

## Introduction

This is a report of a controlled study of organic tomato yield using different cultural techniques and spray regimes. The factors studied were:

1. air drainage - a comparison of:
  - (a) wide plant spacing for plants allowed to sprawl on the ground
  - (b) basket weave trellis.
2. soil splash - (to reduce the transmission of spores of fungus) a comparison of:
  - (a) the physical barrier of black plastic mulch in the rows of tomatoes with oat straw mulch in between the rows
  - (b) no mulch at all, with the tomato plants exposed to the soil.
3. sprays - a comparison of:
  - (a) control group with no spray
  - (b) compost tea spray
  - (c) copper spray.

In total there were 12 rows of tomatoes, with the three spray groups each having four different categories of cultural techniques.

Category 1	no mulch	no trellis
Category 2	no mulch	yes trellis
Category 3	yes mulch	no trellis
Category 4	yes mulch	yes trellis

To prevent errors due to fertility differences throughout the plot and to account for inevitable spray drift (which was minimized by using a hand held motorized Solo mist blower, which was emptied and double rinsed between spraying different mixes), there were nine mini-plots within the larger plot, each with the four different categories.

COMPOST	COPPER	NO SPRAY
COPPER	NO SPRAY	COMPOST
NO SPRAY	COMPOST	COPPER

Mulching consisted of black plastic mulch in 4 foot wide strips, with oat straw several inches thick placed in between the rows of plastic mulch. The oat straw was put down about 6 weeks after transplanting the tomatoes into the ground.

Trellis consisted of stakes placed between every other plant using the basket weave system. Wooden stakes 4 feet high were used primarily with an occasional 6 foot metal stake used to secure the entire trellis arrangement from sagging . A new line of twine was placed every 9 or 10 inches up, and the suckers were pruned up to but not including the last sucker below the first truss of fruit.

Fertility was from compost which has been heavily applied to the land for the last 8 years at an average rate of 12 to 20 tons per acre, and organic bagged fertilizer (5-3-4) applied at recommended rates.

Size of plot was 133 feet by 78 feet, slightly over 1/4 acre. A total of 734 plants were used in the study. They were planted on June 21, 1994. The reason for the late planting date is that we had no rain from May 26- June 21, and extreme heat during the period. The last frost was May 27, so we held off planting before the late May rain not wanting to lose the transplants to frost (which usually comes right after rain in our locale). We ended up waiting for three and one-half weeks. We have no irrigation, but with a rich loam with organic matter over 9% we usually are fine relying upon the New England rain for our water supply. The late planting date probably reduced the earliness of yield by a week or two and overall yields by as much as 10%. Unfortunately due to the death of my stepfather in mid September our last recorded and weighed harvest was on September 21, although there was probably no more than another 10% of sizable fruit on the vine. The biggest difference was in the copper sprayed plants (as the slides will show). They were significantly healthier as regards foliage at the end of the season and the extra yield would have been mostly in that category.

Varieties used were Sunbeam and Ultrasweet. No comparison was made between varieties. However, an equal length of row was used of both varieties for each of the different spray and cultural techniques.

The tomatoes were graded and sold wholesale. All yields in the report are only of quality tomatoes. Rejects were not weighed. Although were originally planned to weigh rejects as well, it was too confusing to carry that out. As it was, there were 12 rows with three different spray systems, giving us 36 different sections to be weighed in the field each harvest day. There was no practical way to keep them all separate and then reweigh them after grading was done up at the barn.

Plant spacing was 33 inches apart for the ground sprawl system and 22 inches apart for the trellis system.

Weeds were hand hoed twice between all rows before the straw mulch was laid down. Also, in the rows without straw mulch, weeding/hoeing continued so that there would be no difference in yield due to weeds. Weeds were not a problem in any of the categories as the slides will show. Also, weeds were pulled from the holes in the black plastic mulch where the plants grew.

The straw was put down late enough that the soil had a chance to build up warmth (rather than cool the soil as straw mulch may do due to its light color). Also delaying putting down the mulch for 6 weeks helped to keep the oat seeds from sprouting so early that they would become a nuisance. The combination of plastic mulch and oat straw did an effective job of keeping the fruit clean.

