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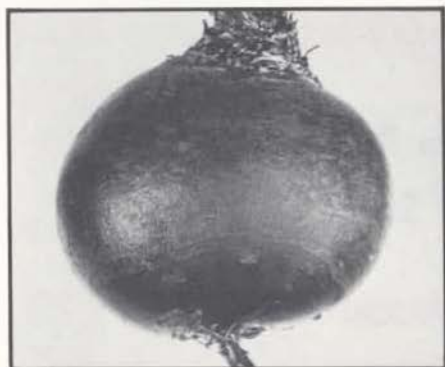


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**PARMA RED GLOBE**  
**PARMA GIANT**

New Curly Top Resistant  
Table Beets and Swiss Chard



W. R. SIMPSON

IDAHO Agricultural  
Experiment Station

Bulletin No. 451  
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**New Curly Top Resistant  
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**W. R. SIMPSON**

Curly top is one of the most destructive diseases affecting beets in southern Idaho (4,5). Wide fluctuations in sugar beet production which occurred in the intermountain area between 1920 and 1930 were caused by severe outbreaks of curly top. Sugar beet varieties which are resistant to injury by the virus complex (1,2) are now in use but, until now, no resistant varieties of red table beet or Swiss chard have been available. Many home gardeners in southern Idaho do not attempt to grow red table beets or Swiss chard because of curly top. Commercial plantings by canners and processors in southwest Idaho have failed because of losses caused by curly top.

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**BREEDING FOR VIRUS RESISTANCE**

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The University of Idaho began investigations of the beet virus problems in the early 1950s. All commercial red table beet and Swiss chard varieties tested were found susceptible. The use of genetically resistant material offered the only feasible solution to the problem. A breeding program in beets was established utilizing the backcross method to incorporate the curly top disease re-

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sistance already present in sugar beets. Sugar beet varieties used in the program included SL 92 (a curly top resistant selection from US 22/3) and SL 9090. Table beet varieties used in these crosses included Detroit Dark Red, Green Top Bunching, Crosby Egyptian and Perfected Detroit Red. The Lucullus variety of chard was included in the work. The  $F_1$  hybrids were found to be intermediate in character of the two parental lines. The  $F_1$ s are completely susceptible to curly top under conditions of severe disease exposure, although under moderate exposure they appear to have intermediate resistance. This generation exhibited hybrid vigor and under moderate exposure to curly top produced good yields.

$F_2$  populations grown under exposure to curly top provided opportunity to select for quality and vigor, as well as curly top resistance. Resistance to curly top in the breeding lines was improved if the early generation material was selected for vigor under severe curly top exposure. The percentage of the population carrying a high degree of curly top resistance varied, depending on the parent. Beet plants in hybrid populations showing dominant resistance to curly top under a mild curly top exposure reacted differently under a severe exposure to the disease (Table I). This was especially true with some of the Crosby Egyptian crosses. On the other hand, selfed selections of Detroit Dark Red and Green Top Bunching from  $F_2$  populations under severe curly top exposure will yield between 75 and 95 percent resistant lines.

**Table I. CURLY TOP REACTION OF  $F_2$  BEET HYBRIDS OBTAINED FROM RESISTANT X SUSCEPTIBLE PARENTS**

Variety or line	No. of plants in each curly top grade <sup>1</sup>								
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
SL 92 resistant (control)	14	54	14	10					
R & G 300 susceptible (control)						5	10	40	32
Detroit D. Red x SL 92	2	3	1	6	27				
Gr. Top Bunching x SL 92	1	6	5	9	17	6			
Crosby Egyptian x SL 92					4	7	29	9	
Perfected Detroit x SL 92		1	7	4	14	14	1		
Lucullus chard x SL 92	1	3	14	14	10	2			
Detroit D. Red x SL 9090		1	4	3	7	14	3		
Perfected Detroit x SL 9090			3	3	11	17	4	1	

<sup>1</sup>Curly top grades established as follows:

1. Plants showing very few symptoms or were not injured.
2. Plants showing slight leaf curling.
3. Plants showing pronounced curling and some dwarfing.
4. Plants showing pronounced curling and dwarfing.
5. Plants showing near death or death from the disease.

