that NO_3 levels averaged 3.5 ppm or "very low" according to the standardized soil tests from A & L Plains Agricultural Laboratories. Nitamin 30L was applied at 70 and 140 lbs N/A using a CO_2-charged backpack spray rig equipped with a single nozzle that delivered the product at 35 psi into narrow furrows centered 3" below the transplant zone. Nitamin 43G and urea (45-0-0) were weighed out at rates of 70 and 140 lbs N/A, and the fertilizer granules were spread uniformly by hand on the soil surface and raked into the top 3" of soil. Fertilizer treatments were applied on May 23, and chile peppers transplanted the following day into plots measuring 3.5 x 20' with 12 plants/plot. The pepper crop was monitored weekly for optimal growth, as well as diseases, insects and weeds. The crop was irrigated regularly as needed, and harvested on September 27 (128 days after transplanting). The growing season had unusually high air and soil temperatures during June, July and early August which slowed down crop growth. Additionally, early rabbit feeding caused damage to several plots located at the front of the trial. Pepper yields were recorded by taking 5 individual plants (or sub-samples) from each of the individual treatment plots. For the data, the entire plant was weighed, following which all marketable peppers were removed, counted and weighed. The trial was conducted as a RCB design with treatments replicated 4 times. However, due to the rabbit damage, only 3 reps were used in the evaluation. All data were subjected to ANOVA using SAS procedures and means separated using Fisher's Protected LSD at the 5% level.

Results and Discussion: Analysis of the pepper total plant weights indicated there was an increase in all plant weights for each of the fertilizer treatments (except Nitamin 43G applied at 140 lbs N) when compared to the untreated control (Table 1). The low plant weight with Nitamin 43G at 140 lbs N was likely not influenced by fertilizer treatment, but rather due to other factors, possibly including field variation. There were no visible symptoms of fertilizer toxicity with any treatment rate. When averaging across fertilizer products, Nitamin 30L showed plant weights that were 14% greater than either urea or Nitamin 43G. Marketable fruit weight (Table 1) was higher for all fertilizer treatments and increased an average 31% when compared to the untreated control. Although not significant, average marketable fruit weight for the urea treatments was 15% less compared to Nitamin 30L, an indication that the extended release formula in Nitamin 30L benefited the longer-season pepper crop. When compared to the untreated control, marketable fruit number/plant was significantly higher with Nitamin 30L, regardless of rate, indicating there were more pepper pods produced per plant with that fertilizer formulation. Analysis of percent pepper fruit weight (fruit weight / total plant weight) showed that only the Nitamin 30L formulation applied at 140 lbs N/A was significantly higher than the untreated control; however, all fertilizer treatments showed some increase in percent fruit weight. Finally, average total yields in Nitamin 30L-treated plots were significantly higher than the untreated control, increased by an average 37%. Both average urea and Nitamin 43G yields increased 27% compared to the control plots. The results of this study indicate that Nitamin 30L was superior to the untreated, as well as to the urea and Nitamin 43G treatments. This positive response may be a result of formulation, which was concentrated more around the root zone during early growth, as well as the extended slow release of available nitrogen during the growth of this long-season crop.

Table 1. Effects of Nitamin 30L and Nitamin 43G on Chile Pepper Yield Characteristics

Treatment	*Rate* (lbs N/A)	Preplant application	Total Weight	Marketable Fruit Weight	Marketable Fruit Number	Percent Fruit by Weight	Yield
			lbs/plant	lbs/plant	No./plant	%	lbs/A
Untreated	0		2.4	1.7	28.1	70.7	14,863
Urea (45-0-0)	140	Broadcast	3.1	2.3	30.2	74.3	19,805
Urea	70	Broadcast	3.2	2.4	34.2	74.4	20,839
Nitamin 30L	140	In-furrow	3.8	2.9	37.1	76.0	24,858
Nitamin 30L	70	In-furrow	3.5	2.6	38.6	74.1	22,506
Nitamin 43G	140	Broadcast	2.9	2.2	30.7	73.0	19,021
Nitamin 43G	70	Broadcast	3.3	2.5	35.2	74.6	21,425
		LSD (0.05)	**0.6**	**0.5**	**7.6**	**4.0**	**3,979**

Trial Results for the Texas Wintergarden

Herbicide Screen for Weed Control and Crop Injury in Direct-Seeded Onions

Final Report

Objective: To evaluate the effects of early postemergence applications of Chateau 51WDG (flumioxazin), Goal 2XL (oxyfluorfen) and GoalTender 4L (oxyfluorfen) on crop injury, bulb size distribution and yield, and weed control in onions (Allium cepa, var. "Sunrise").

Materials and Methods: The trial was conducted at the Del Monte Ag Research Farm located northeast of Crystal City on a Bookout clay loam soil with a pH of 7.7 and 1.8% organic matter. All standard crop management and pest control (fertilizer, pesticides, etc.) measures were utilized as needed during the growing season to maximize onion production. Prefar (bensulide), the local standard was applied at 2.0 quarts per acre and incorporated into the soil prior to planting. The trial was seeded on October 26, 2005 using a two-row Monosem vacuum planter on previously-formed beds centered on 40-inch rows. Each plot measured 6.67' x 20' with 2 rows per plot. At the appropriate onion leaf stages, postemergence applications of the herbicides were made using a CO_2-pressurized backpack sprayer and hand-held boom equipped with four flat fan nozzles that delivered 20 gallons per acre at 30 PSI and at an approximate speed of 3 mph. The trial was designed as a randomized complete block (RCBD) with 17 treatments replicated 4 times. Percent weed control and crop injury ratings were recorded during the season and after the final ratings were taken, all plots were hand-weeded to allow optimal growth of the onion crop. The onions were dug, cut and bagged on May 16, 2006, after which the bulbs were categorized by size. All data was analyzed using SAS procedures and means separated according to Fischer's Protected LSD at the 0.05 level of confidence.

Results and Discussion: Average onion leaf injury was significantly greater on November 29 with GoalTender 4L + NIS (non-ionic surfactant) when compared to all other oxyfluorfen treatments (Table 1); however, this injury was generally tolerable and greatly reduced by the January 3 rating. GoalTender applications were generally less injurious to onions than Goal 2XL, and this was evident at both the 1-leaf and 2-leaf application stages. On January 3, Goal applications made to 2-leaf onions had significantly higher injury (7.5 and 13.8%) compared to GoalTender; however, both products had negligible injury by January 31.

Chateau applications made to 2-leaf onions showed that both the 1.0 oz and 2.0 oz rates had 7.5% injury or less (Table 1), unless a COC (crop oil concentrate) was added to the spray. By January 31, there was no injury from Chateau applications, with the exception of the 2.0 oz rate + COC, which continued to have the greatest amount of injury throughout the test. Where Chateau was impregnated on fertilizer and applied following hand-weeding, no injury was visible within those plots.

Weed ratings recorded on January 3 showed that average control of London rocket (Sisymbrium irio) and fumitory (Fumaria officinalis L.) with postemergence Chateau was 6.4% and 23.6% less, respectively, when compared to the Goal/GoalTender treatments (Table 2). Control of both weeds was significantly improved when either NIS or COC was added to the spray, especially at the 2.0 oz rate. By January 31, Chateau control of both weeds was poor where no NIS or COC had been included in the spray, suggesting that these weeds were only suppressed and not controlled. Average preemergence control with Chateau impregnated fertilizer was excellent at 98 and 96%, for both London rocket and fumitory, respectively.

Goal and GoalTender gave excellent control of both London rocket and fumitory by January 3, and good control continued through January 31. Where applications of either product were applied at the 1-leaf stage, control of fumitory had decreased to about 75% by January 31, while applications made at the 2-leaf stage continued to control fumitory at an average 95%. Average control was generally not different when comparing Goal to GoalTender; however, as the rate of either product increased from 0.125 lb ai to 0.25 lb ai, so did control of both weed species.

There were no consistent trends with onion bulb size distribution when comparing individual herbicide treatments in this test (Table 3). However, averaging individual size categories across herbicides showed that Chateau treatments resulted in 46.6% prepak size bulbs compared to only 36.9% for Goal/GoalTender treatments. Medium size distribution for both herbicides was equivalent (40.6%); however, jumbo and colossal sizes averaged 10.6% and 2.1% for Chateau, respectively, while increasing to 17.2% and 5.4% for Goal/GoalTender treatments. Growers receive premium prices for jumbo and colossal onion sizes; therefore, on a potential profit basis, the Goal/GoalTender treatments likely produced more profits for growers in this test. Reduced size distribution with Chateau may have been a factor of reduced control of fumitory in this test.

Total onion yields were greatest (though not significantly) where Goal and GoalTender were applied at 0.125 lb ai, regardless of timing of application. Where Chateau was applied at the 2-leaf stage and at the 1.0 oz rate, yields were highest when NIS was included with the application. This result was likely due to the improved control of fumitory. However, when applied at the 2.0 oz rate, yields were reduced, regardless of whether NIS or COC were added to the spray. Averaging yields across herbicides showed that overall yields with Goal/GoalTender resulted in a 12% increase compared to Chateau, again likely the result of improved control of fumitory.

Both herbicide active ingredients offer good crop safety in onions, except where COC was added with Chateau. Improved control of fumitory with Goal/GoalTender suggests a benefit to using this product in fields where this weed is present. Future research should include multiple applications of all three products to determine whether fumitory control can be improved or extended, and thereby reduce the need to hand weed fields.