Slides were taken of the tomatoes from the same 13 spots every two weeks throughout the season to develop a visual record of disease control and plant health.

A slide show and presentation of these results will be made at the New Hampshire Farm and Forest Expo on Saturday, February 4, 1995, sponsored by the NH Department of Agriculture Organic Certification Program. Also, an interview was conducted by the market gardener's newsletter Growing for Profit published in Lawrence, Kansas and a report may appear in the next issue.

Green Truck Farm has been certified organic since 1987 and is located at Starrett Farm in Frankestown, N.H.

This research project was developed and implemented with the assistance of George Hamilton of UNH Cooperative Extension, Hillsborough County and Dr. Cheryl Smith, the UNH Plant Pathologist. Both came to the farm to help plan the project prior to planting and also to give an evaluation of the project and health of the tomato plants and their disease status during the summer. George came by the farm, on a regular basis throughout the season and was a great help and encouragement as always.

## Conclusions on Cultural Systems

	<u>CATEGORY</u>	<u>COMMENT</u>
AVOID	1. no mulch/no trellis .	This is the worst option from the beginning through the end.
????	2. no mulch/yes trellis	Came in second place in overall yield, but hard to offer a consistent rationale because no mulch did worse than mulch in general and trellis did worse than no trellis in general.
LATE CROP/SEPTEMBER HIGH OVERALL YIELD	3. yes mulch/no trellis	The best harvest during the month of September. Also, this system had the highest overall yield for the season.
EARLY CROP/AUGUST	4. yes mulch/yes trellis	The best option for the first month of harvest (nearly 60% ahead after the first month). At the end, total yield tied for last place. Possible reasons: (1) by pinching off early suckers, we decreased the ultimate number of large stems, each with many possible trusses of fruit, and (2) this pruning focuses early energy on the main stem leading to larger and earlier first fruits and higher early yield.

## Conclusions on Sprays

1. The foliage on the tomato plants sprayed with copper were significantly better throughout and especially in mid-late September when the other two systems had begun to defoliate quite rapidly.
2. According to Dr. Cheryl Smith, UNH Plant Pathologist and George Hamilton UNH Cooperative Extension Agricultural Educator, we did not have a serious problem with early blight this year. However, we did have septoria. The Septoria would cause leaf defoliation which could cause sunscald, except by September the sun was not high enough to do much damage to the fruit. The early blight usually goes right into the fruit and causes spoilage there, but that was not a key factor this year. We did conclude that Copper spray helped control Septoria and that compost tea spray did not.
3. Stressed out plants (those receiving no spray) produced 27% more fruit than the copper spray through August, but then dropped off in September, when the copper spray plants did 18% better than no spray. The theory we came up with is that the stressed out plants (those with no spray) focused on fruit production early. Eventually, their plant health declined and they could not produce fruit in high numbers. By contrast, the copper spray plants were not stressed out early and thus focused on building plant health rather than fruit. If the season had gone on another two or three weeks, the copper spray plants would have increased their relative yield gain significantly. Surprisingly, compost tea spray had the highest yield overall (2nd place in August, 1st place in September and 1st place overall yield). Why? All we can imagine is that the compost acted to fertilize the plants enough to keep them producing in September, but did not suppress diseases enough to stress them a bit and encourage early fruit production as well. Would the same results ensue if we had no problems with early blight? We do not know. Perhaps our choice of varieties or the weather were primarily responsible for that factor.

### Conclusions on Trellis

1. Through August, trellised plants produced about 38% more fruit.
2. By the end of the season, total yield had dropped to 10% less than non-trellised plants.

REASONS: See above cultural systems number 4 reasons (1) and (2).

### Conclusions on Mulch

1. Mulching plants was significantly better at first in producing more fruit. However, the percentage of gain dropped steadily from 60 to 30 to 22 to 16 to 6 to 2 percent better as the season progressed.
2. Timeliness of the rain could have been a major factor in that the mulch helped the early tomatoes size up bigger. If rain had not occurred in large enough amounts, then mulch could play a major role in keeping the supply of large fruit continuing throughout the season.
3. Thus, clearly irrigation is a major factor. If you have irrigation, then mulch is less important, except as a system to keep the fruit clean and keep the weeds down.