## PEDIGREE

Selections from crosses with parental lines of Detroit Dark Red, Green Top Bunching and Swiss chard were saved for further selections. These were backcrossed 3 times to their respective table beet parents and were re-selected for 5 generations under curly top exposure. These tests were concluded under field conditions at Parma and Jerome, Idaho (Tables II, III).

**Table II. PERCENTAGE OF BEET AND CHARD PLANTS REMAINING HEALTHY AFTER EXPOSURE TO NATURAL CURLY TOP INFECTION IN EXPERIMENTAL PLOTS AT THE PARMA BRANCH EXPERIMENT STATION, PARMA, IDAHO**

Variety or line	Replicated test (4x) Years				
	1960	1961	1962	1963	1964
<b>Table beets</b>					
Detroit Dark Red	.05	1.04	3.33	.50	0.00
Green Top Bunching	8.50	3.05	3.73	1.50	0.00
Crosby Egyptian	0.00	0.00	-----	-----	0.00
Asgrow Wonder	2.10	0.00	-----	-----	-----
Morse Detroit	1.05	1.56	-----	1.00	0.00
Ohio Canner	.04	0.00	-----	-----	-----
Gardeners Model	-----	-----	-----	-----	18.48
Flat Egyptian	1.50	0.00	-----	-----	-----
Harris Detroit Dark Red	-----	-----	-----	-----	0.00
Perfected Detroit	2.01	3.05	4.80	2.00	3.52
13 (89)	70.00	78.00	93.11	80.00	88.26
19 (88)	97.50	94.60	82.62	92.55	95.82
<b>Swiss chard</b>					
Lucullus	4.20	5.50	18.20	20.00	8.70
3-4 (78)	41.10	47.50	57.40	72.00	78.00
<b>Sugar beets</b>					
R & G 300 (old type)	0.00	1.25	-----	0.00	0.00
US 33	32.07	36.50	-----	-----	24.00
US 56	48.00	56.00	-----	-----	-----
SL 92	79.50	89.11	82.61	92.00	82.20
SL 9090	81.20	87.00	83.11	94.00	88.12

Commercial susceptible varieties (Tables II, III) were eliminated by the disease under severe exposure. Curly top disease was not severe at Jerome in 1963. Crosses with SL 92 carried a higher level of curly top resistance than the SL 9090 progeny.

Lines 3-4, 13 and 19 were sampled for quality in 1964, and were found acceptable for processing and canning. All three lines had good production records in the Parma trials (Table IV). The

**Table III. PERCENTAGE OF BEET AND CHARD PLANTS REMAINING HEALTHY AFTER EXPOSURE TO NATURAL CURLY TOP INFECTION IN EXPERIMENTAL PLOTS AT JEROME, IDAHO**

Variety or line	Replicated test (4x)				
	1960	1961	Years		1964
			1962	1963	
<b>Table beets</b>					
Detroit Dark Red	0.00	1.15	4.50	62.50	2.50
Green Top Bunching	0.01	4.25	5.50	65.25	1.15
Perfected Detroit	0.00	0.05	1.50	-----	-----
Harris Detroit Dark Red	-----	-----	-----	-----	0.01
Gardeners Model	-----	-----	-----	-----	12.25
13 (89)	68.82	72.84	84.66	93.50	84.45
19 (88)	82.75	86.35	80.80	97.80	84.72
<b>Swiss chard</b>					
Lucullus	5.75	4.20	7.18	72.80	4.15
3-4 (78)	47.75	37.29	62.25	84.00	80.05
<b>Sugar beets</b>					
R & G 300 (old type)	1.00	1.75	3.25	78.25	4.50
US 33	27.25	33.75	24.00	72.00	30.00
US 56	48.00	55.55	47.25	88.00	56.25
SL 92	86.45	86.75	88.18	96.45	85.50
SL 9090	84.78	88.60	91.78	98.25	87.65

figures in Table IV indicate the necessity for curly top resistance for satisfactory beet yields in southern Idaho. Commercial susceptible varieties used for comparison in these trials were severely damaged by curly top. The breeding lines will be hereafter designated as follows: beet line 13 as **Parma Globe**, beet line 19 as **Parma Red Globe**, chard line 3-4 as **Parma Giant**—and released for commercial use in southern Idaho.