Table 1. Effect of Herbicide Treatments on Onion Leaf Injury Following Postemergence Applications

Trt #	Treatment	Rate Product or (lbs a.i./A)	Timing	Nov. 29	Jan. 3	Jan. 31
				--------------- % Leafy Injury -----------------		
1	*Prefar 4E*	2.0 QTS	PPI	0	0	0
2	*Prefar 4E +* *Handweed*	2.0 QTS	PPI	0	0.5	0
3	*Prefar +* *Chateau 51WDG*	2.0 QTS 1.0 OZ	PPI POST 2-LEAF	0	0.8	0
4	*Prefar +* *Chateau +* *NIS*	2.0 QTS 1.0 OZ 0.25% V/V	PPI POST 2-LEAF	0	4.3	0
5	*Prefar +* *Chateau*	2.0 QTS 2.0 OZ	PPI POST 2-LEAF	0	3.0	0
6	*Prefar +* *Chateau +* *NIS*	2.0 QTS 2.0 OZ 0.25% V/V	PPI POST 2-LEAF	0	7.5	0
7	*Prefar +* *Chateau +* *COC*	2.0 QTS 2.0 OZ 1.0% V/V	PPI POST 2-LEAF	0	17.5	13.8
8	*Prefar +* *Chateau*	2.0 QTS 2.0 OZ (IMPREG.)	PPI POST 2-LEAF	0	0.8	0
9	*Prefar +* *Chateau*	2.0 QTS 2.0 OZ (IMPREG.)	PPI POST 2-LEAF POST 5-LEAF	0	0	0
10	*Prefar +* *GoalTender 4L*	2.0 QTS 0.125	PPI POST 1-LEAF	2.5	0	0
11	*Prefar +* *GoalTender*	2.0 QTS 0.188	PPI POST 1-LEAF	5.0	3.3	3.8
12	*Prefar +* *Goal 2XL*	2.0 QTS 0.125	PPI POST 1-LEAF	7.5	0.5	0
13	*Prefar +* *GoalTender +* *NIS*	2.0 QTS 0.125 0.25% v/v	PPI POST 1-LEAF	12.5	3.3	0
14	*Prefar +* *GoalTender*	2.0 QTS 0.125	PPI POST 2-LEAF	0	3.0	0
15	*Prefar +* *GoalTender*	2.0 QTS 0.25	PPI POST 2-LEAF	0	3.8	0
16	*Prefar +* *Goal*	2.0 QTS 0.125	PPI POST 2-LEAF	0	7.5	1.3
17	*Prefar +* *Goal*	2.0 QTS 0.25	PPI POST 2-LEAF	0	13.8	1.3
			LSD (0.05)	**3.8**	**3.0**	**3.6**

Table 2. Effect of Herbicide Treatments on the Control of London Rocket (*Sisymbrium irio*) and Fumitory (*Fumaria officinalis* L.) in Onions Grown in the Texas Wintergarden

Trt #	Treatment	Rate Product or (lbs a.i./A)	Timing	London Rocket	Fumitory	London Rocket	Fumitory
				January 3		January 31	
				% Control			
1	*Prefar 4E*	2.0 QTS	PPI	0	0	0	0
2	*Prefar 4E +* *Handweed*	2.0 QTS	PPI	0	0	93.8	60.0
3	*Prefar +* *Chateau 51WDG*	2.0 QTS 1.0 OZ	PPI POST 2-LEAF	83.5	43.8	45.0	40.0
4	*Prefar +* *Chateau +* *NIS*	2.0 QTS 1.0 OZ 0.25% V/V	PPI POST 2-LEAF	93.3	81.3	86.3	75.0
5	*Prefar +* *Chateau*	2.0 QTS 2.0 OZ	PPI POST 2-LEAF	71.0	36.3	53.8	47.5
6	*Prefar +* *Chateau +* *NIS*	2.0 QTS 2.0 OZ 0.25% V/V	PPI POST 2-LEAF	92.3	92.0	92.3	83.5
7	*Prefar +* *Chateau +* *COC*	2.0 QTS 2.0 OZ 1.0% V/V	PPI POST 2-LEAF	99.0	99.0	95.8	99.0
8	*Prefar +* *Chateau*	2.0 QTS 2.0 OZ (IMPREG.)	PPI POST 2-LEAF	97.0	94.8	95.8	86.0
9	*Prefar +* *Chateau*	2.0 QTS 2.0 OZ (IMPREG.)	PPI POST 2-LEAF + POST 5-LEAF	99.0	97.0	98.0	91.0
10	*Prefar +* *GoalTender 4L*	2.0 QTS 0.125	PPI POST 1-LEAF	99.0	86.3	94.8	76.3
11	*Prefar +* *GoalTender*	2.0 QTS 0.188	PPI POST 1-LEAF	99.0	90.8	99.0	78.8
12	*Prefar +* *Goal 2XL*	2.0 QTS 0.125	PPI POST 1-LEAF	99.0	91.3	96.8	72.5
13	*Prefar +* *GoalTender +* *NIS*	2.0 QTS 0.125 0.25% v/v	PPI POST 1-LEAF	93.3	94.8	96.0	77.5
14	*Prefar +* *GoalTender*	2.0 QTS 0.125	PPI POST 2-LEAF	79.8	94.5	87.3	88.3
15	*Prefar +* *GoalTender*	2.0 QTS 0.25	PPI POST 2-LEAF	97.0	98.0	97.0	97.0
16	*Prefar +* *Goal*	2.0 QTS 0.125	PPI POST 2-LEAF	89.8	98.0	85.0	97.0
17	*Prefar +* *Goal*	2.0 QTS 0.25	PPI POST 2-LEAF	96.5	99.0	94.5	99.0
			LSD (0.05)	**20.0**	**24.2**	**18.8**	**24.7**

Table 3. Effect of Herbicide Treatments on the Onion (Variety "Sunrise") Bulb Size Distribution When Grown in the Texas Wintergarden

Trt #	Treatment	Rate Product or (lbs ai/A)	Timing	Onion Bulb Size Distribution				Total Yield
				Prepak	Medium	Jumbo	Colossal	
				------------------- % of Total Yield			-------------------	lbs/A
1	*Prefar 4E*	2.0 QTS	PPI	52.5	37.1	8.3	2.2	33,209
2	*Prefar 4E +* *Handweed*	2.0 QTS	PPI	35.9	48.3	12.9	2.9	32,980
3	*Prefar +* *Chateau 51WDG*	2.0 QTS 1.0 OZ	PPI POST 2-LEAF	53.0	38.2	8.1	0.7	31,985
4	*Prefar +* *Chateau +* *NIS*	2.0 QTS 1.0 OZ 0.25% V/V	PPI POST 2-LEAF	45.5	40.2	11.9	2.4	42,863
5	*Prefar +* *Chateau*	2.0 QTS 2.0 OZ	PPI POST 2-LEAF	52.2	38.4	7.4	2.0	31,135
6	*Prefar +* *Chateau +* *NIS*	2.0 QTS 2.0 OZ 0.25% V/V	PPI POST 2-LEAF	52.2	35.0	11.8	1.0	30,542
7	*Prefar +* *Chateau +* *COC*	2.0 QTS 2.0 OZ 1.0% V/V	PPI POST 2-LEAF	42.6	45.0	12.4	0	24,588
8	*Prefar +* *Chateau*	2.0 QTS 2.0 OZ (IMPREG.)	PPI POST 2-LEAF	43.9	41.2	8.0	6.9	28,452
9	*Prefar +* *Chateau*	2.0 QTS 2.0 OZ (IMPREG.)	PPI POST 2-LEAF + POST 5-LEAF	37.3	46.5	14.4	1.8	38,836
10	*Prefar +* *GoalTender 4L*	2.0 QTS 0.125	PPI POST 1-LEAF	48.9	34.4	10.0	6.7	30,646
11	*Prefar +* *GoalTender*	2.0 QTS 0.188	PPI POST 1-LEAF	44.2	35.9	15.9	4.1	32,686
12	*Prefar +* *Goal 2XL*	2.0 QTS 0.125	PPI POST 1-LEAF	27.5	43.0	21.8	7.7	44,507
13	*Prefar +* *GoalTender +* *NIS*	2.0 QTS 0.125 0.25% v/v	PPI POST 1-LEAF	30.5	51.9	17.6	0	34,352
14	*Prefar +* *GoalTender*	2.0 QTS 0.125	PPI POST 2-LEAF	46.6	34.0	12.6	6.8	45,422
15	*Prefar +* *GoalTender*	2.0 QTS 0.25	PPI POST 2-LEAF	51.2	30.0	13.0	5.8	36,489
16	*Prefar +* *Goal*	2.0 QTS 0.125	PPI POST 2-LEAF	20.9	43.5	24.7	10.6	32,866
17	*Prefar +* *Goal*	2.0 QTS 0.25	PPI POST 2-LEAF	25.3	51.7	21.3	1.7	39,577
			LSD (0.05)	**25.8**	**19.4**	**11.5**	**7.4**	**17,256**

Application: EPOST 1-LEAF

Location	Crystal City, TX	**Wind speed / direction**	0
Date	11/22/05	**Crop**	Onions
Time of day	10:30 a.m.	**Variety**	Sunrise
Type of application	Broadcast	**Crop stage**	1-true leaf (2-3”)
Carrier	Water	**Air temp. (°F)**	62
Gas (if not CO_2)	CO_2	**Soil temp. (°F)**	50
GPA	20	**Soil beneath**	Moist
PSI	30	**Soil surface**	Semi-moist
Nozzle tips	8002	**% Relative humidity**	Moderate
Nozzle spacing	18”	**Sky conditions**	Clear/Sunny
Boom width (“)	6.5’	**# Replications**	4
Boom height (“)	18”	**Sprayed by**	RWW

Weeds present: Fumitory (2”), Henbit (1”)

Application: POST 2-LEAF

Location	Crystal City, TX	**Wind speed / direction**	5 – 15 mph / SW
Date	12/19/05	**Crop**	Onions
Time of day	10:30 a.m.	**Variety**	Sunrise
Type of application	Broadcast	**Crop stage**	2 – 4 leaves
Carrier	Water	**Air temp. (°F)**	60
Gas (if not CO_2)	CO_2	**Soil temp. (°F)**	55
GPA	20	**Soil beneath**	Moist
PSI	30	**Soil surface**	Moist
Nozzle tips	8002	**% Relative humidity**	Moderate
Nozzle spacing	18”	**Sky conditions**	Overcast
Boom width (“)	6.5’	**# Replications**	4
Boom height (“)	18”	**Sprayed by**	JCH

Weeds present: Fumitory (4- 6”), Henbit (2 – 3”), London Rocket (2 – 6”)

Evaluation of Reflex® and Dual Magnum for Control of Yellowtop in Snap Beans

Final Report

Objective: To evaluate the effects of Reflex applied preemergence (PRE) and at two early postemergence (EPOST) timings for control of Yellowtop (*Verbesina encelioides*), crop injury and yield in processing green beans.