# Spray conditions



NO SPRAY	COPPER	<b>COMPOST TEA</b>
<b>COMPOST TEA</b>	NO SPRAY	COPPER
COPPER	<b>COMPOST TEA</b>	NO SPRAY

1. No mulch/No trellis	_____▶▶
2. No mulch/Yes trellis	_____▶▶
3. Yes mulch/No trellis	_____▶▶
4. Yes mulch/Yes trellis	_____▶▶
1. No mulch/No trellis	_____▶▶
2. No mulch/Yes trellis	_____▶▶
3. Yes mulch/No trellis	_____▶▶
4. Yes mulch/Yes trellis	_____▶▶
1. No mulch/No trellis	_____▶▶
2. No mulch/Yes trellis	_____▶▶
3. Yes mulch/No trellis	_____▶▶
4. Yes mulch/Yes trellis	_____▶▶

# Growing Conditions

# Green Truck Farm

(POUNDS OF NO. 1  
TOMATOES HARVESTED)

Old County Road South  
Francestown, NH 03043

(603) 547-2127

CATEGORY	thru							% comparison
	8/16	8/23	8/31	9/4	9/10	9/17	9/21	
1	26	90	330	484	527	816	1132	1.00
2	34	123	428	659	794	981	1250	1.10
3	33	110	378	559	745	1003	1403	1.32
4	63	165	551	767	895	1003	1137	1.00
MULCH	96	275	928	1325	1639	1906	2440	1.02
NO MULCH	60	213	758	1143	1421	1797	2382	1.00
TRELLIS	97	288	978	1425	1688	1884	2287	1.00 (.9)
NO TRELLIS	59	200	708	1043	1372	1819	2535	1.11 (1.0)
NO SPRAY	59	173	618	853	1027	1239	1540	1.00
COMPOST	48	156	581	826	1071	1246	1706	1.11
COPPER	49	159	487	779	952	1218	1576	1.02
TOTALS	156	488	1686	2468	3060	3703	4822	

Category 1 no mulch, no trellis  
 2 no mulch, trellis  
 3 mulch, no trellis  
 4 mulch, trellis



Tomato  
Harvest

**Green Truck Farm**  
**Old County Road South**  
**Francestown, NH 03043**  
**(603) 547-2127**

Category	# plants	total lbs.	lbs/plant
1	148	1132	7.6
2	225	1250	5.6
3	145	1403	9.7
4	216	1137	5.3

	total row ft.	total lbs.	lbs/100 ft.	lbs/Acre
1	400	1132	283	18,961
2	400	1250	313	20,971
3	400	1403	351	23,517
4	400	1137	284	19,028

	# plants	total rowft	plant/100 ft.	plants/Acre
1	148	400	37	2479
2	225	400	56	3752
3	145	400	36	2412
4	216	400	54	3618

	# plants	total <del>row ft.</del> lbs.	<del>plants/100 ft.</del> LBS/PLANT	LBS/ACRE
NO SPRAY	245	1540	6.3	19,396
COMPOST	245	1706	7.0	21,473
COPPER	245	1576	6.4	19,832

category 1 no mulch no trellis  
 2 no mulch yes trellis  
 3 yes mulch no trellis  
 4 yes mulch yes trellis