**Table IV. AVERAGE YIELD COMPUTED IN TONS PER ACRE OF TABLE BEET AND SWISS CHARD GROWN UNDER CURLY TOP EXPOSURE AT THE PARMA BRANCH AGRICULTURAL EXPERIMENT STATION, PARMA, IDAHO**

Variety or line <sup>1</sup>	Replicated test plot (4x) <sup>2</sup>				
	1961	1962	1963	1964	Average
Detroit Dark Red	3.64	5.11	6.37	5.53	5.16
Green Top Bunching	4.97	5.53	5.70	5.07	5.31
Morse Detroit	4.69	4.44	5.28	4.34	4.68
Swiss chard <sup>2</sup>	3.92	4.20	5.70	3.99	4.45
Parma Giant	9.24	12.87	11.95	10.59	11.16
Parma Globe	20.17	24.73	23.27	22.54	22.67
Parma Red Globe	21.20	26.90	23.01	22.09	23.30

<sup>1</sup>Curly top was severe in all commercial table beet plantings.

<sup>2</sup>Foliage weight was recorded for the yield of chard.

<sup>3</sup>Two-row bed plantings 30 feet long.

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## DESCRIPTION OF PARMA RED GLOBE

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Early to midseason in maturity with the majority of roots 2-2½ inches in diameter in 55-65 days from the date of emergence from the soil as a spring planted crop in Idaho. The plant is 12-15 inches high by the time the root reaches 2-2½ inches in diameter. The plant averages 12-14 leaves which comprise 50 percent of the total plant fresh weight. Leaves when young are typically light green but later darken to a reddish purple. They are ovate to elliptical in shape and rounded to a slightly tapered base. The average diameter at the base of the neck varies from 1 to 1½ inches. The roots are shallow-globe to globe in shape by the time they reach 2-3 inches in diameter. The root has a small to medium tap root with a few fibrous side roots usually limited to the lower section of the root. Skin color of the beet root is a dark purplish red to maroon red and the freshly cut flesh is dark red and uniformly colored. In cross section the root is nearly circular in outline with the 10-12 rather indistinct zones.