Materials and Methods: The trial was conducted on a grower's farm in cooperation with Del Monte located in Derby, TX (south of San Antonio). All standard crop management and pest control (fertilizer, pesticides, etc.) measures were utilized by the grower as needed during the season to maximize green bean production. Treflan (trifluralin), a local standard was applied at 1.0 pint per acre by the grower and incorporated into the soil prior to planting. The trial was seeded by the grower on March 23, 2006 on 80" beds containing 5 rows/bed. Each plot measured 6.67 x 20 ft. In addition to Treflan, Dual Magnum (s-metolachlor) was applied at 6.0 oz/A (also a grower standard) following planting. At the appropriate crop and weed stages, herbicide applications were made using a CO_2-pressurized backpack sprayer and hand-held boom equipped with four flat fan nozzles that delivered 20 gallons per acre at 30 PSI at a speed of 3 mph. The original protocol called for applications to be made at two stages: (1) 2 – 4 leaf Yellowtop and (2) 2 – 4 trifoliate beans; however, the weed and green bean growth stages were simultaneous in the field, therefore, a second application applying Reflex one week later was included when beans were at the 4 – 5 trifoliate stage. The trial was designed as a randomized complete block (RCBD) with 12 treatments replicated 4 times. Percent weed control and crop injury ratings were recorded during the season. The beans were hand-harvested on May 15, 2006 (58 days after planting) by taking a 0.25 m^2sub-sample, counting the number of plants and removing all pods for weighing. All data were analyzed using SAS procedures and means separated according to Fischer's Protected LSD at the 0.05 level.

Results and Discussion: All weeds except Yellowtop (a significant problem in green bean production) were controlled with the applications of Treflan (PPI) and Dual Magnum (PRE) in this study, and no visible crop injury was recorded from these treatments by April 12 (Table 1). However, PRE applications of Reflex + Dual Magnum caused 7.5% (tolerable) stunting, but also gave excellent control of Yellowtop (99.0%). Reflex applied EPOST to green beans at the 2 – 4 leaf Yellowtop growth, showed that crop injury ranged from 8.8% (high rate) to 6.3% (low rate). Injury was noted in very slight stunting, but mostly as some leaf stippling and crinkling. Adding Dual Magnum to EPOST Reflex treatments increased crop injury to 15% by April 21. When applied one week later to 4 – 5 trifoliate beans (or 6 – 10 leaf Yellowtop), no crop injury was noted, and excellent control of Yellowtop was observed by May 5. In this study, Yellowtop was controlled at all Reflex application timings, and control continued until the crop was harvested. At harvest, plant populations recorded showed no significant differences between any treatments (data not shown). Green bean yields were significantly decreased in plots treated with 16.0 oz of Reflex at the 2 – 4 leaf Yellowtop stage, although this appears to be an anomaly, as the higher rate of Reflex applied at that timing produced higher yields with no higher crop injury. However, where Dual Magnum was tank-mixed with Reflex and applied EPOST, crop yields were significantly lower (lowest in the test), suggesting that this treatment may not be advantageous on green beans. Perhaps a lower rate of Reflex may reduce crop injury and subsequent yields if this herbicide combination is further pursued in beans.

Overall results of this study indicate that Reflex applied PRE in combination with Dual Magnum is an excellent treatment for control of Yellowtop. However, EPOST applications may also be used if this weed escapes PRE applications during the course of the growing season, without any significant crop injury or yield loss potential.

Table 1. Evaluation of Reflex for Control of Yellowtop and Yield in Snap Beans Produced in the Texas Wintergarden Region.

Trt	Treatment	Product Rate	Timing	% Crop Injury			% Control Yellowtop			Yield
				Apr. 12	Apr. 21	May 5	Apr. 12	Apr. 21	May 5	Tons/A
1	*Untreated **			0	0	0	0	0	0	11.2
2	*Reflex 2L +* *NIS*	16.0 oz 0.25% v/v	EPOST 4 trifoliate (beans)	0	0	0	0	0	99.0	10.4
3	*Reflex +* *NIS*	20.0 oz 0.25% v/v	EPOST 4 trifoliate (beans)	0	0	0	0	0	99.0	11.5
4	*Reflex +* *Dual Magnum 7.62E*	16.0 oz 12.0 oz	EPOST 4 trifoliate (beans)	0	0	0	0	0	99.0	10.6
5	*Dual Magnum +* *Reflex +* *NIS*	6.0 oz 16.0 oz 0.25% v/v	PRE EPOST 4 trifoliate (beans)	0	0	0	0	0	99.0	10.4
6	*Dual Magnum +* *Reflex +* *NIS*	6.0 oz 20.0 oz 0.25% v/v	PRE EPOST 4 trifoliate (beans)	0	0	0	0	0	99.0	10.3
7	*Reflex +* *NIS*	16.0 oz 0.25% v/v	EPOST 2-4 leaf (weeds)	0	6.3	0	0	99.0	99.0	11.3
8	*Reflex +* *NIS*	20.0 oz 0.25% v/v	EPOST 2-4 leaf (weeds)	0	8.8	0	0	99.0	99.0	11.9
9	*Reflex +* *Dual Magnum*	20.0 oz 6.0 oz	EPOST 2-4 leaf (weeds)	0	15.0	0	0	99.0	99.0	7.8
10	*Dual Magnum +* *Reflex +* *NIS*	6.0 oz 16.0 oz 0.25% v/v	PRE EPOST 2-4 leaf (weeds)	0	6.3	0	0	99.0	99.0	8.7
11	*Dual Magnum +* *Reflex +* *NIS*	6.0 oz 20.0 oz 0.25% v/v	PRE EPOST 2-4 leaf (weeds)	0	8.8	0	0	99.0	99.0	10.6
12	*Dual Magnum +* *Reflex*	6.0 oz 16.0 oz	PRE	7.5	0	0	99.0	99.0	99.0	9.9
			LSD (0.05)	**1.2**	**4.0**	**0**	**0**	**0**	**0**	**3.1**

Notes: Treflan applied at 1.0 pint/A by grower prior to planting. Average # of Yellowtop per plot = 20.5 or 1 plant/6.5 ft^2

Application: PRE

Location	Derby, TX	**Wind speed / direction**	5 – 15 / N
Date	3/23/06	**Crop**	Snap Beans
Time of day	12:00 p.m.	**Variety**	Del Monte 0404
Type of application	Broadcast	**Crop stage**	Seed
Carrier	Water	**Air temp. (^oF)**	60
Gas (if not CO_2)	CO_2	**Soil temp. (^oF)**	60
GPA	20	**Soil beneath**	Moist
PSI	30	**Soil surface**	Moist
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

Weeds present: None

Application: EPOST (2-4 leaf weeds)

Location	Derby, TX	**Wind speed / direction**	5 – 10 / SE
Date	4/12/06	**Crop**	Snap Beans
Time of day	3:30 p.m.	**Variety**	Del Monte 0404
Type of application	Broadcast	**Crop stage**	2 – 4 Trifoliate
Carrier	Water	**Air temp. (^oF)**	85
Gas (if not CO_2)	CO_2	**Soil temp. (^oF)**	80
GPA	20	**Soil beneath**	Semi-moist
PSI	30	**Soil surface**	Dry
Nozzle tips	8002	**% Relative humidity**	High
Nozzle spacing	18”	**Sky conditions**	Partly cloudy/Sunny
Boom width (“)	6.5’	**# Replications**	4
Boom height (“)	18”	Sprayed by	RWW

Weeds present: Yellowtop (2-4 leaves)

Application: EPOST (4 – 5 trifoliate beans)

Location	Derby, TX	**Wind speed / direction**	0 – 5 / NE
Date	4/21/06	**Crop**	Snap Beans
Time of day	3:00 p.m.	**Variety**	Del Monte 0404
Type of application	Broadcast	**Crop stage**	4 – 5 Trifoliate
Carrier	Water	**Air temp. (^oF)**	85
Gas (if not CO_2)	CO_2	**Soil temp. (^oF)**	80
GPA	20	**Soil beneath**	Semi-moist
PSI	30	**Soil surface**	Dry
Nozzle tips	8002	**% Relative humidity**	High
Nozzle spacing	18”	**Sky conditions**	Sunny
Boom width (“)	6.5’	**# Replications**	4
Boom height (“)	18”	**Sprayed by**	RWW

Weeds present: Yellowtop (6 – 10 leaves, 4 – 10”)

Herbicide Screen for Leafy Brassicas (IR-4 Leafy Greens Pilot Project)

Final Report

Objective: To evaluate the effects of selected herbicides applied preemergence (PRE) and postemergence (POST) on crop injury and yield of leafy brassicas (turnips, mustard greens, collards and leafy kale) grown for processing in the Texas Wintergarden region.

