What Do you Get When You Mix Pumpkins, Cowpeas, Buckwheat and Mycorrhiza?

Steven Kirk
Field Supervisor
Lincoln University Cooperative Extension
-Commercial Vegetable Program

Carver Farm Site History: Sweet potatoes for several years, then fallow weeds for one.

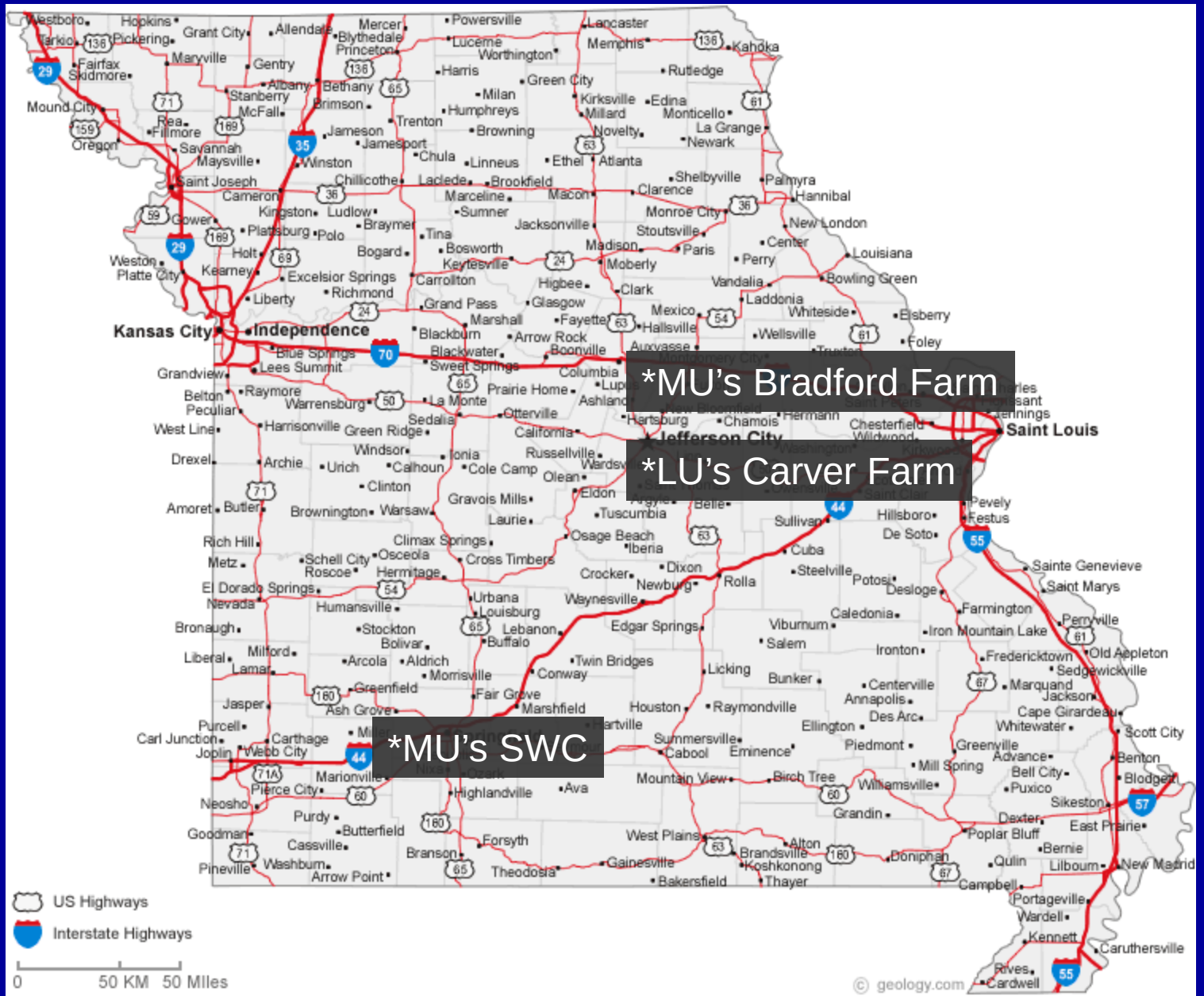
Evaluation of Mycorrhizal Inoculated & Non-inoculated Jack-O-Lantern Pumpkin Cultivars in Missouri

Steven Kirk, Nahshon Bishop, Timothy Reinbott, Kerry Clark, Catherin Bohnert and Andrew Thomas

- ***ABSTRACT:*** Four cultivars of mycorrhizal inoculated & non-inoculated pumpkins were evaluated at LU's George Washington Carver Research Farm in Jefferson City, MO, and at MU's SWC Center in Mt Vernon, MO, and Bradford Farms in Columbia, MO during the 2013 growing season.

- Replicated trials including 'treated' and 'control' were analyzed for 'marketable yield' along with individual fruit characteristics of 'fruit weight', and 'size'.

