

EFFECT OF PLANT PROTECTORS ON TOMATOES, PEPPERS,  
AND MUSKMELONS AT REDMOND, OREGON IN 1986

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ABSTRACT

Wallo'Waters<sup>2</sup> (WoW) were evaluated on tomatoes (cv. Santiam), peppers (cv. Sweet Banana), and cantaloupe (cv. Burpee's Sweet'n Early Hybrid). Transplants of tomatoes and peppers and seed of cantaloupe were placed in WoW on April 25, May 15, and June 5 for comparison with non-protected plants and seeds planted June 6. WoW protected plants from a low air temperature of 18° F. No ripe tomatoes were obtained from non-protected frost damaged plants. Ripe tomato yield was greatest from plants set April 25 and May 15. Weight of peppers at the August 20 harvest for plants set in WoW on May 15 was significantly higher than the non-protected control. The total number and weight of peppers for the same comparison were also significant. Seedling emergence and establishment of muskmelons were poor under WoW so the purposes of treatment replication were not achieved. Further research needs to be conducted to determine the most effective way to use the Wallo'water protectors.

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INTRODUCTION

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Low air and soil temperatures with a short growing season seriously limit production of warm season vegetables in central Oregon. Area gardeners have used various kinds of materials and devices for frost protection and growth regulation. In recent years several commercial products have become available. One of these is the 6 mil clear polyethylene plastic cylinders which when filled with water are sufficiently rigid for free-standing. These structures, called Wallo'Waters (WoW) surround the plant for protection against frost and improvement of soil and air temperature. WoW have been previously described in Special Report 747

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2 Wallo'Waters is registered trademark of TerraCopia, Inc. ACKNOWLEDGMENTS: The able assistance of many Deschutes County Master Gardeners under direction of Ann McDonald made the study possible. Their names appear in Appendix I. They may be contacted for information on gardening in the area.

(1). They were observed to provide excellent frost protection of tomato plants and improved early yield. Therefore, tests with replicated treatments to document these findings were conducted at Redmond in 1986. Besides tomatoes, peppers and muskmelon were chosen for evaluation in the Wallo'Waters.

## MATERIALS AND METHODS

All experiments were established on a sandy loam soil at the Redmond site of the Central Oregon Experiment Station. Three-hundred twelve pounds per acre of 27-12-0 was broadcast on the field in the spring and incorporated during seedbed preparation. Tomato (cv. Santiam) and pepper (cv. Sweet Banana) transplants and seed of cantaloupe (cv. Burpee's Sweet'n Early Hybrid) were placed in WoW on April 25, May 15, and June 5. These three dates of planting plus June 6 for plants and seeds not in WoW comprised the four treatments that were replicated four times in a randomized complete block design. Each vegetable was handled as a separate experiment. The WoW were set up a week in advance of planting into them so soil could be warmed. The cylinders of each WoW were filled with water about two-thirds full so the structure formed a tepee, the top being closed to give maximum protection and retention of heat within each unit. Tops of WoW were kept closed until plants could no longer be contained. Two stakes were placed inside each WoW when tops were opened to help support the plant top growth and prevent WoW collapse. All WoW were left on the plants throughout the season. Weeds were controlled by hand inside and outside the WoW as needed. On June 13, a light application of ammonium nitrate and muriate of potash was made around all plants and shallowly incorporated. Another similar application was made on July 7.

Only one tomato and pepper transplant in a WoW comprised a treatment of one replication in each experiment. Three-four muskmelon seeds were planted in each WoW. Plants were hand-watered when necessary.

Tomatoes were picked, counted, and weighed on the dates shown in Table 1. On September 15, tomato plants were pruned and gently enclosed within the WoW from which the stakes were removed. Tops of all WoW were closed for maximum protection. All green fruit from the control and branches that could not be inserted inside the WoW were picked on September 15.

Peppers were picked several times throughout the season when the fruit was yellow.

Cantaloupe vines were trained over the sides of the WoW when sufficient growth had occurred.

Data were analyzed statistically and significant differences determined at the five percent probability level.

## RESULTS AND DISCUSSION

Tomatoes. Wallo'Waters prevented death to tomato plants. The unprotected plants (controls) were severely damaged and/or killed by several frosts. Consequently, no ripe fruit were obtained (Table 1). Perhaps ripe fruit from non-protected plants may have been produced if control plants had been replaced with aged transplants. However, some green fruit were produced for the control treatment. A good comparison of WoW with non-protected plants was not achieved.