Materials and Methods: The trial was conducted at the Del Monte Ag Research Farm located northeast of Crystal City on a Bookout clay loam soil with a pH of 7.7 and 1.8% organic matter. All standard crop management and pest control (fertilizer, pesticides, etc.) measures were utilized as needed during the growing season to maximize crop production. The field was disked and beds prepared for planting on October 25, 2005, following which PRE herbicides were immediately sprayed to respective plots. POST herbicide treatments were applied on November 9. All treatments were applied using a CO_2-pressurized backpack sprayer and hand-held boom equipped with four flat fan nozzles that delivered 20 gallons per acre at 30 PSI and at an approximate speed of 3 mph. Each plot measured 3.3 x 20 ft with 1row per plot. The trial was designed as a randomized complete block (RCBD) with 16 treatments replicated 4 times. Percent crop injury ratings were recorded during the season and yields were taken when crops were mature. All data were analyzed using SAS procedures and means separated according to Fischer's Protected LSD at the 0.05 level.

Results and Discussion: Average injury from PRE- and POST-applied herbicides was greater in turnip greens compared to mustard greens (Table 1.) Significant PRE injury was observed in turnips with flufenacet, oxyfluorfen, KIH-485, flumioxazin and V-10142, followed by moderate injury with s-metolachlor, prodiamine, pronamide, ethofumesate and sulfentrazone. When applied POST, injury was higher with quinclorac, oxyfluorfen and flucarbazone compared to PRE applications at the same rate. Herbicide injury from PRE-applied treatments in mustard was moderate to moderately high with flufenacet, oxyfluorfen, ethofumesate, and V-10142. Injury responses were similar with POST applications. Yields of both turnips and mustard greens followed crop injury patterns. In turnips, yields were highest in plots treated PRE with thiobencarb, quinclorac, flucarbazone, dimethenamid-p and pendimethalin. Yields of POST treated turnips were highest with thiobencarb, flufenacet, quinclorac, s-metolachlor, dimethenamid-p, sulfentrazone, and flumioxazin. In mustard greens, yields were lowest in PRE-treated plots where flufenacet, oxyfluorfen, and ethofumesate were applied. Yields were also low in POST-treated plots of flucarbazone, oxyfluorfen, and V-10142.

Crop injury in leafy kale was highest in plots treated PRE with flufenacet, oxyfluorfen, KIH 485, and flumioxazin. POST-applied treatments of flufenacet, quinclorac, flucarbazone, oxyfluorfen, KIH-485, and V-10142 also caused significant injury (38% or more). Collard injury was greatest in plots treated PRE with quinclorac, pronamide, and V-1042, while with POST applications injury was high with flufenacet, flucarbazone, oxyfluorfen and V-10142. Leafy kale yields were not significantly influenced by herbicide treatments when applications were made PRE, though yields were lower in plots were crop injury was significant. POST-applied herbicides caused significantly reduced yields in leafy kale only where flucarbazone and oxyfluorfen were applied. Similarly, yields of collard greens were not negatively influenced, though where oxyfluorfen and V-10142 were applied yields decreased an average 40% compared to the untreated control. Similarly, POST-applied treatments reduced collard green yields only where oxyfluorfen and V-10142 had been sprayed.

The results of this research indicate that several herbicides have potential for use in leafy brassicas including thiobencarb, s-metolachlor, pronamide, dimethenamid-p, pendimethlin, sulfentrazone and flumioxazin, though rates and timings of application need further study. V-10142 should be dropped from further study has all crops were injured from this herbicide.

Application: PRE

Location	Crystal City	**Wind speed / direction**	0 – 10 / SE
Date	10/25/05	**Crop**	Leafy Brassicas
Time of day	11:30 a.m.	**Variety**	4 varieties
Type of application	Broadcast - Hooded	**Crop stage**	Seed
Carrier	Water	**Air temp. (^{o}F)**	74
Gas (if not CO_2)	CO_2	**Soil temp. (^{o}F)**	64
GPA	20	**Soil beneath**	Moist
PSI	30	**Soil surface**	Dry
Nozzle tips	8002	**% Relative humidity**	Low
Nozzle spacing	18”	**Sky conditions**	Clear
Boom width (“)	3.3’	**# Replications**	4
Boom height (“)	18”	**Sprayed by**	RWW
Weeds present: None			

Application: POST

Location	Crystal City	**Wind speed / direction**	0 – 5 / SW
Date	11/09/05	**Crop**	Leafy Brassicas
Time of day	3:00 p.m.	**Variety**	4 varieties
Type of application	Broadcast - Hooded	**Crop stage**	1 – 2 leaves
Carrier	Water	**Air temp. (^{o}F)**	85
Gas (if not CO_2)	CO_2	**Soil temp. (^{o}F)**	79
GPA	20	**Soil beneath**	Moist
PSI	30	**Soil surface**	Moist
Nozzle tips	8002	**% Relative humidity**	High
Nozzle spacing	18”	**Sky conditions**	Clear/Sunny
Boom width (“)	3.3’	**# Replications**	4
Boom height (“)	18”	Sprayed by	RWW
Weeds present: Fumitory (cotyledon)			

Table 1. Effect of PRE and POST applications of Herbicides on Percent Crop Injury in Turnip and Mustard Greens in Texas (2006)

Treatment	Chemistry	Rate (lbs a.i.)	Timing	Turnip Greens		Mustard Greens	
				PRE	POST	PRE	POST
				(% Crop Injury)			
Untreated				0	0	0	0
Bolero	Thiobencarb	1.0	PRE & POST	12.5	3.8	0	0
Define	Flufenacet	0.5	PRE & POST	95.8	18.8	37.5	0
Paramount	Quinclorac	0.125	PRE & POST	2.5	23.8	0	2.5
Dual Magnum	s-Metolachlor	0.65	PRE & POST	35.0	2.5	3.8	0
Everest	Flucarbazone	0.013	PRE & POST	18.8	99.0	0	95.0
Barricade	Prodiamine	0.66	PRE & POST	35.0	47.3	0	0
GoalTender	Oxyfluorfen	0.5	PRE & POST	95.0	96.0	57.5	62.5
Kerb	Pronamide	1.0	PRE & POST	37.5	26.3	0	3.8
KIH 485		166 g ai/ha	PRE & POST	76.0	45.0	7.5	7.5
Nortron	Ethofumesate	1.0	PRE & POST	37.5	53.8	22.5	7.5
Outlook	Dimethenamid-p	0.5	PRE & POST	6.3	0	8.8	0
Prowl H2O	Pendimethalin	0.5	PRE & POST	3.8	23.8	0	0
Spartan	Sulfentrazone	0.1	PRE	23.8	2.5	0	0
Chateau	Flumioxazin	0.3	PRE	89.8	0	6.3	0
V-10142	Unknown	0.1	PRE & POST	70.0	74.3	31.3	74.3
			LSD (0.05)	**36.1**	**34.4**	**20.1**	**20.1**

Table 2. Effect of PRE and POST applications of Herbicides on the Yield of Turnip and Mustard Greens in Texas (2006)

Treatment	Chemistry	Rate (lbs a.i.)	Timing	Turnips Greens		Mustard Greens	
				PRE	POST	PRE	POST
				(lbs / 5' row)			
Untreated				6.5	10.4	11.2	10.2
Bolero	Thiobencarb	1.0	PRE & POST	10.8	11.4	10.5	10.4
Define	Flufenacet	0.5	PRE & POST	0	8.4	4.1	9.5
Paramount	Quinclorac	0.125	PRE & POST	9.2	9.2	10.7	10.7
Dual Magnum	s-Metolachlor	0.65	PRE & POST	5.5	11.1	10.5	11.5
Everest	Flucarbazone	0.013	PRE & POST	8.6	0	10.4	0
Barricade	Prodiamine	0.66	PRE & POST	5.2	5.5	11.2	9.3
GoalTender	Oxyfluorfen	0.5	PRE & POST	0	0	1.7	1.9
Kerb	Pronamide	1.0	PRE & POST	4.6	7.0	10.4	8.7
KIH 485		166 g ai/ha	PRE & POST	2.3	4.5	9.0	7.3
Nortron	Ethofumesate	1.0	PRE & POST	5.5	3.5	5.2	7.4
Outlook	Dimethenamid-p	0.5	PRE & POST	9.8	10.1	7.5	8.4
Prowl H2O	Pendimethalin	0.5	PRE & POST	9.4	4.1	10.8	10.6
Spartan	Sulfentrazone	0.1	PRE	7.2	11.3	10.5	10.1
Chateau	Flumioxazin	0.3	PRE	0	10.4	7.9	9.0
V-10142	Unknown	0.1	PRE & POST	2.5	3.9	6.3	2.8
			LSD (0.05)	**5.9**	**5.0**	**3.0**	**2.8**

Table 3. Effect of PRE and POST applications of Herbicides on Percent Crop Injury in Leafy Kale and Collard Greens in Texas (2006)

Treatment	Chemistry	Rate (lbs a.i.)	Timing	Leafy Kale		Collard Greens	
				PRE	POST	PRE	POST
				(% Crop Injury)			
Untreated				0	0	0	0
Bolero	Thiobencarb	1.0	PRE & POST	15.0	5.0	0	0
Define	Flufenacet	0.5	PRE & POST	84.8	62.5	0	36.3
Paramount	Quinclorac	0.125	PRE & POST	3.8	38.8	38.8	5.0
Dual Magnum	s-Metolachlor	0.65	PRE & POST	23.8	25.0	0	6.3
Everest	Flucarbazone	0.013	PRE & POST	16.3	63.5	5.0	36.3
Barricade	Prodiamine	0.66	PRE & POST	30.0	23.8	6.3	0
GoalTender	Oxyfluorfen	0.5	PRE & POST	81.3	86.3	0	62.5
Kerb	Pronamide	1.0	PRE & POST	38.5	24.8	71.3	2.5
KIH 485		166 g ai/ha	PRE & POST	62.3	51.3	12.5	20.0
Nortron	Ethofumesate	1.0	PRE & POST	24.8	22.5	18.8	0
Outlook	Dimethenamid-p	0.5	PRE & POST	12.5	23.8	8.8	7.5
Prowl H2O	Pendimethalin	0.5	PRE & POST	15.0	26.3	3.8	2.5
Spartan	Sulfentrazone	0.1	PRE	23.8	12.5	6.3	3.8
Chateau	Flumioxazin	0.3	PRE	83.5	12.5	3.8	0
V-10142	Unknown	0.1	PRE & POST	31.3	72.3	41.3	56.3
			LSD (0.05)	**42.9**	**44.5**	**24.4**	**30.8**