TOMATO  
HARVEST

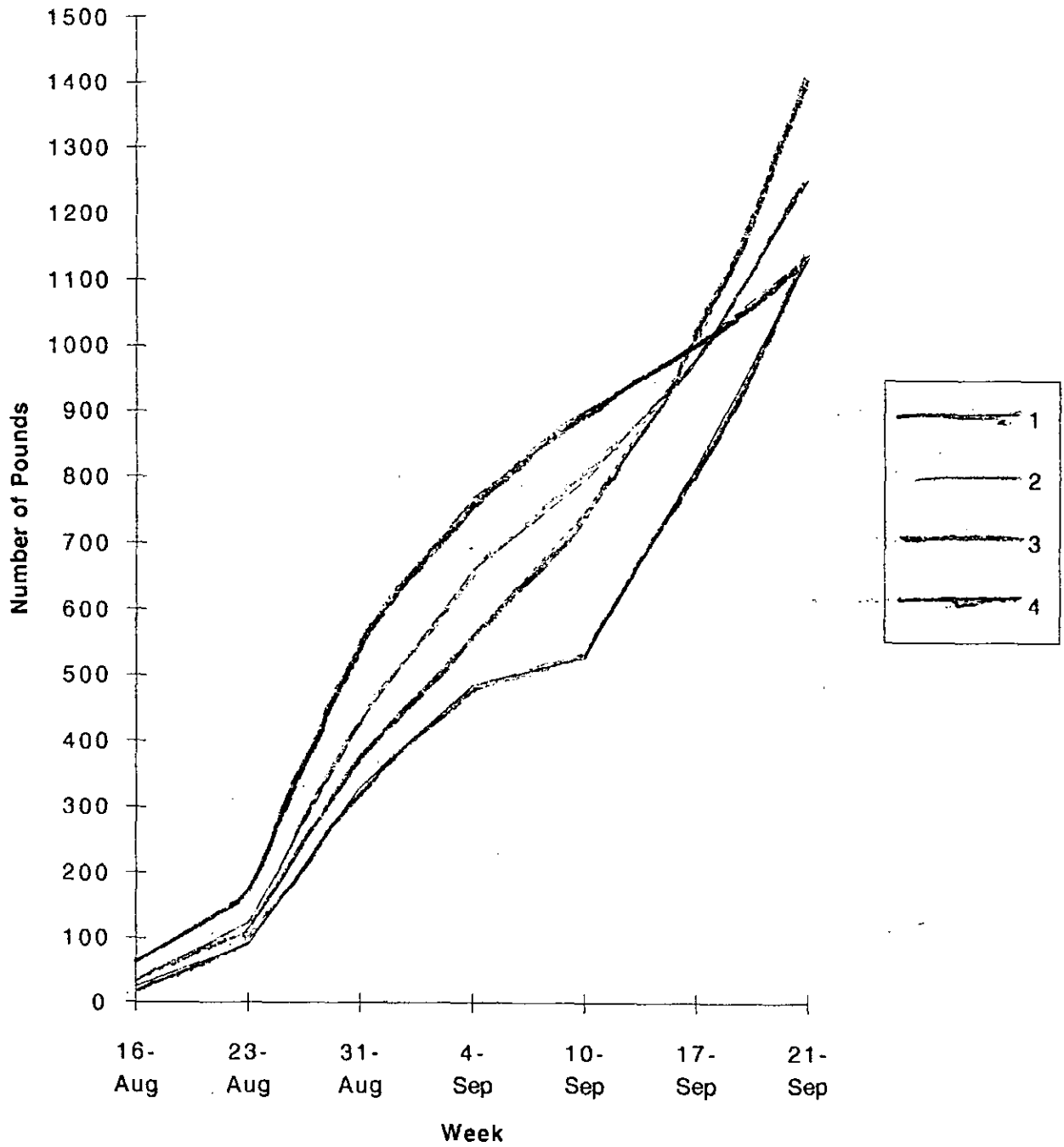
**Green Truck Farm**  
**Old County Road South**  
**Francestown, NH 03043**  
**(603) 547-2127**

SPRAY TYPE	CATEGORY	TOTAL LBS.	ROW FT.	LBS/100 FT.	LBS/ACRE	COMPARISON %
NO SPRAY	1	408	133	307	20,569	1.36
	2	374	133	281	18,827	1.24
	3	416	133	313	20,971	1.38
	4	342	133	257	17,219	1.14
COMPOST	1	390	133	293	19,631	1.30
	2	478	133	359	24,053	1.59
	3	537	133	404	27,068	1.78
	4	301	133	226	15,142	1.00
COPPER	1	334	133	251	16,817	1.11
	2	398	133	299	20,033	1.32
	3	450	133	338	22,646	1.50
	4	394	133	296	19,832	1.31