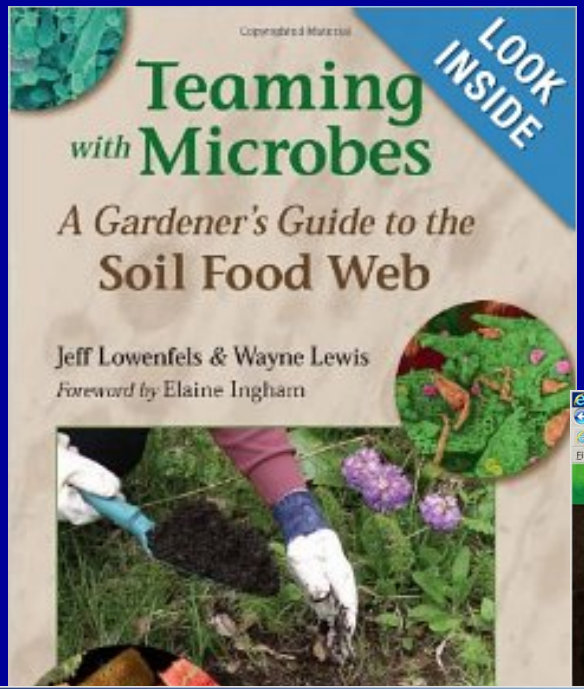
Three Planting Location in Missouri

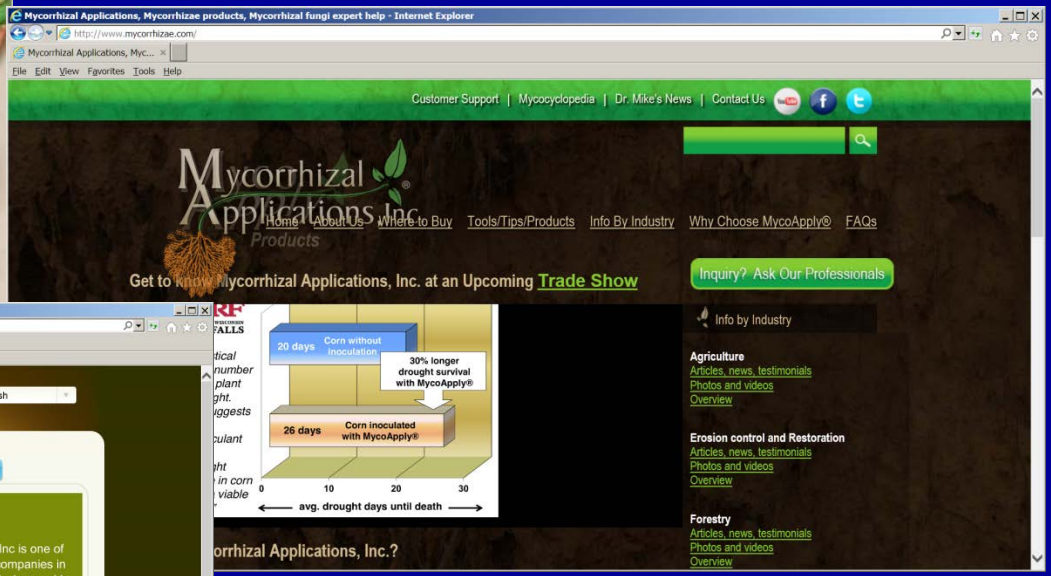


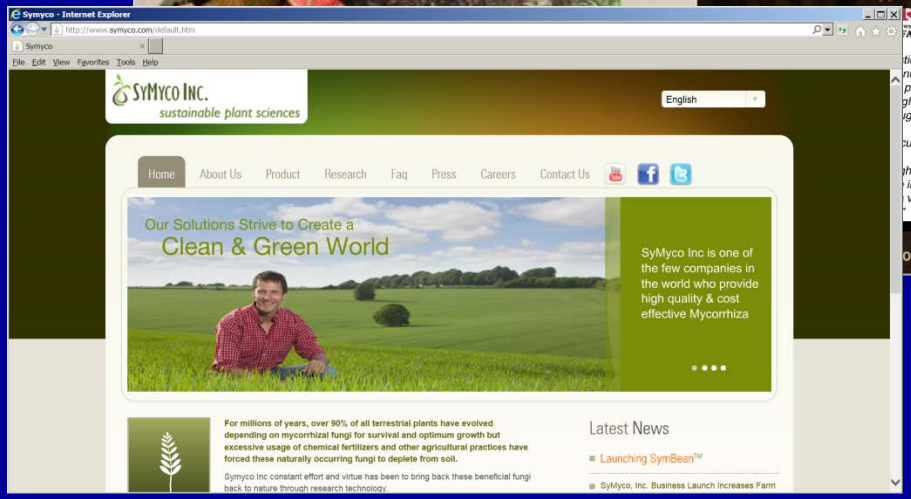
Why Mycorrhizae?

Benefits:

- Nutrient and water uptake improved
- Improved root and plant growth
- Improved yield
- Transplant shock and drought stress reduced







Four Jack-O-Lantern pumpkin cultivar were chosen for this trial

Treated			
Code	**Cultivar**	**Size**	**Source**
P3	Gladiator	20-25 lbs	Harris
P4	Apollo	18-30 lbs	Harris
P6	Magic Lantern	16-24 lbs.	Harris
P15	Goose Bumps II	8-12 lbs	Rupp
Control			
Code	**Cultivar**	**Size**	**Source**
CP3	Gladiator	20-25 lbs	Harris
CP4	Apollo	18-30 lbs	Harris
CP6	Magic Lantern	16-24 lbs.	Harris
CP15	Goose Bumps II	8-12 lbs	Rupp

Materials and Methods

Materials and Methods

- On July 3rd Seeds were direct seeded into 804 insert 4-cell packs in the greenhouse.
- Half were inoculated with Mycorrhizal fungi.

804 insert 4-cell packs

Materials and Methods

- ½ Tbsp of mycorrhizal fungi powder was added to ¾ quart of tap-water and mixed well.
- A turkey baster was used to inoculate seeds at a rate of ½ oz (15 ml) of solution per 2 rows of pumpkin seed.

Materials and Methods

- Prior to laying the plastic mulch, fertilizer was applied and cultivated into the soil at rates recommended by Kinsey Agricultural Service's analysis of soil samples.