Table 4. Effect of PRE and POST applications of Herbicides on the Yield of Leafy Kale and Collard Greens in Texas (2006)

Treatment	Chemistry	Rate (lbs a.i.)	Timing	Leafy Kale		Collard Greens	
				PRE	POST	PRE	POST
				(lbs / 5' row)			
Untreated				2.3	4.8	3.6	6.6
Bolero	Thiobencarb	1.0	PRE & POST	3.4	4.6	3.6	4.2
Define	Flufenacet	0.5	PRE & POST	1.3	2.8	4.8	4.0
Paramount	Quinclorac	0.125	PRE & POST	4.1	2.1	5.6	6.2
Dual Magnum	s-Metolachlor	0.65	PRE & POST	3.7	4.2	7.7	6.4
Everest	Flucarbazone	0.013	PRE & POST	4.5	1.9	5.0	5.0
Barricade	Prodiamine	0.66	PRE & POST	3.4	2.7	4.1	6.0
GoalTender	Oxyfluorfen	0.5	PRE & POST	1.8	1.1	2.5	1.9
Kerb	Pronamide	1.0	PRE & POST	3.0	4.2	4.4	5.1
KIH 485		166 g ai/ha	PRE & POST	2.4	3.1	5.7	3.5
Nortron	Ethofumesate	1.0	PRE & POST	3.6	4.4	5.7	5.4
Outlook	Dimethenamid-p	0.5	PRE & POST	3.9	4.2	6.4	6.3
Prowl H2O	Pendimethalin	0.5	PRE & POST	3.8	2.6	4.4	5.0
Spartan	Sulfentrazone	0.1	PRE	3.3	4.1	5.4	5.3
Chateau	Flumioxazin	0.3	PRE	0.9	4.4	2.7	4.0
V-10142	Unknown	0.1	PRE & POST	2.4	2.1	1.8	2.2
			LSD (0.05)	**2.7**	**2.9**	**3.1**	**3.1**

Herbicide Performance in High Density Spinach

Final Report

Objective: To evaluate the effects of herbicides applied preemergence (PRE) early-postemergence (EPOST) on control of London rocket (*Sisymbrium irio*) and fumitory (*Fumaria ofinicalis* L.) in spinach (*Spinacia oleracea* var. "DMC 66-09") grown for processing in the Texas Wintergarden region.

Materials and Methods: The trial was conducted at the Del Monte Ag Research Farm located northeast of Crystal City on a Bookout clay loam soil with a pH of 7.7 and 1.8% organic matter. All standard crop management and pest control (fertilizer, pesticides, etc.) measures were utilized as needed during the growing season to maximize spinach production. The field was disked and beds prepared for planting on November 30, 2005. All PRE and EPOST treatments were applied using a CO_2-pressurized backpack sprayer and hand-held boom equipped with four flat fan nozzles that delivered 20 gallons per acre at 30 PSI and at an approximate speed of 3 mph. Each plot measured 6.67 x 20 ft with14 lines of spinach per plot. PRE treatments were applied immediately following planting, and EPOST treatments applied on January 3, 2006. The trial was designed as a randomized complete block (RCBD) with 12 treatments replicated 4 times. Percent weed control and crop injury ratings were recorded during the season and yields were taken on March 9, 2006. All data were analyzed using SAS procedures and means separated according to Fischer's Protected LSD at the 0.05 level of confidence.

Results and Discussion: Spinach injury on January 3, 2006 resulting from the herbicide applications was highest with Outlook applied at 10.7 oz/A (28.8%) followed Nortron at 32.0 oz/A (13.8%). All other injury from individual treatments was 6% or less. By January 31 all injury decreased with the exception of where Nortron + Stinger was applied EPOST. In those plots, crop injury increased from less than 4% to 15%. Control of London rocket was poor where Dual Magnun was applied at 5.5 oz/A, and where Far-Go was applied at 40 oz/A. All other herbicide treatments resulted in at least 90% or higher control of London rocket. Control of fumitory was 93% or higher in all plots except where Far-Go and Nortron (24 oz/A rate) were applied. Regardless of herbicide injury and weed control, spinach yields were not significantly affected. The results of this research indicate that the herbicides evaluated may have the potential for use in spinach production and should be further researched.

Table 1. The Effects of Herbicides on Crop Injury, Weed Control and Yield in High Density Spinach.

Treatment	Product Rate (oz/A)	Timing	% Injury	% Injury	% Control London Rocket	% Fumitory	Yield 3/9/06
			1/3/06	1/31/06	1/31/06	1/31/06	lbs/plot
Untreated			0	0	0	0	93.5
Dual Magnum 7.62E	5.5	PRE	2.5	0	65.8	94.5	91.8
Dual Magnum 7.62E	10.9	PRE	6.3	0	92.0	96.8	100.3
Dual Magnum 7.62E + *Nortron 4SC*	5.5 5.2	PRE EPOST	0	0	97.3	95.3	80.6
Dual Magnum 7.62E + *Nortron 4SC*	10.9 5.2	PRE EPOST	3.8	2.5	98.8	98.8	82.6
Dual Magnum 7.62E + *Dual Magnum 7.62E +* *Nortron 4SC*	5.5 5.5 5.2	PRE EPOST EPOST	3.8	0	95.8	96.0	72.2
Dual Magnum 7.62E + *Stinger 3EC*	10.9 8.0	PRE EPOST	1.3	8.8	95.3	98.5	100.8
Dual Magnum 7.62E + *Stinger 3EC +* *Nortron 4SC*	10.9 8.0 5.2	PRE EPOST EPOST	3.8	15.0	98.8	97.5	88.5
Outlook 6E	10.7	PRE	28.8	2.5	99.0	99.0	94.4
Far-GO 4E	40.0	PRE	0	0	53.8	47.5	105.7
Nortron 4SC	24.0	PRE	1.3	0	91.8	83.8	75.5
Nortron 4SC	32.0	PRE	13.8	0	98.0	93.8	82.8
		LSD (0.05)	**6.4**	**2.5**	**18.5**	**18.2**	**NS**

Application: EPOST

Location	Crystal City, TX	**Wind speed / direction**	0 – 5 mph/South
Date	1/03/06	**Planting Date**	Nov. 30, 2005
Time of day	12:30 p.m	**Variety**	DMC 66-09
Type of application	EPOST	**Crop stage**	2 – 4 leaves
Carrier	Water	**Air temp. (°F)**	74
Gas (if not CO_2)	CO_2	**Soil temp. (°F)**	62
GPA	20	**Soil beneath**	Moist
PSI	30	**Soil surface**	Dry
Nozzle tips	8002	**% Relative humidity**	Low
Nozzle spacing	18”	**Sky conditions**	Clear/Sunny
Boom width (“)	6.5’	**# Replications**	4
Boom height (“)	18”	**Sprayed by**	RWW
Weeds:			

Evaluation of Nortron Applied Postemergence on Weed Control and Yield in Spinach

Final Report

Objective: To evaluate the effects of Nortron applied early-postemergence (EPOST) and postemergence on control of London rocket (*Sisymbrium irio*) and henbit (*Lamium amplexicaule* L.) in spinach (*Spinacia oleracea* var. "DMC 66-16") grown for processing in the Texas Wintergarden region.

Materials and Methods: The trial was conducted at the Del Monte Ag Research Farm located northeast of Crystal City on a Bookout clay loam soil with a pH of 7.7 and 1.8% organic matter. All standard crop management and pest control (fertilizer, pesticides, etc.) measures were utilized as needed during the growing season to maximize spinach production. The field was disked and beds prepared for planting on October 25, 2005, following which Dual Magnum was sprayed over the entire trial. All EPOST and POST treatments were applied using a CO_2-pressurized backpack sprayer and hand-held boom equipped with four flat fan nozzles that delivered 20 gallons per acre at 30 PSI and at an approximate speed of 3 mph. Each plot measured 6.67 x 20 ft with 2 beds per plot. EPOST treatments of Nortron were applied on November 8 and POST treatments applied on November 21. The trial was designed as a randomized complete block (RCBD) with 12 treatments replicated 4 times. Percent weed control and crop injury ratings were recorded during the season and yields were taken on February 21, 2006. All data were analyzed using SAS procedures and means separated according to Fischer's Protected LSD at the 0.05 level of confidence.

Results and Discussion: Spinach injury evaluated on November 22 was 34% or less in all plots treated with postemergence herbicides. Injury was greatest with Nortron applied at 0.082 (either once or twice) or when Nortron was tank-mixed with Stinger. Injury observed on January 3 (5 weeks later) showed that significant injury continued to be present in plots treated twice with Nortron at 0.082 lb a.i./A, while all other treatments had 13% or less injury. By January 31, all plots contained 10% or less crop injury and ratings were not significantly different from the control.

Control of London rocket with the low rate of Dual Magnum was 85%, and improved to 92% with hand-weeding. However, all herbicide treatments were not siginificantly different from the Dual Magnum + hand-weed check with the exception of where Stinger or Nortron (one or two low-rate applications) were applied. Similarly, henbit control was excellent with all EPOST applications with the exception of Stinger or Nortron applied at the low rate, either once or twice. These results indicate that Stinger is not an effective herbicide for controlling either London rocket or henbit, but that does not limit its usefulness in processing spinach production. For effective weed control, Nortron must be applied at a rate of 0.164 lbs a.i./A. Tank-mixing Stinger with Nortron increased control of both weed species by 8 – 16%, but this was also similar to Nortron applied at the same rate alone.