There was no significant difference among WoW treatments for total yield (green plus ripe fruit). Transplants set April 25 in WoW gave the highest production of early tomatoes. For all harvest dates, the greatest yield of ripe tomatoes occurred from plants set April 25 and May 15. Therefore, the data suggest that setting transplants in WoW on April 25 can promote earlier harvest but plants in WoW on May 15 is sufficiently early to obtain a maximum yield of ripe tomatoes.

Peppers. No significant differences occurred among treatments for number of fruit harvested on any date but for total fruit harvested transplants set in WoW May 15 had more fruit than the unprotected plants (Table 2). Weight of fruit from August 20 harvest was significantly higher for plants set in WoW May 15 than non-protected plants. The total yield for the same treatment comparison was also significant. Further research is necessary to validate this finding.

Muskmelons. Germination was poor in the WoW. The soil seemed to dry fairly quickly under the protectors, evidently because of the elevated soil temperature. There may have been too little water entering the WoW from the sprinkler. When WoW are closed, hand watering is necessary. There did not appear to be sufficient movement of soil water into soil covered by WoW. Plants may have suffered from high temperature, and low moisture stress.

All of the fruit was immature and from two to four inches in diameter. Table 3 shows the number and weight of fruit produced.

Data were not analyzed statistically but it appears that the non-protected plants were more productive. It was difficult to train the vines over the WoW edges.

Table 4 gives the daily maximum and minimum air temperatures and heat units per day inside and outside the WoW. Heat units are temperature-time values expressed in degree days. They are calculated by subtracting the base temperature (minimum temperature for growth) from the average daily temperature. Base temperatures of 40 and 50°F are usually used as the minimum temperatures for growth of cool and warm season vegetables, respectively. Accumulated daily heat units for varieties may be used for comparisons of relative maturity or time required from planting to harvest for some vegetables, such as peas and sweet corn. The increase in number of heat units inside the WoW is shown in Table 5.

#### REFERENCE

1. Nelson, J.L., R. Brevig, and M. Young. 1985. Response of vegetables to floating row covers and plant protectors in Central Oregon. In Irrigated Crops Research in Central Oregon 1985. Oregon Agricultural Experiment Station. Special Report 747. pp. 82-86.

APPENDIX I

List of Master Gardeners who worked on the Garden Research in 1986.

<u>Name</u>	<u>Address</u>	<u>Phone No.</u>
Anne McDonald	560 S.W. 35th Redmond, OR 97756	548-4952
Laurie Lefors	18460 Couch Mkt. Road Bend, OR 97701	382-7705
Clay/Patsy Vincent	63910 Quail Haven Dr. Bend, OR 97701	382-4580
Donna Cotton	20781 St. George Ct. Bend, OR 97702	389-5321
Jeanne Beaver	65280 85th Pl. Bend, OR 97701	382-0230
Jim Volking	1315 N.W. Ithica Bend, OR 97701	382-2592
Dick Uffelman	61135 Ladera Rd. Bend, OR 97702	382-5910
Glenda Swope	65336 73rd St. Bend, OR 97701	382-3669
Tom Gamm	4990 N.E. O'Neill Redmond, OR 97756	548-5277
June Nicholas	4563 S.W. 58th Redmond, OR 97756	548-1544
Carol Ulett	154 N.E. Franklin Bend, OR 97701	382-1821
James Powell	105 S. 12th Redmond, OR 97756	548-6588
Vernon Patrick	P.O. Box 517 Redmond, OR 97756	548-4283

Table 1. Production of tomatoes (cv. Santiam) from protected and non-protected plants at Redmond, Oregon, 1986

Treatment <sup>1</sup>	Ripe fruit						Green fruit			Total yield	
	Early harvest <sup>2</sup>			All harvests <sup>3</sup>			No.	Wt. (kg)	Wt./ fruit (gm)	No.	Wt. (kg)
	No.	Wt. (kg)	Wt./ fruit (gm)	No.	Wt. (kg)	Wt./ fruit (gm)					
P - 4/25	18	1.5	84.0	50	3.5	71.3	10	.4	50.2	60	3.8
P - 5/15	8	.7	93.2	43	3.4	79.0	12	.5	39.9	55	3.8
P - 6/5	3	.3	78.0	23	2.0	89.5	21	1.2	48.6	44	3.1
NP - 6/6	0	---	----	0	---	----	23	1.7	54.4	23	1.7
LSD (5%)	8	.9	81.8	15	1.0	13.4	20	1.4	34.2	26	1.6

1 Treatment: P = transplants protected with clear polyethylene water-filled cylinders.

NP = non-protected plants (control).

4/25, 5/15, 6/5, 6/6 = month/day transplants set.