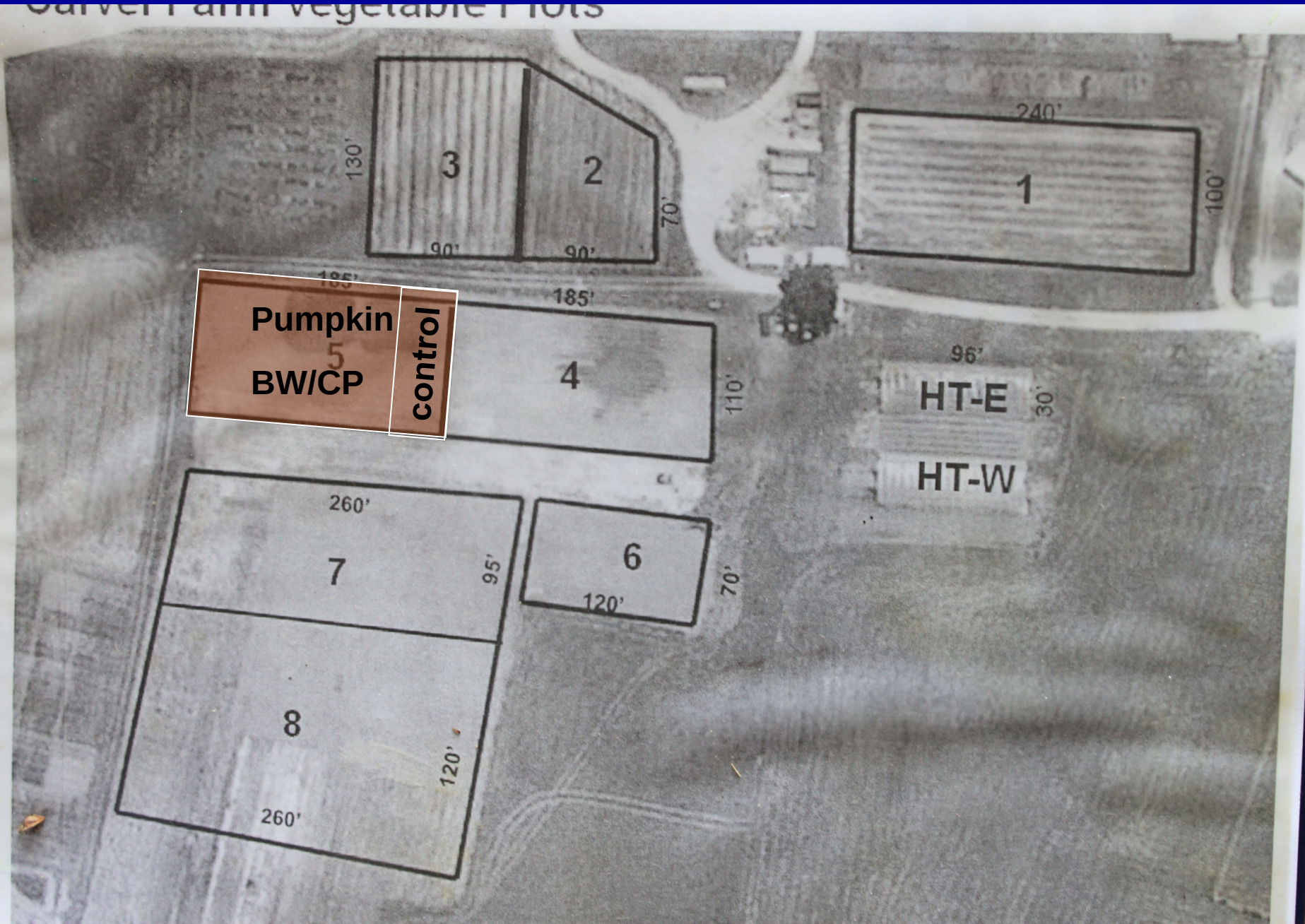
Kinsey Ag. Services Soil Recommendations for all 3 Locations

	Fertilizers	Analysis	Lb/plot
Carver Farm recommendations: per .46 acre plot.			
Anions	Urea	46-0-0	23
	Ammonium Sulfate	21-0-0-24	161
	Sulfur	90-92%	41.4
	Monoammonium Phosphate (MAP)	11-52-0	92
Cations	Gypsum		368
Traces	Boron*	14.30%	6.9
	Manganese sulfate	28%	13.8
	Copper Sulfate	23%	4.6
	Zinc Sulfate	36%	16.1
Bradford Farm recommendation: per .74 acre plot.			
Anions	Ammonium Nitrate	34-0-0	92.5
	Ammonium Sulfate	21-0-0-24	129.5
	Sulfur	90-92%	55.5
	Diammonium Phosphate (DAP)	18-46-0	148
Cations	Pellated CA Lime		222
	Potassium Sulfate	0-0-50	185
Traces	Boron*	14.30%	11.1
	Copper Sulfate	23%	3.7
	Zinc Sulfate	36%	7.4
Southwest Center recommendation: per .20 acre plot.			
Anions	Urea	46-0-0	10
	Ammonium Sulfate	21-0-0-24	13
	Sulfur	90-92%	24
	Diammonium Phosphate (DAP)	18-46-0	63
Cations	Pellated CA Lime		313
	Potassium Sulfate	0-0-50	50
Traces	Boron*	14.30%	4
	Manganese Sulfate	28%	6
	Copper Sulfate	23%	5
	Zinc Sulfate	36%	6

Materials and Methods

- On July 2nd A cover crop of cowpeas and buckwheat were planted between the rows as a 'living' mulch.
- Buckwheat and cowpea seed were inoculated with Mycorrhizal fungi a rate of 1.5 oz. per 30 lbs of seed using a portable poly cement mixer at
- A non-inoculated cover crop of buckwheat and cowpeas was planted between the rows in the control plot.
- Vines were hand-directed to grow into the cover crop.

Carver Farm pumpkin plot map



1.5 oz. of Mycorrhizae powder per 30 lb. of seed

Gatorade makes a good Mycorrhizae sticker

Broadcasting cover crop seed between the rows

Harrowing in cover crop seed between the rows

Materials and Methods

- On July 12th, 2013, plants were transplanted into raised beds covered in black bio-degradable plastic mulch at Carver Farm.
- SWC pumpkins were planted on July 9th and 11th
- Bradford Farm was planted on July 22nd.
- Plant spacing for Carver Farm and the SWC was 3' within a row and 9' on center between rows. Spacing for Bradford Farm was 2' within a row and 10' on center between rows. Each block consisted of 4 plants of the same cultivar and replicated 4 times.

Planting pumpkins at Carver Farm

Planting pumpkins at Carver Farm

Planting pumpkins at Carver Farm

Trap Cropping

- A trap-crop of Blue Hubbard and Red Kuri squash was planted at the end of each row at Carver Farm and the SWC to attract squash bugs.