Spinach yields in this test were not significantly different from the Dual Mangum alone or Dual Magnum + hand-weeded check. Where initial spinach injury was higher than 30% (Nortron applied at 0.082 lb a.i./A twice), yields were 25% lower compared to the control plots. It is unclear why crop injury and yield was lower with the double application at that low rate compared to the higher rate of Nortron.

These results indicate that Nortron has the potential for use as a postemergence-applied herbicide in processing spinach. Stinger was recently labeled in spinach and these results indicate that tank-mixing Stinger with Norton may improve control of London rocket and henbit, as well as other potential weeds. More research is needed to evaluate Stinger and Nortron tank-mixes, as well as other postemergence-applied herbicides for use in spinach.

Table 1. The Effects of Selected Herbicide Treatments on Percent Crop Injury in Spinach.

Trt #	Treatment	Rate	Timing	% Injury	% Injury	% Injury
		lbs a.i./A		Nov. 22	Jan. 3	Jan. 31
1	*Dual Magnum 7.62E*	0.325	PRE	0	0	0
2	*Dual Magnum +* *Handweed*	0.325	PRE	0	0	0
3	*Dual Magnum +* *Stinger 3EC*	0.325 0.188	PRE EPOST	5.0	6.3	2.5
4	*Dual Magnum +* *Stinger +* *Nortron*	0.325 0.188 0.164	PRE EPOST EPOST	22.5	11.3	8.8
5	*Dual Magnum +* *Nortron*	0.325 0.082	PRE EPOST	27.5	12.5	10.0
6	*Dual Magnum +* *Nortron*	0.325 0.164	PRE EPOST	11.3	0	0
7	*Dual Magnum +* *Nortron*	0.325 0.25	PRE EPOST	15.0	6.3	2.5
8	*Dual Magnum +* *Nortron +* *Nortron*	0.325 0.082 0.082	PRE EPOST POST	33.8	22.5	7.5
9	*Dual Magnum +* *Nortron +* *Nortron*	0.325 0.164 0.164	PRE EPOST POST	12.5	1.3	0
10	*Dual Magnum +* *Nortron +* *Nortron*	0.325 0.25 0.25	PRE EPOST POST	13.8	6.3	0
11	*Dual Magnum +* *Dual Magnum*	0.325 0.325	PRE EPOST	17.5	8.8	3.8
12	*Dual Magnum +* *Dual Magnum +* *Nortron*	0.325 0.325 0.164	PRE EPOST EPOST	20.0	10.0	7.5
			LSD (0.05)	**12.5**	**15.6**	**11.5**

Table 2. The Effects of Selected Herbicide Treatments on Weed Control and Yield in Spinach.

Trt #	Treatment	Rate	Timing	% Control London Rocket	% Control Henbit	Yield
		lbs a.i./A		Jan. 31	Jan. 31	Tons/A
1	*Dual Magnum 7.62E*	0.325	PRE	85.0	87.5	6.5
2	*Dual Magnum +* *Handweed*	0.325	PRE	92.3	96.0	6.5
3	*Dual Magnum +* *Stinger 3EC*	0.325 0.188	PRE EPOST	75.0	83.8	6.2
4	*Dual Magnum +* *Stinger +* *Nortron*	0.325 0.188 0.164	PRE EPOST EPOST	91.3	91.3	6.1
5	*Dual Magnum +* *Nortron*	0.325 0.082	PRE EPOST	76.3	83.5	5.8
6	*Dual Magnum +* *Nortron*	0.325 0.164	PRE EPOST	90.0	97.0	8.3
7	*Dual Magnum +* *Nortron*	0.325 0.25	PRE EPOST	85.0	91.3	7.3
8	*Dual Magnum +* *Nortron +* *Nortron*	0.325 0.082 0.082	PRE EPOST POST	78.8	83.8	4.9
9	*Dual Magnum +* *Nortron +* *Nortron*	0.325 0.164 0.164	PRE EPOST POST	93.8	97.0	6.1
10	*Dual Magnum +* *Nortron +* *Nortron*	0.325 0.25 0.25	PRE EPOST POST	96.0	98.0	6.2
11	*Dual Magnum +* *Dual Magnum*	0.325 0.325	PRE EPOST	83.8	97.0	7.1
12	*Dual Magnum +* *Dual Magnum +* *Nortron*	0.325 0.325 0.164	PRE EPOST EPOST	93.8	98.0	7.3
			LSD (0.05)	**13.8**	**13.0**	**2.1**

Application: EPOST

Location	Crystal City	**Wind speed / direction**	0 – 5 / SW
Date	November 8, 2005	**Crop**	Spinach
Time of day	3:15 p.m.	**Variety**	DMC 66-16
Type of application	Broadcast	**Crop stage**	Cotyledon – 2 leaf
Carrier	Water	**Air temp. (^{o}F)**	80
Gas (if not CO_2)	CO_2	**Soil temp. (^{o}F)**	78
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**	4
Boom height (“)	18”	Sprayed by	RWW
Weeds present: Pigweed (Cotyl.); fumitory (Cotyl.); London rocket (Cotyl. – 1 leaf)			

Application: POST

Location	Crystal City	**Wind speed / direction**	0 – 5 / SW
Date	November 21, 2005	**Crop**	Spinach
Time of day	4:30 p.m.	**Variety**	DMC 66-16
Type of application	Broadcast	**Crop stage**	4 – 5 leaves
Carrier	Water	**Air temp. (^{o}F)**	72
Gas (if not CO_2)	CO_2	**Soil temp. (^{o}F)**	66
GPA	20	**Soil beneath**	Moist
PSI	30	**Soil surface**	Dry
Nozzle tips	8002	**% Relative humidity**	Low
Nozzle spacing	18”	**Sky conditions**	Clear
Boom width (“)	6.5’	**# Replications**	4
Boom height (“)	18”	Sprayed by	RWW
Weeds present: Fumitory (1”); Henbit (1”); London rocket (1 – 2”)			

Application:

Location		**Wind speed / direction**	
Date		**Crop**	
Time of day		**Variety**	
Type of application		**Crop stage**	
Carrier		**Air temp. (^{o}F)**	
Gas (if not CO_2)		**Soil temp. (^{o}F)**	
GPA		**Soil beneath**	
PSI		**Soil surface**	
Nozzle tips		**% Relative humidity**	
Nozzle spacing		**Sky conditions**	
Boom width (“)		**# Replications**	
Boom height (“)		Sprayed by	
Weeds present:			

Evaluation of Herbicides Applied Postemergence in Spinach (IR-4 Leafy Greens Project)

Final Report

Objective: To evaluate the effects of selected herbicides applied early-postemergence (EPOST) on crop injury and control of London rocket (*Sisymbrium irio*), fumitory, henbit (*Lamium amplexicaule* L.) and fumitory (*Fumaria officinalis*) in spinach (*Spinacia oleracea* var. "DMC 66-16") grown for processing in the Texas Wintergarden region.

Materials and Methods: The trial was conducted at the Del Monte Ag Research Farm located northeast of Crystal City on a Bookout clay loam soil with a pH of 7.7 and 1.8% organic matter. All standard crop management and pest control (fertilizer, pesticides, etc.) measures were utilized as needed during the growing season to maximize spinach production. The field was disked and beds prepared for planting on October 25, 2005. All EPOST treatments were applied on November 8 using a CO_2-pressurized backpack sprayer and hand-held boom equipped with four flat fan nozzles that delivered 20 gallons per acre at 30 PSI and at an approximate speed of 3 mph. Each plot measured 6.67 x 20 ft with 2 beds per plot. The trial was designed as a randomized complete block (RCBD) with 12 treatments replicated 4 times. Percent weed control and crop injury ratings were recorded during the season; however yields were not taken during this trial. All data were analyzed using SAS procedures and means separated according to Fischer's Protected LSD at the 0.05 level of confidence.

Results and Discussion: Spinach injury recorded on November 12 was high in plots treated with GoalTender, KIH-485, Dual Magnum, Outlook and Prowl H_20 and remained high throughout the season (January 31) for GoalTender, Outlook and Prowl H_20 (Table 1). Control of London rocket recorded on January 31 was excellent (> 90%) with GoalTender and Outlook (low rate). Good control (80 – 89%) was found in plots treated with KIH-485, Nortron and Outlook (high rate). Control was inadequate to poor with Dual Magnum (both rates), Prowl H_20, Far-Go and Paramount. Henbit control was excellent in plots treated with Dual Magnum (high rate), GoalTender, Outlook (both rates), Prowl H_20, and Paramount. All other treatments failed to adequately control henbit in this trial. Finally, excellent fumitory control was achieved only with GoalTender, Outlook (high rate), and Prowl H_20.

The results of this research indicate that significant crop injury can occur from EPOST applications of the selected herbicide treatments. While good to excellent control of the three weed species can be obtained, more often than not, herbicides also significantly injure the spinach crop. In future studies, GoalTender, KIH-485, Outlook (high rate), and Prowl H_20 at the applied rates should be dropped or at least alternative uses should be investigated.

Table 1. Effects of Herbicide Treatments on Percent Crop Injury in Spinach.