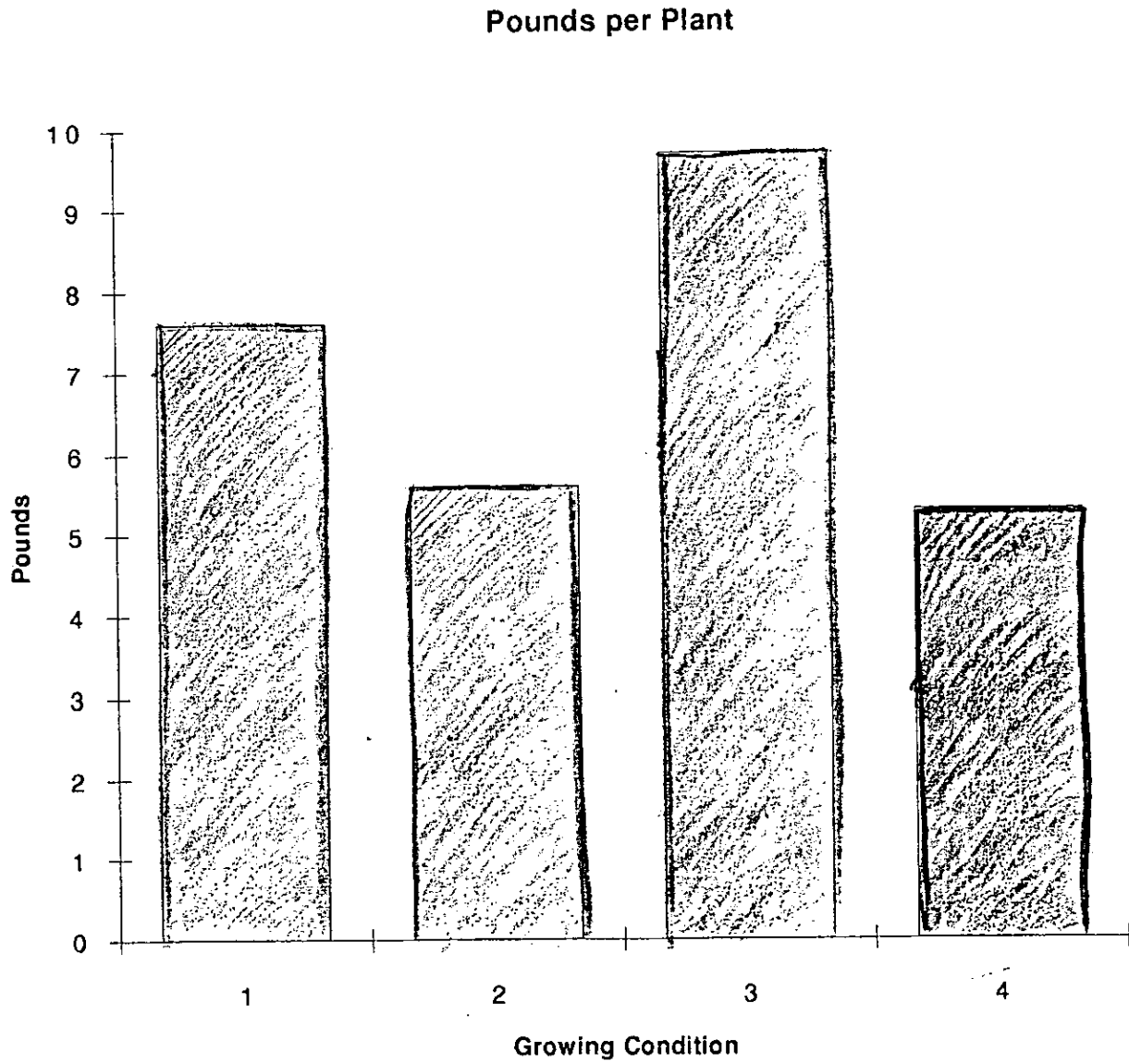
Note: in each spray type, category 3 was the highest yield — indicating consistency.