Trap-crops, Pumpkins, Cowpeas and Buckwheat

Pumpkins, Cowpeas and Buckwheat

Control Pumpkins, Cowpeas and Buckwheat

Pesticide control

- Pesticide control at Carver Farm consisted of 1 application of Dipel insecticide (*Bacillus thuringiensis*) to all cucurbits on July 19th. Two applications of Azera insecticide (*Pyrethrin + Azadirachtin*) was applied to the trap-crops only on July 19th, August 1st and 7th.

- On August 15th, Azera was applied to all the trap crops and to the eastern most row of the cultivar trial.

- At the SWC, imidacloprid was applied once to the trap-crops on the south end of the trial at the beginning of the season after true leaves were established, and Azera was applied weekly to the north end trap-crops.

- Bradford Farms did not plant trap-crops and applied no pesticides.

Vines were hand-directed into the cover crop

Pumpkin vines growing into Buckwheat & Cowpeas

Buckwheat & Cowpea cover crop between pumpkins

Pumpkin growing in Buckwheat & Cowpea cover crop

Harvest

Harvest

- All pumpkins were harvested at the end of the 2013 growing season.
- Carver Farm pumpkins were picked on September 19th.
- SWC was harvested on September 27th.
- Bradford Farm pumpkins were picked on October 17th.

Harvest

Harvest

- Bulk data was collected by following each vine in each block, collecting all rip fruit and weighing each individual pumpkin.

- Individual fruit characteristic data was determined by selecting one representative pumpkin from each block, and measuring the circumference at the equator and at the pole.