Trt #	Treatment	Rate (lbs a.i./A)	Timing	% Injury		
				Nov. 12	Jan. 3	Jan. 31
1	*Untreated*			0	0	0
2	*Handweed*			0	0	0
3	*Dual Magnum 7.62E*	0.325	PRE	28.8	22.5	8.8
4	*GoalTender*	0.125	EPOST	96.8	99.0	99.0
5	*KIH-485*	0.166 g a.i./ha	EPOST	56.0	46.3	7.3
6	*Nortron 4SC*	0.164	EPOST	25.0	8.8	10.0
7	*Dual Magnum*	0.49	EPOST	37.3	31.3	2.0
8	*Outlook 6E*	0.98	EPOST	65.0	50.0	26.8
9	*Prowl H_2O 3.8AS*	1.0	EPOST	46.3	46.3	25.0
10	*Outlook 6E*	0.49	EPOST	43.8	20.0	5.0
11	*Far-Go 4E*	1.25	EPOST	18.8	16.3	6.3
12	*Paramount 75DF*	0.125	EPOST	21.3	23.8	12.5
			LSD (0.05)	**28.3**	**31.8**	**14.1**

Table 2. Effects of Herbicide Treatments on Control of Weeds in Spinach.

Trt #	Treatment	Rate (lbs a.i./A)	Timing	% Control (1/31/06)		
				London Rocket	Henbit	Fumitory
1	*Untreated*			0	0	0
2	*Handweed*			94.3	96.8	96.8
3	*Dual Magnum 7.62E*	0.325	PRE	78.8	92.5	84.5
4	*GoalTender*	0.125	EPOST	94.5	95.8	92.0
5	*KIH-485*	0.166 g a.i./ha	EPOST	81.3	67.5	83.5
6	*Nortron 4SC*	0.164	EPOST	83.8	68.8	87.0
7	*Dual Magnum*	0.49	EPOST	73.8	69.8	70.0
8	*Outlook 6E*	0.98	EPOST	87.5	93.8	92.3
9	*Prowl H_2O 3.8AS*	1.0	EPOST	15.0	98.0	96.0
10	*Outlook 6E*	0.49	EPOST	92.3	94.8	83.5
11	*Far-Go 4E*	1.25	EPOST	25.0	30.0	73.3
12	*Paramount 75DF*	0.125	EPOST	12.5	91.0	66.3
			LSD (0.05)	**24.7**	**37.5**	**35.4**

Application: EPOST

Location	Crystal City	**Wind speed / direction**	0
Date	November 8, 2005	**Crop**	Spinach
Time of day	5:00 p.m.	**Variety**	DMC 66-16
Type of application	Broadcast	**Crop stage**	Cotyledon – 2 leaf
Carrier	Water	**Air temp. (^oF)**	73
Gas (if not CO_2)	CO_2	**Soil temp. (^oF)**	77
GPA	20	**Soil beneath**	Moist
PSI	30	**Soil surface**	Moist
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: Fumitory (1”)

Evaluation of Selected Herbicides on Weed Control in Wintergarden Spinach

Final Report

Objective: To evaluate the effects of pre-plant incorporated (PPI), preemergence (PRE) and early-postemergence (EPOST) applications on control of London rocket (*Sisymbrium irio*), henbit (*Lamium amplexicaule* L.) and fumitory (*Fumaria officinalis* L.) in spinach (*Spinacia oleracea* var. "DMC 66-16") grown for processing in the Texas Wintergarden region.

Materials and Methods: The trial was conducted at the Del Monte Ag Research Farm located northeast of Crystal City on a Bookout clay loam soil with a pH of 7.7 and 1.8% organic matter. All standard crop management and pest control (fertilizer, pesticides, etc.) measures were utilized as needed during the growing season to maximize spinach production. The field was disked and beds prepared for spraying PPI treatments on October 25, 2005, following which Ro-Neet was sprayed to designated plots using a CO_2-pressurized backpack sprayer and hand-held boom equipped with four flat fan nozzles that delivered 20 gallons per acre at 30 PSI and at an approximate speed of 3 mph. Following incorporation, the beds were rolled and flattened in preparation for planting. Spinach seed was planted using a gravity-feed seeder that planted seeds at an average spacing of 13 seeds per linear foot, with 2 rows of spinach per bed. Each plot measured 6.67 x 30 ft with 2 beds per plot. After planting, Dual Magnum (grower standard) and other selected treatments were applied PRE. EPOST treatments of Nortron were applied on November 9, 2005. The trial was designed as a randomized complete block (RCBD) with 21 treatments replicated 4 times. Percent weed control and crop injury ratings were recorded during the season; however, no yields were taken in this study due to mid-season root disease. All data were analyzed using SAS procedures and means separated according to Fischer's Protected LSD at the 0.05 level of confidence.

Results and Discussion: Percent crop injury evaluated 10 weeks after planting (WAP) showed that there was significant stunting with treatments where V-10142, Prowl H_2O, GoalTender, KIH-485, Grasp and Define were applied PRE (Table 1). In addition, injury was observed with double applications of Nortron applied POST. However, by 13 WAP injury remained high where V-10142, Prowl H_2O, GoalTender and Grasp were applied. All other treatments showed injury symptoms (stunting) of 10% or less.

Control of fumitory varied between treatments when observations were recorded on January 4 (Table 1). Control was poor to fair with the untreated and hand weeded plots, as well as with treatments of Nortron (low and medium rates), Far-Go and Paramount. Good control was observed with treatments of Ro-Neet (old grower standard), Nortron (high rate) and Pyramin, while excellent control (95% or better) was found in all other treatments. Dual Magnum (grower standard) gave excellent control of fumitory. Control of London rocket and henbit was good to excellent with Dual Magnum, while Ro-Neet gave poor control of London rocket. In addition, poor control of London rocket was found in plots treated with Barricade, Prowl H_2O, Far-Go and Paramount, while all other treatments gave good to excellent control. Finally, henbit control was poor to fair in plots treated with the medium and high rates of Nortron, Kerb, KIH-485 and Paramount. Good to excellent control was achieved in all other treatments.

No yield was taken with this study due to a mid season disease which attacked the roots and randomly killed plants in about one fourth of the trial area. However, the results do indicate that Outlook, Nortron, Barricade, Kerb, KIH-485, Pyramin, Far-Go, Paramount and Define have potential for use in processing spinach, and may be useful as potential tank-mix partners with Dual Magnum or Ro-neet for expanding weed control potential in spinach.

Table 1. Effects of Selected Herbicides for Weed Control in Processing Spinach in Crystal City, TX

Trt #	Treatment	Rate	Timing	% Injury	% Injury	% Control Fumitory	% Control London Rocket	% Control Henbit
		lbs a.i./A		Jan. 14	Jan. 31	Jan. 4	January 31	
1	*Untreated*			0	0	0	0	0
2	*Handweed*			0	0	73.3	99.0	99.0
3	*Dual Magnum 7.62E*	0.65	PRE	3.8	0	98.0	91.3	94.3
4	*Outlook 6E*	0.5	PRE	11.3	0	93.3	92.5	95.8
5	*Ro-Neet 6E*	2.25	PPI	16.3	0	86.8	41.3	95.8
6	*Nortron 4SC*	0.75	PRE	0	0	73.5	91.3	89.5
7	*Nortron*	1.0	PRE	0	0	65.0	93.8	73.5
8	*Nortron*	1.25	PRE	0	0	84.8	90.0	57.5
9	*Dual Magnum +* *Nortron*	0.325 0.164	PRE EPOST	8.8	0	95.0	91.3	97.0
10	*Dual Magnum +* *Nortron +* *Nortron*	0.325 0.164 0.164	PRE EPOST POST	30.0	0	98.0	93.8	98.0
11	*Barricade 4FL*	0.66	PRE	0	0	96.0	53.8	96.8
12	*V-10142 75WDG*	0.1	PRE	91.3	86.3	98.0	81.3	95.8
13	*Prowl H_2O 3.8ACS*	0.5	PRE	48.8	38.8	98.0	47.5	95.8
14	*Kerb 50W*	1.0	PRE	0	0	98.0	96.0	12.5
15	*GoalTender 4L*	0.5	PRE	99.0	99.0	99.0	99.0	99.0
16	*KIH-485 60WDG*	166 g ai/ha	PRE	21.3	5.0	99.0	96.0	67.5
17	*Pyramin 4.51SC*	1.5	PRE	0	10.0	83.8	85.0	86.8
18	*Far-Go 4E*	1.25	PRE	0	0	47.5	23.8	85.8
19	*Paramount 75DF*	0.125	PRE	0	0	74.5	20.0	65.0
20	*Grasp 2SC*	0.125	PRE	87.3	85.0	99.0	90.0	88.8
21	*Define 4SC*	0.6	PRE	18.8	0	98.0	98.0	94.5
			LSD (0.05)	**18.6**	**8.3**	**27.6**	**22.2**	**21.8**

Application: PPI/PRE

Location	Crystal City	**Wind speed / direction**	0 – 5 mph / SW
Date	October 25, 2005	**Crop**	Spinach
Time of day	5:30 p.m.	**Variety**	DMC 66-16
Type of application	Broadcast	**Crop stage**	Seed
Carrier	Water	**Air temp. (^oF)**	73
Gas	CO_2	**Soil temp. (^oF)**	76
GPA	20	**Soil beneath**	Moist
PSI	30	**Soil surface**	Dry
Nozzle tips	8002	**% Relative humidity**	Low
Nozzle spacing	18”	**Sky conditions**	Clear
Boom width (“)	6.5’	**# Replications**	4
Boom height (“)	18”	**Sprayed by**	RWW / JCH
Weeds present: None			

Application: EPOST

Location	Crystal City	**Wind speed / direction**	0 – 5 mph / SW
Date	November 9, 2005	**Crop**	Spinach
Time of day	2:00 p.m.	**Variety**	DMC 66-16
Type of application	Broadcast	**Crop stage**	Cotyledon – 2-lf
Carrier	Water	**Air temp. (^oF)**	80
Gas (if not CO_2)	CO_2	**Soil temp. (^oF)**	78
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**	4
Boom height (“)	18”	**Sprayed by**	RWW
Weeds present: Fumitory (cotyledon)			

Application: POST

Location	Crystal City	**Wind speed / direction**	0 – 5 mph / SW
Date	November 21, 2005	**Crop**	Spinach
Time of day	4:30 p.m.	**Variety**	DMC 66-16
Type of application	Broadcast	**Crop stage**	4 – 5 leaves
Carrier	Water	**Air temp. (^oF)**	72
Gas (if not CO_2)	CO_2	**Soil temp. (^oF)**	66
GPA	20	**Soil beneath**	Moist
PSI	30	**Soil surface**	Dry
Nozzle tips	8002	**% Relative humidity**	Low
Nozzle spacing	18”	**Sky conditions**	Clear
Boom width (“)	6.5’	**# Replications**	4
Boom height (“)	18”	**Sprayed by**	RWW
Weeds present: Fumitory (1”); henbit (1”)			

Evaluation of Eptam 7-E at Selected Rates and Timings on Weed Control and Crop Injury in Spinach

Final Report

Objective: To evaluate the effects of pre-plant incorporated (PPI), post-plant incorporated (POST-Plant) and chemigated (CHEM) applications at 14 and 21 days after planting on control of London rocket (*Sisymbrium irio*), henbit (*Lamium amplexicaule* L.) and fumitory (*Fumaria officinalis* L.) in spinach (*Spinacia oleracea* var. "DMC 66-16") grown for processing in the Wintergarden region.