Figure 1. Parma Red Globe

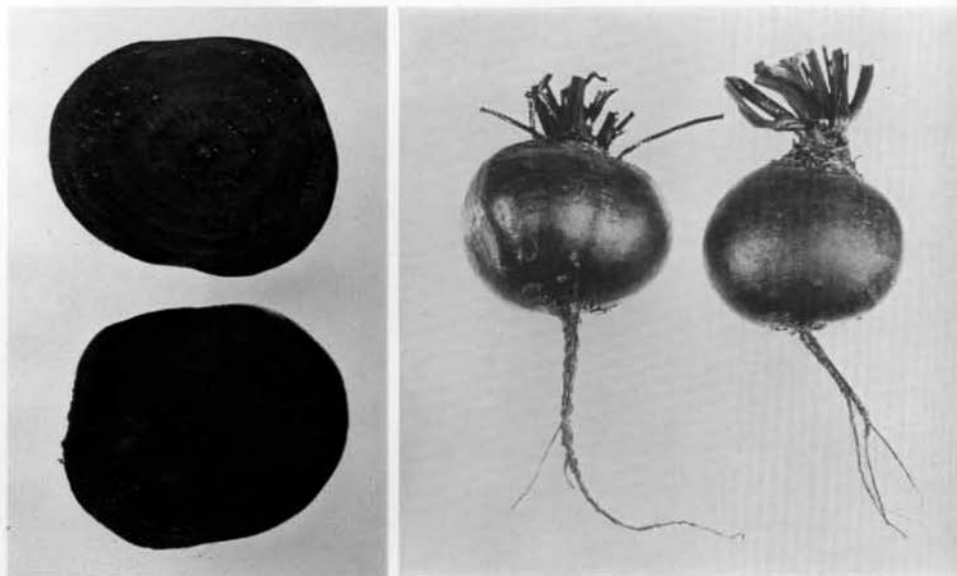
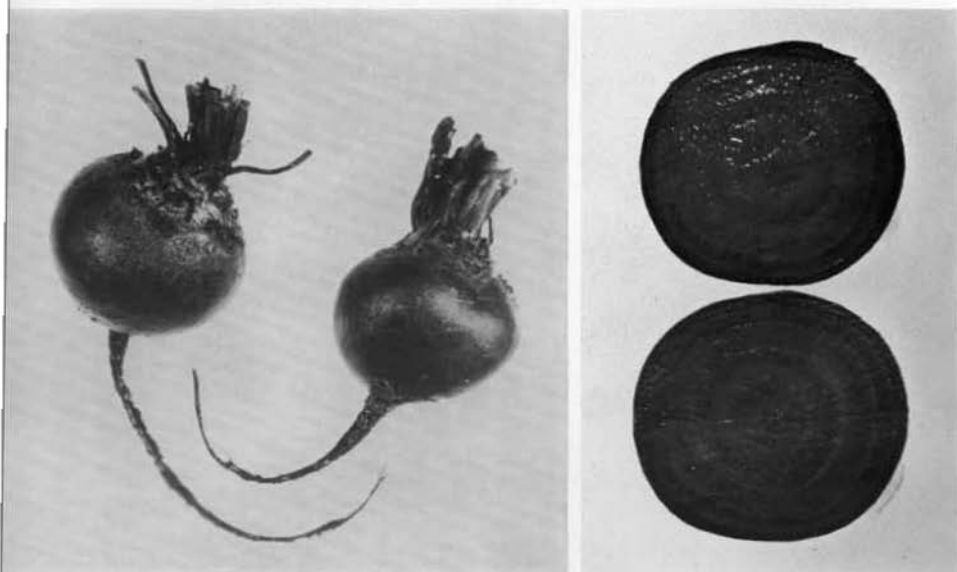


Figure 2. Parma Globe



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### DESCRIPTION OF PARMA GLOBE

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The Parma Globe is midseason in maturity, just slightly later than Detroit Dark Red, and reaches 2-2½ inches in diameter in 65-70 days from the date of emergence from the soil as a spring planted crop in Idaho. The plant is 10-12 inches high by the time the root reaches 2-2½ inches in diameter. The plant averages 10-12 leaves which comprise 40 percent of the total plant fresh weight. Young leaves are green but later darken and turn red. The leaves are ovate to elliptical in shape, rounded to a slightly pointed tip; slightly tapered base; midrib slightly curved downward; sides of the leaf flat or slightly ascending, undulate to wavy or crinkled margin. The red petioles are 4-6 inches in length. The average diameter at the base of the neck varies from ¾ to 1¼ inches. The roots are round in shape (globe) by the time they reach 2-2½ inches in diameter. The small tap root has a few fibrous roots limited mostly to the lower sections of the root. The skin color of the beet root is purplish red to red. In cross section the root is approximately circular in outline and contains 10-14 zones which are distinguishable, but uniformly colored.



Figure 3. Parma Giant

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### DESCRIPTION OF PARMA GIANT

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This vigorous chard line reaches maturity in about 60 days in southwestern Idaho. The succulent, tender leaves are medium dark green, large and smooth to slightly crumpled. The petioles are of medium length, broad and white. Its crisp leaves make it good in fresh salads and for use as a potherb.

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