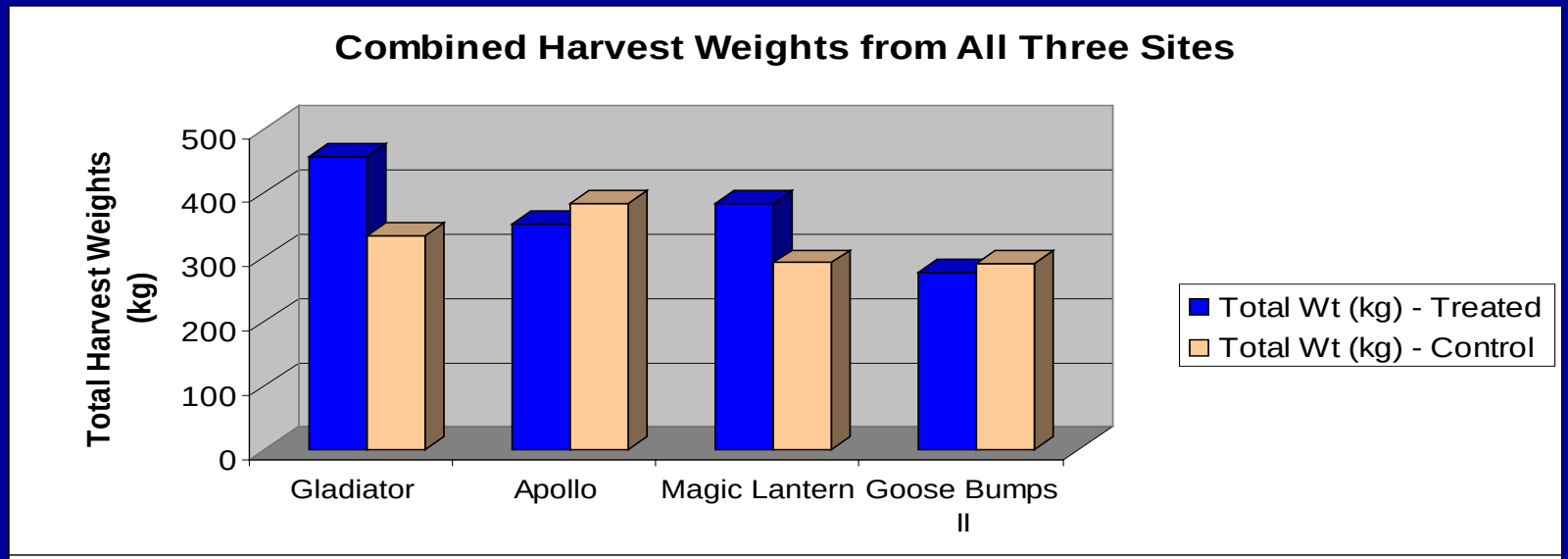
Harvest

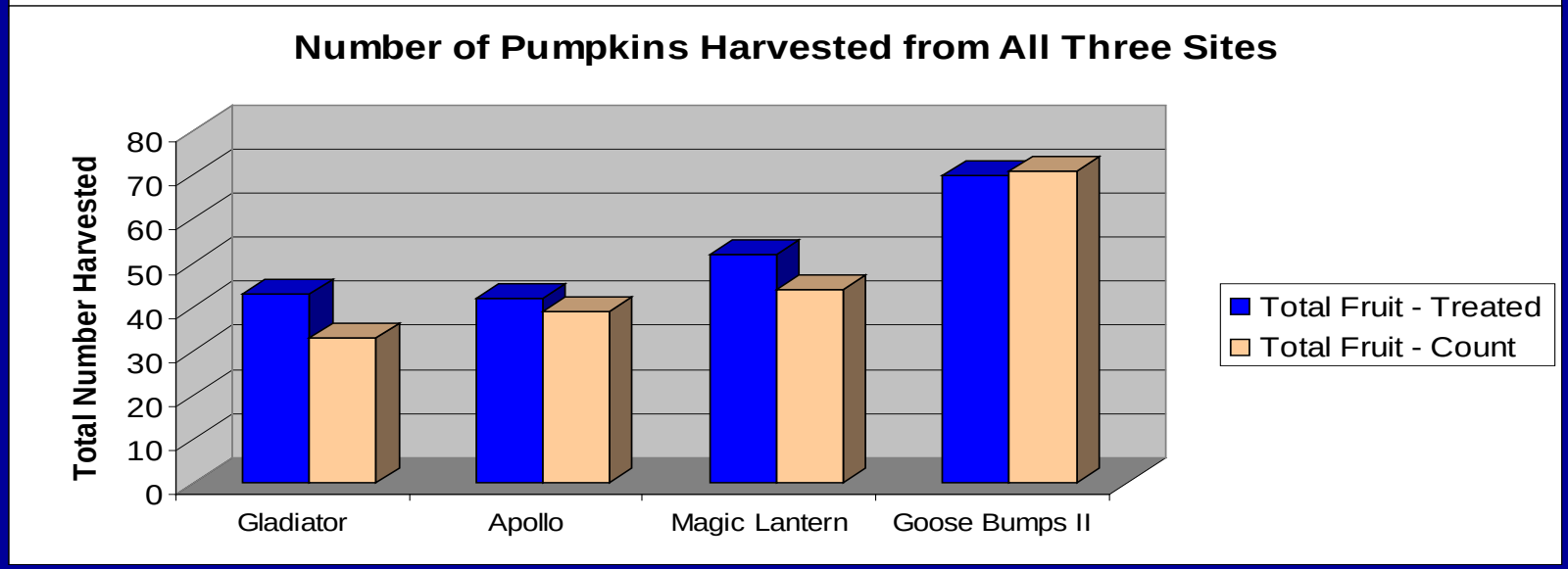
Harvest

Harvest

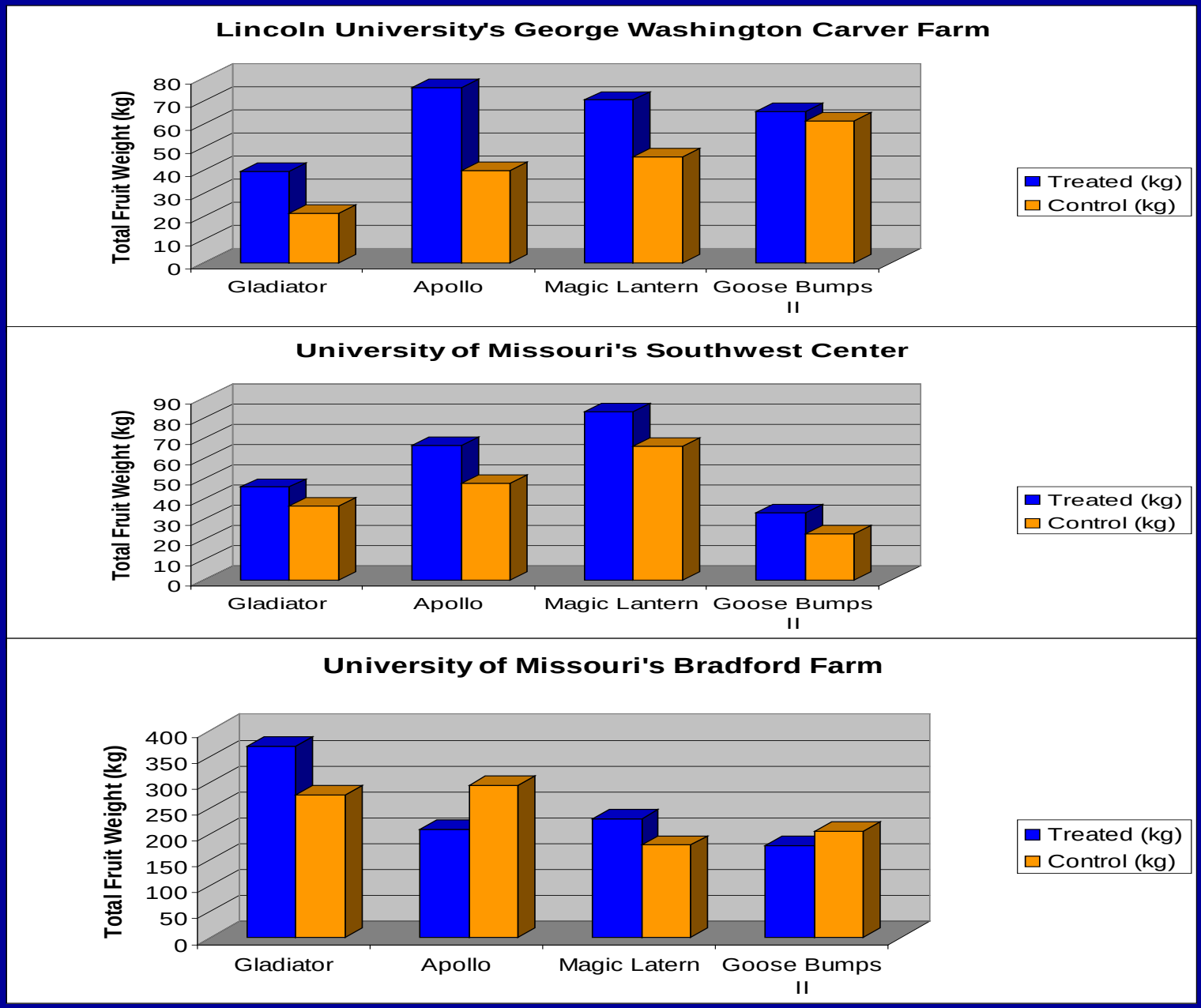
Results and Discussion

Combined Harvest Weights and Fruit Count from All Three Sites

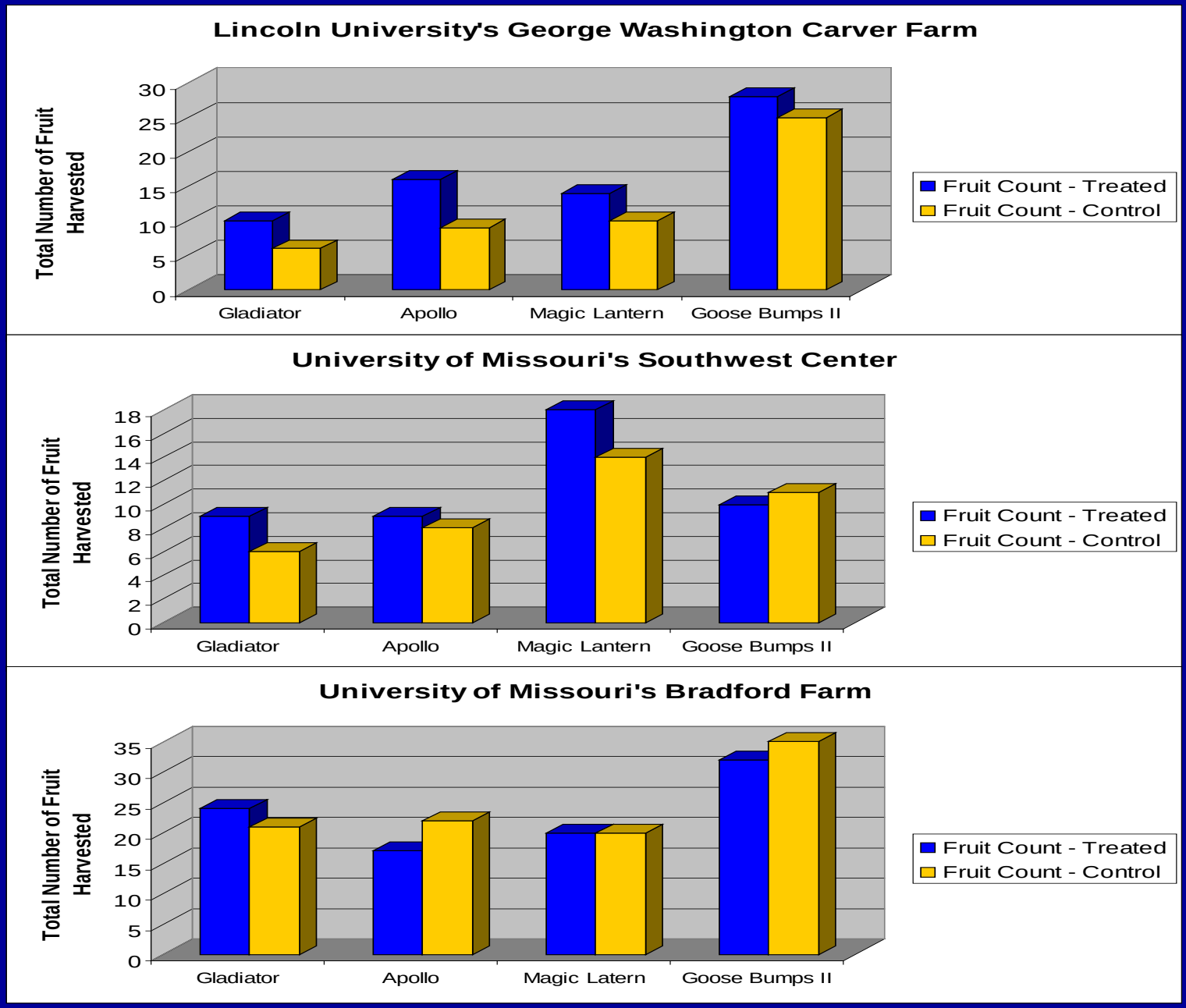




Weight Comparison between Mycorrhizal Inoculated & Non-inoculated Pumpkins

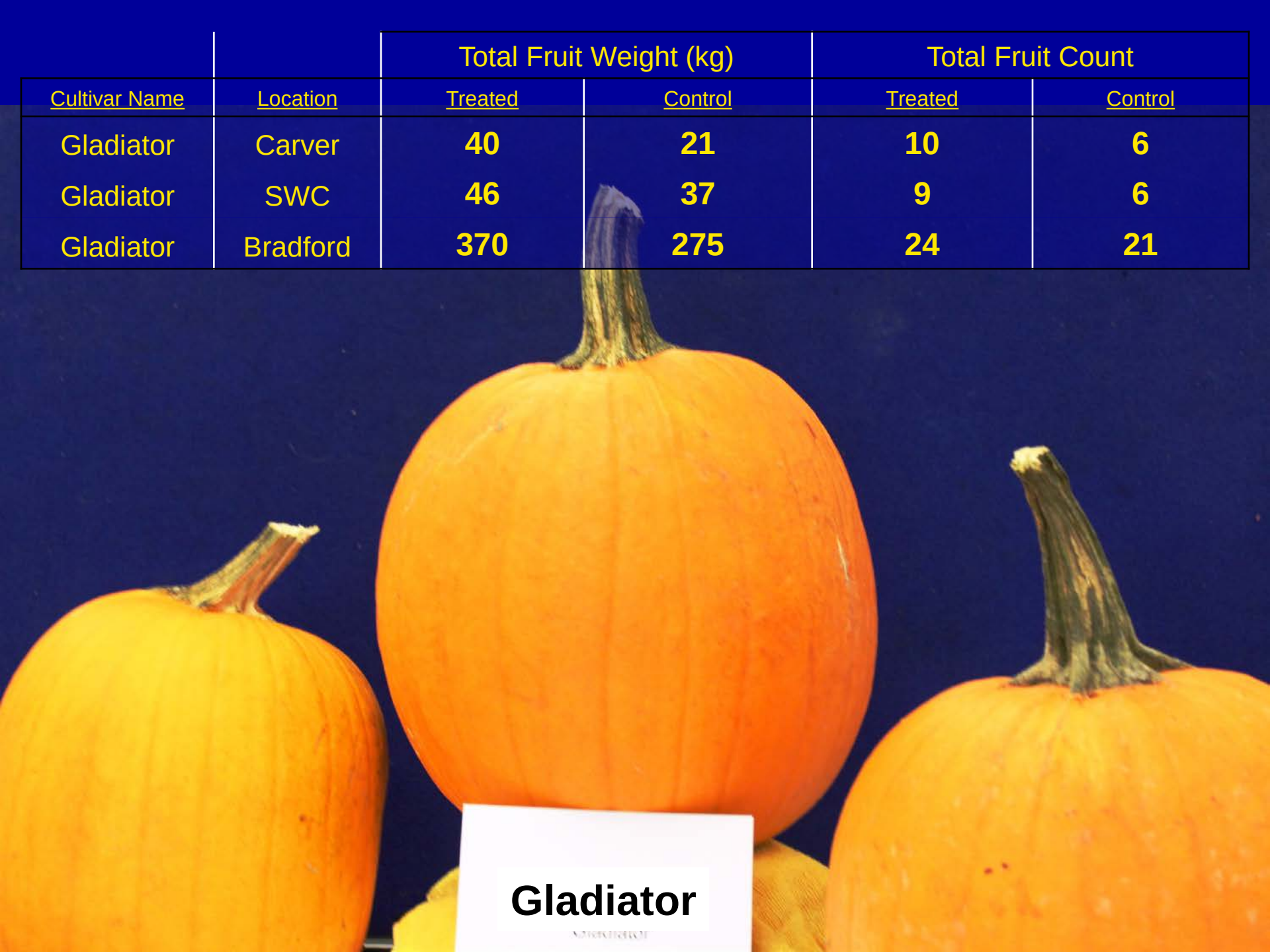