category 1 no mulch no trellis  
 2 no mulch yes trellis  
 3 yes mulch no trellis  
 4 yes mulch yes trellis

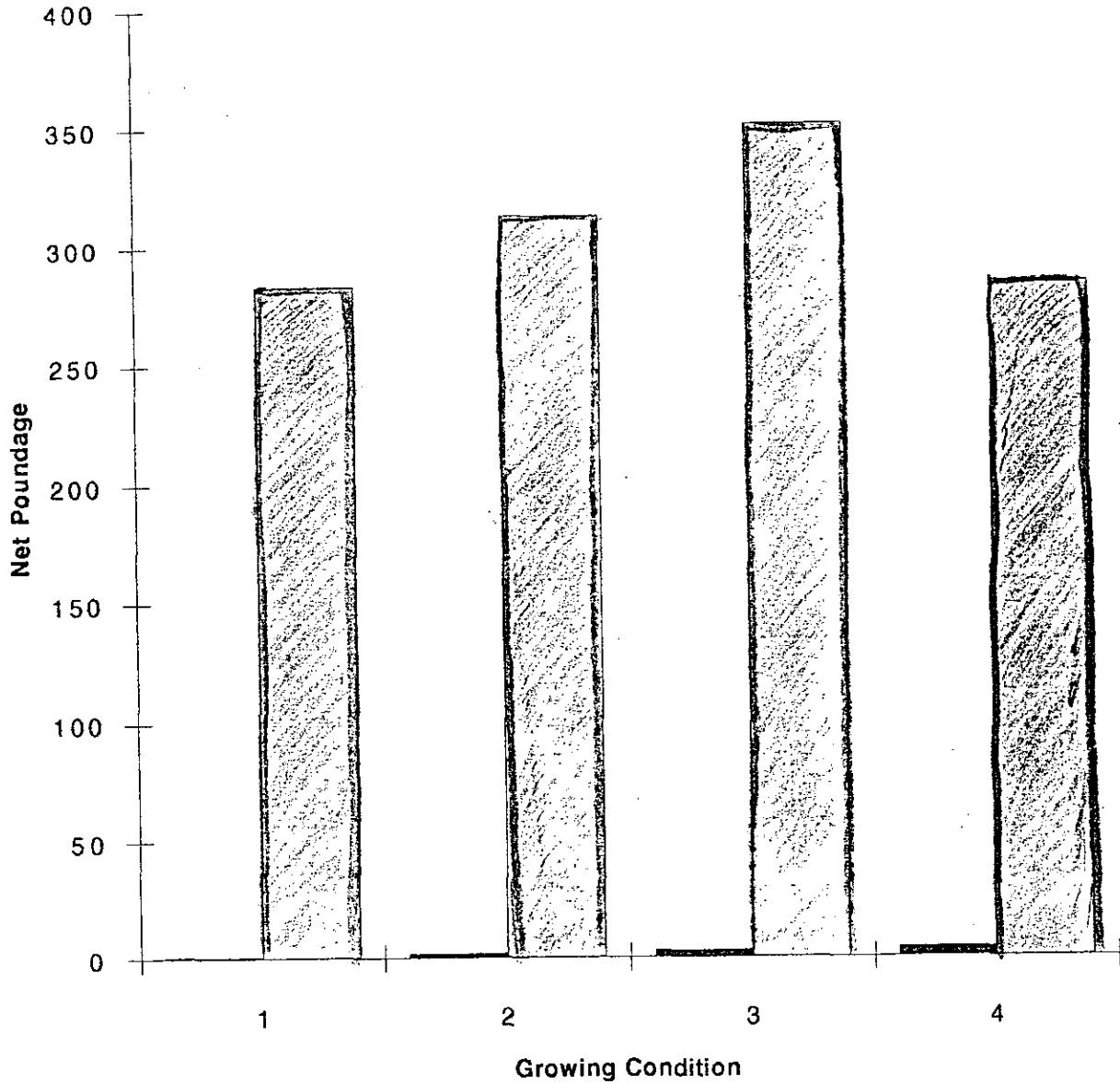
Cumulative by Condition (Weekly)