2 Early Harvest: total number and weight of ripe fruit picked on August 13 and 20.

3 All Harvests: Included ripe fruit picked August 13 and 20 plus August 25, 28, September 3, 10 and 15.

Table 2. Effect of Wallo'Water plant protectors on peppers at Redmond, Oregon, 1986

Treatment <sup>1</sup>	Number and weight of fruit harvested													
	Aug. 13		Aug. 20		Aug. 28		Sept. 3		Sept. 10		Sept. 22		Total	
	No.	Wt. (gm)	No.	Wt. (gm)	No.	Wt. (gm)	No.	Wt. (gm)	No.	Wt. (gm)	No.	Wt. (gm)	No.	Wt. (gm)
P - 4/25	7	161.1	14	253.8	10	148.3	8	120.7	14	192.9	12	78.0	63	954.8
P - 5/15	6	165.5	16	304.3	12	155.9	7	91.8	16	211.7	20	107.3	77	1036.5
P - 6/5	5	131.5	7	130.6	4	61.4	4	52.9	8	110.1	12	101.3	40	587.7
NP - 6/6	2	33.1	7	100.8	3	56.1	4	65.5	7	91.7	11	62.3	33	409.5
LSD (5%)	6	158.6	10	179.5	11	164.2	7	99.9	10	151.6	15	118.5	37	564.2

<sup>1</sup> Treatment: P = transplants protected with clear polyethylene water-filled cylinders.  
 NP = non-protected plants (control).  
 4/25, 5/15, 6/5, 6/6 = month/day transplants set.

Table 3. Effect of Wallo'Waters on number and weight of muskmelon at Redmond, Oregon, 1986

Treatment <sup>1</sup>	Number and weight of fruit September 22								Total		Wt./ Fruit (gm)
	Rep. I		Rep. II		Rep. III		Rep. IV		No.	Wt. (gm)	
	No.	Wt. (gm)	No.	Wt. (gm)	No.	Wt. (gm)	No.	Wt. (gm)			
P - 4/25	6	862.4	5	1159.9	0	0	0	0	11	2022.3	183.8
P - 5/15	5	1529.4	0	0	0	0	0	0	5	1529.4	305.9
P - 6/5	0	0	0	0	3	1802.4	2	793.1	5	2595.5	519.1
NP - 6/6	6	2139.7	3	1096.9	4	2193.4	4	705.6	17	6135.6	360.9

<sup>1</sup> Treatment: P = transplants protected with clear polyethylene water-filled cylinders.  
 NP = non-protected plants (control).  
 4/25, 5/15, 6/5, 6/6 = month/day transplants set.

Table 4. Daily air temperatures and heat units outside and inside Wallo'Waters at Redmond, Oregon, 1986

Month	Day	Outside WoW <sup>1</sup>			Inside WoW <sup>2</sup>		
		Max.	Min.	50°F degree days	Max.	Min.	50°F degree days
		-----°F-----			-----°F-----		
April	26	48	22	0	93	33	13
	27	55	42	0	101	42	21.5
	28	58	26	0	98	32	15
	29	53	31	0	101	32	16.5
	30	50	18	0	95	32	13.5
May	1	59	28	0	110	32	21
	2	73	40	6.5	89	42	15.5
	3	54	37	0	90	39	14.5
	4	52	21	0	94	32	13
	5	54	37	0	62	46	4
	6	46	28	0	89	32	10.5
	7	53	25	0	100	32	16
	8	56	25	0	100	32	16
	9	60	28	0	95	32	13.5
	10	56	32	0	88	32	10
	11	44	23	0	94	32	13
	12	53	26	0	102	32	17
	13	65	42	3.5	95	46	20.5
	14	57	23	0	108	32	20
	15	61	35	0	104	40	22

1 Outside WoW: air temperature measured five feet above soil.

2 Inside WoW: air temperature measured 12 inches above soil near center of WoW.

Table 5. Effect of Wallo'Water (WoW) on air temperatures for the two periods at Redmond, Oregon, 1986

Treatment	Period	Heat units <sup>1</sup>		Mean air temperature <sup>2</sup>			
		40°F Base degree days	50°F Base degree days	Max.	Min.	Mean	
		-----°F-----			-----°F-----		
No WoW	4/26-5/15	74	10	55.4	29.5	42.5	
	5/16-6/5	458	268	78.1	45.2	61.7	
WoW	4/26-5/15	506	306	95.4	35.2	65.3	
	5/16-6/5	809	599	108.0	49.0	78.5	

1 Heat Units =  $\frac{\text{Max.} + \text{Min.}}{2}$  - base temperature

2 Air temperature: for outside WoW was from the weather station where thermometer is enclosed in protective shelter five feet above ground. Temperature was taken about 12 inches above soil near the center of the WoW.