Count Comparison between Mycorrhizal Inoculated & Non-inoculated Pumpkins



		Total Fruit Weight (kg)		Total Fruit Count	
Cultivar Name	Location	Treated	Control	Treated	Control
Apollo	Carver	**76**	**40**	**16**	**9**
Apollo	SWC	**67**	**48**	**9**	**8**
Apollo	Bradford	**209**	**295**	**17**	**22**

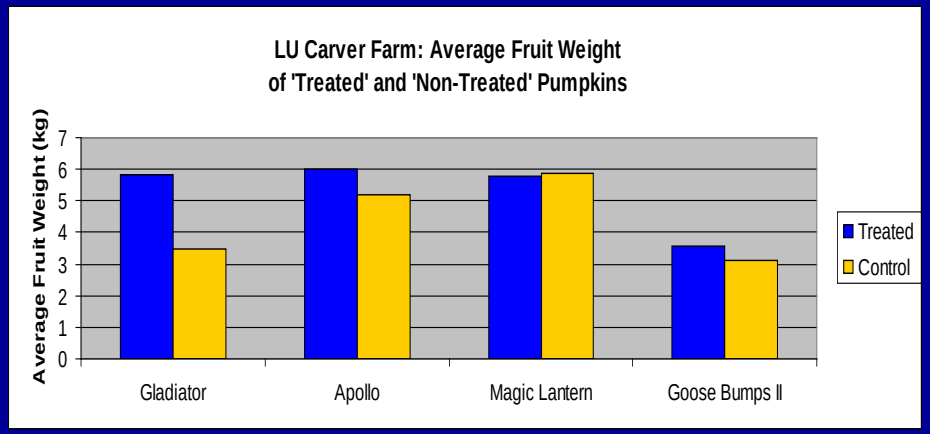
		Total Fruit Weight (kg)		Total Fruit Count	
Cultivar Name	Location	Treated	Control	Treated	Control