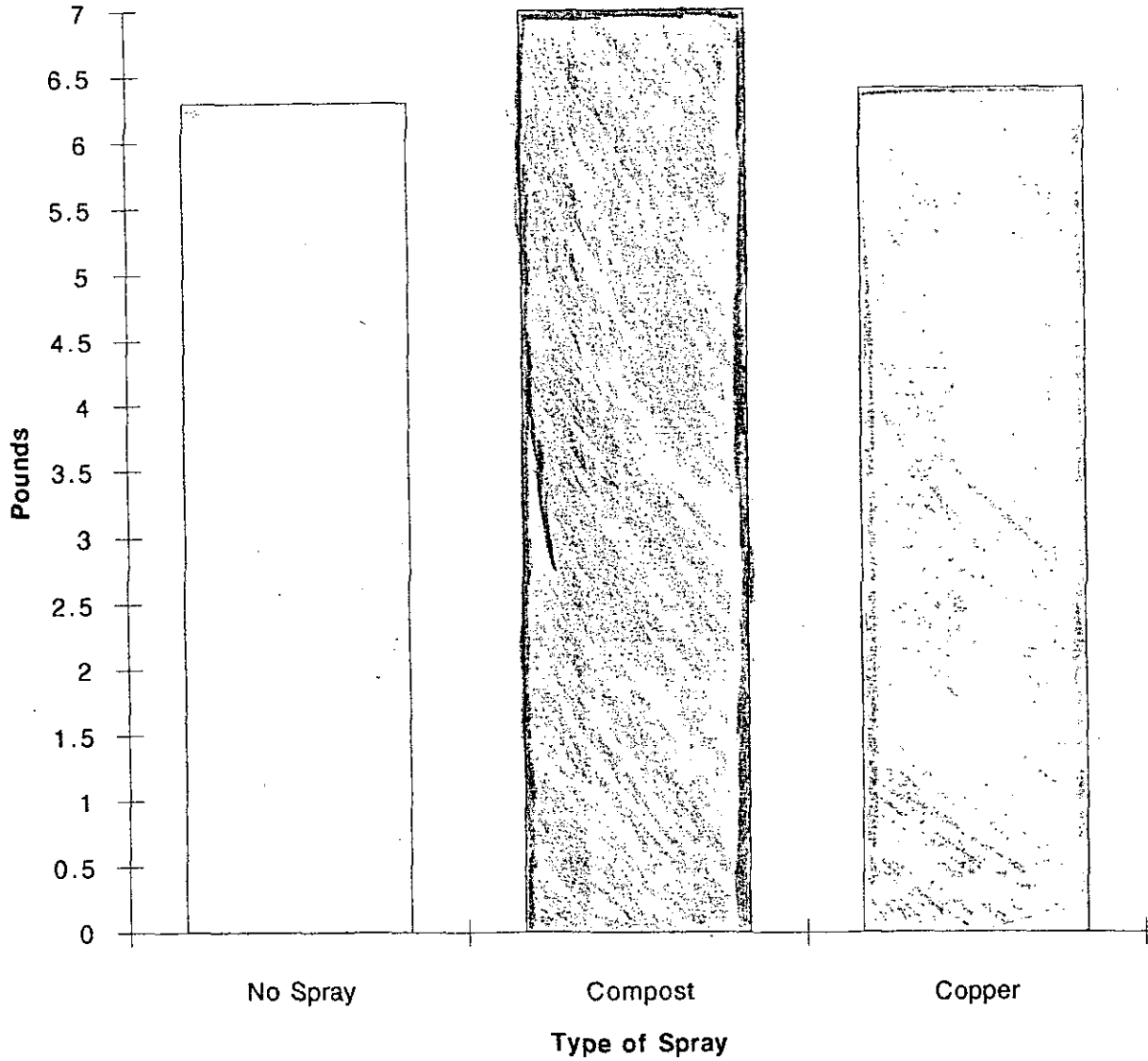
Pounds per Plant Chart 1



Pounds per 100 Feet



Pounds per Plant by Spray



Pounds per 100' by Spray and Growing Condition