Materials and Methods: The trial was conducted at the Del Monte Ag Research Farm located northeast of Crystal City on a Bookout clay loam soil with a pH of 7.7 and 1.8% organic matter. All standard crop management and pest control (fertilizer, pesticides, etc.) measures were utilized as needed during the growing season to maximize spinach production. The field was disked and beds prepared for spraying PPI treatments on October 25, 2005, following which Eptam was sprayed to designated plots using a CO_2-pressurized backpack sprayer and hand-held boom equipped with four flat fan nozzles that delivered 20 gallons per acre at 30 PSI and at an approximate speed of 3 mph. Following applications of the PPI treatments the field was immediately cultivated with rolling baskets to incorporate the Eptam. Following incorporation, the beds were rolled and flattened in preparation for planting. Spinach seed was planted using a gravity-fed seeder that planted seeds at an average spacing of 13 seeds per liner foot, with 2 rows of spinach per bed. Each plot measured 6.67 x 30 ft with 2 beds per plot. After planting, Dual Magnum (grower standard) was applied PRE, as well as the Eptam POST-Plant treatments, which were incorporated by hand using a rake. At 14 and 21 days following planting, Eptam CHEM treatments were applied by drenching the plots with the appropriate ratio of water/Eptam to simulate chemigation using overhead irrigation. The trial was designed as a randomized complete block (RCBD) with 12 treatments replicated 4 times. Percent weed control and crop injury ratings were recorded during the season, and yields taken on February 21, 2006. All data were analyzed and means separated according to Fischer's Protected LSD at the 0.05 level.

Results and Discussion: In this test, Dual Magnum, the grower standard, applied PRE did not cause significant injury to spinach (Table 1). When Eptam was applied PPI, there was a general trend for percent crop injury to increase as the rate of Eptam increased from 1.5 pints to 4.0 pints/A. However, this injury was temporary, and less than 17% on November 22. Spinach treated PPI with Eptam followed by a CHEM application 14 days after planting had significantly higher crop injury compared to plots where Eptam was applied PPI or where Eptam was CHEM-applied at 21 days. Crop injury decreased in all plots by January 3, though it was still significant in CHEM-treated plots at 14 days. By January 31, less that 7% injury was observed in all plots, indicating that although significant injury occurred with the CHEM applications at 14 days, the spinach was able to outgrow this response. The data also suggest that spinach is more susceptible to crop injury from CHEM applications at 14 days compared to 21 days. Although crop injury was visible in these plots, there were no significant differences in yield for any treatments, including where early crop injury was 38 – 47% with CHEM applications at 14 days. Control of fumitory, London rocket and henbit was poor with PRE applications of Dual Magnum (Table 2), a response that was seen in other locations nearby during 2005. Fumitory control averaged 69.8 – 98% with all Eptam treatments and showed the best control response of all weeds from these treatments. Control of henbit was poor when applied PPI or CHEM at 21 days. Response was excellent (95%) when CHEM-treated at 14 days. London rocket control was generally not satisfactory with the PPI treatments, but improved with the CHEM treatments. The results of this study indicate that although weed control was not excellent with all treatments and rates; Eptam should be considered moderately safe on spinach applied PPI and when chemigated at approximately 21 days following planting. More research is needed to determine whether these responses will occur under additional environmental conditions, at lower rates when applied CHEM, or when granular Eptam is incorporated 14 or 21 days after planting.

Table 1. Influence of Eptam 7-E on Crop Injury and Yield When Applied at Selected Timings and Rates

Trt #	Treatment	Product Rate	Timing	% Injury Nov. 22	% Injury Jan. 3	% Injury Jan. 31	Yield Tons/A
1	*Untreated*			0	0	0	7.04
2	*Handweed*			0	0	0	7.47
3	*Dual Magnum 7.62E*	10.9 oz	PRE	2.5	3.8	2.5	7.99
4	*Eptam 7E*	1.5 pts	PPI	2.5	0	0	7.90
5	*Eptam*	2.5 pts	PPI	13.8	7.5	3.8	8.35
6	*Eptam*	3.5 pts	PPI	16.3	1.3	2.5	8.37
7	*Eptam*	4.0 pts	PPI	16.3	3.8	0	7.88
8	*Eptam*	3.5 pts	Post-Plant	0	0	0	7.26
9	*Eptam +* *Eptam*	3.5 pts 2.0 pts	PPI CHEM @ 14 Days	38.8	17.5	6.3	7.36
10	*Eptam +* *Eptam*	3.5 pts 3.0 pts	PPI CHEM @ 14 days	47.5	23.8	6.3	7.86
11	*Eptam +* *Eptam*	3.5 pts 2.0 pts	PPI CHEM @ 21 Days	15.0	2.5	1.3	7.32
12	*Eptam +* *Eptam*	3.5 pts 3.0 pts	PPI CHEM @ 21 Days	16.3	5.0	0	7.87
			LSD (0.05)	**8.3**	**11.4**	**6.5**	**1.9**

Table 2. Influence of Eptam 7-E (EPTC) on Weed Control When Applied at Selected Timings and Rates

Trt #	Treatment	Product Rate	Timing	Fumitory	Henbit	London Rocket
				------------ % Control on January 31 ------------		
1	*Untreated*			0	0	0
2	*Handweed*			99.0	74.3	98.0
3	*Dual Magnum 7.62E*	10.9 oz	PRE	47.3	0	36.3
4	*Eptam 7E*	1.5 pts	PPI	93.5	35.0	83.8
5	*Eptam*	2.5 pts	PPI	72.0	35.0	53.8
6	*Eptam*	3.5 pts	PPI	94.5	40.0	76.3
7	*Eptam*	4.0 pts	PPI	94.5	57.5	77.5
8	*Eptam*	3.5 pts	Post-Plant	69.8	12.5	73.8
9	*Eptam +* *Eptam*	3.5 pts 2.0 pts	PPI CHEM @ 14 Days	97.0	94.8	88.8
10	*Eptam +* *Eptam*	3.5 pts 3.0 pts	PPI CHEM @ 14 days	98.0	96.0	93.8
11	*Eptam +* *Eptam*	3.5 pts 2.0 pts	PPI CHEM @ 21 Days	97.0	41.3	80.0
12	*Eptam +* *Eptam*	3.5 pts 3.0 pts	PPI CHEM @ 21 Days	96.0	77.5	81.3
			LSD (0.05)	**35.6**	**49.2**	**30.1**

Application: PPI/PRE

Location	Crystal City, TX	**Wind speed / direction**	0 – 5 mph / SW
Date	October 25, 2005	**Crop**	Spinach
Time of day	5:00 p.m.	**Variety**	DMC 66-16
Type of application	Broadcast	**Crop stage**	Seed
Carrier	Water	**Air temp. (^oF)**	70
Gas	CO_2	**Soil temp. (^oF)**	66
GPA	20	**Soil beneath**	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 / JCH
Weeds present: None			

Application: CHEM 1

Location	Crystal City, TX	**Wind speed / direction**	0 – 10 mph / SW
Date	November 10, 2005	**Crop**	Spinach
Time of day	9:30 a.m.	**Variety**	DMC 66-16
Type of application	Chemigation	**Crop stage**	2-leaf
Carrier	Water	**Air temp. (^oF)**	71
Gas (if not CO_2)		**Soil temp. (^oF)**	73
GPA		**Soil beneath**	Moist
PSI		**Soil surface**	Moist
Nozzle tips		**% Relative humidity**	High
Nozzle spacing		**Sky conditions**	Overcast
Boom width (“)		**# Replications**	4
Boom height (“)		**Sprayed by**	RWW
Weeds present: Carelessweed (cotyledon – 1 leaf)			

Application: CHEM 2

Location	Crystal City, TX	**Wind speed / direction**	5 – 10 mph / SW
Date	November 17, 2005	**Crop**	Spinach
Time of day	1:00 p.m.	**Variety**	DMC 66-16
Type of application	Chemigate	**Crop stage**	2 – 4 leaf
Carrier	Water	**Air temp. (^oF)**	63
Gas (if not CO_2)		**Soil temp. (^oF)**	59
GPA		**Soil beneath**	Moist
PSI		**Soil surface**	Dry
Nozzle tips		**% Relative humidity**	Low
Nozzle spacing		**Sky conditions**	Clear
Boom width (“)		**# Replications**	4
Boom height (“)		**Sprayed by**	JCH
Weeds present: None			