Gladiator	Carver	40	21	10	6
Gladiator	SWC	46	37	9	6
Gladiator	Bradford	370	275	24	21

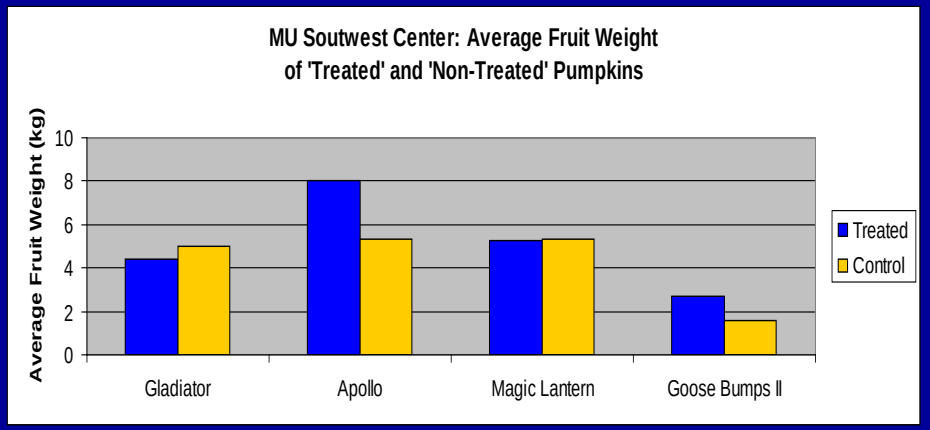


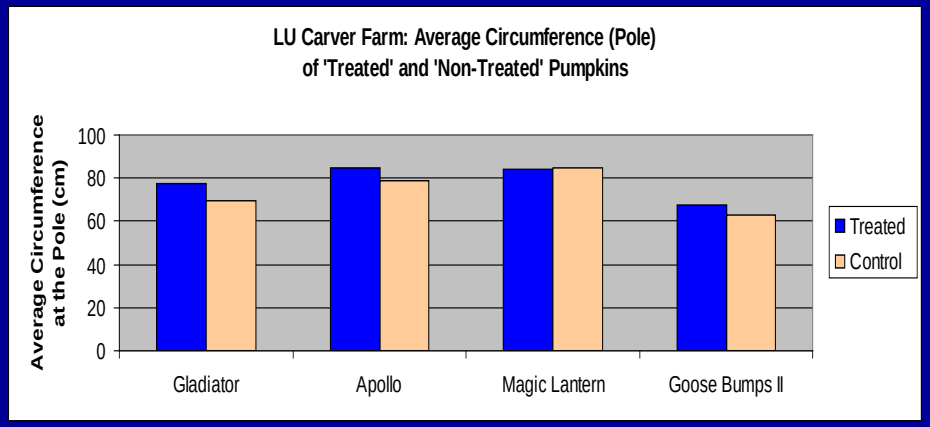
Cultivar Name	Location	Total Fruit Weight (kg)		Total Fruit Count	
		Treated	Control	Treated	Control
Magic Lantern	Carver	**70.61**	**46.07**	**14**	**10**
Magic Lantern	SWC	**83.26**	**66.14**	**18**	**14**
Magic Lantern	Bradford	**229.30**	**178.80**	**20**	**20**

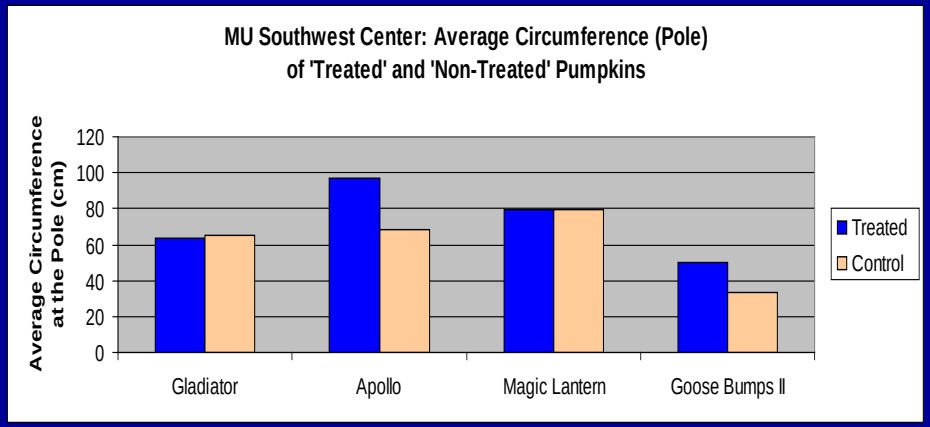
		Total Fruit Weight (kg)		Total Fruit Count	
Cultivar Name	Location	Treated	Control	Treated	Control
Goose Bumps II	Carver	**65.54**	**61.58**	**28**	**25**
Goose Bumps II	SWC	**33.40**	**23.00**	**10**	**11**
Goose Bumps II	Bradford	**177.35**	**206.10**	**32**	**35**

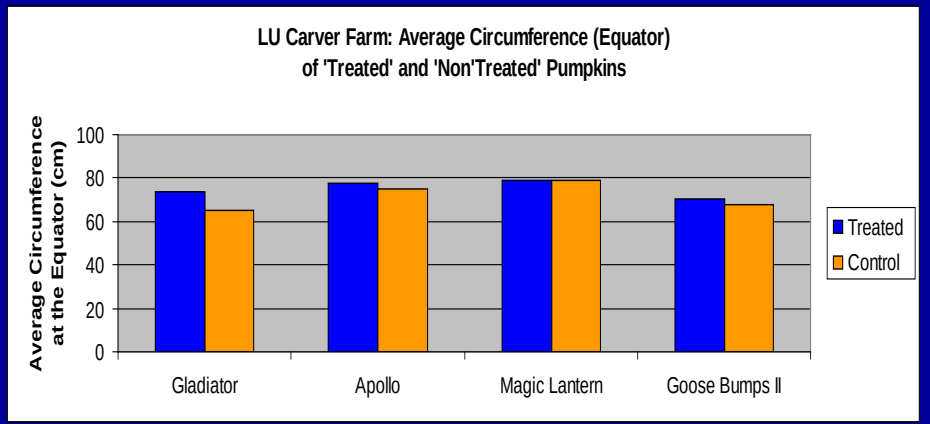
Size Comparison between ‘Treated’ & ‘Non-Treated’ Pumpkins from 2 Sites

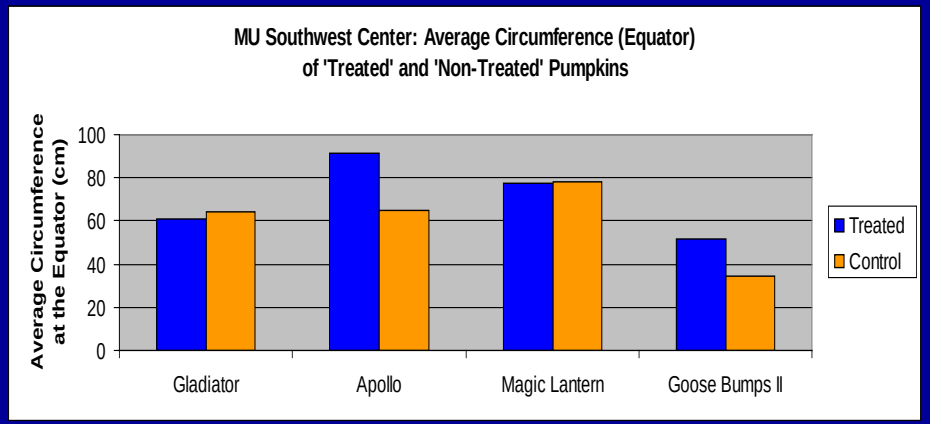












Preliminary Findings: Bulk

- Cowpeas and buckwheat performed well as a smother-crop to suppress weeds.

- Inoculated ‘Gladiator’ pumpkins had greater weights and higher counts at all three sites than non-inoculated.
- ‘Apollo’ and ‘Magic Lantern’ had greater weights and higher counts at Carver and the SWC
- ‘Magic Lantern’ had higher counts at all three sites.
- ‘Goose Bumps II’ had greater weights and higher counts at Carver and higher counts at both Carver and the SWC.

Preliminary Findings: Individual

- Average individual fruit weights were greater for inoculated ‘Gladiator’ ‘Apollo’ and ‘Goose Bumps II’ at both Carver and the SWC than non-inoculated.
- Average circumferences at the poles and at the equators were greater for inoculated ‘Gladiator’ at Carver, and greater for ‘Apollo’ and at both Carver and for the SWC and greater for ‘Goose Bumps II’ at the SWC.
- There were no differences in average weights and circumference measurements for both inoculated and non-inoculated ‘Magic Lantern’ and ‘Gladiator’ pumpkins at the SWC, and no differences in circumference for ‘Magic Lantern’ and ‘Apollo’ at Carver.

Questions???