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Studies with PICKLING CUCUMBERS *in Alabama*

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Studies with PICKLING CUCUMBERS *in Alabama*

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OVER 2,000 Alabama farmers in 22 communities located in 10 counties produced cucumbers for pickling in 1949, with acreage averaging 1¾ acres per grower.

In the South yields of cucumbers for pickles have been lowest of any section of the United States, ranging from 65 to 80 bushels per acre. Yield range in the Northeastern States has been 90 to 120 bushels, while that of the Northwestern States has been 160 to 200 bushels. Highest production in the country has been in California where yields have ranged from 280 to 300 bushels per acre.

PURPOSE AND SCOPE OF STUDY

The two primary objectives of this study were to determine ways by which yield may be increased economically and how high quality in the processed product may be maintained. The study was also intended to obtain information on growth and fruiting habits of the cucumber, and on production costs. To accomplish these objectives, studies were undertaken: (1) to compare a number of newer varieties with older varieties; (2) to determine effects of soil fumigants, plant spacing, fertilizer rates, organic materials, and irrigation on yield and value of the crop; (3) to determine labor requirements and costs of producing and harvesting; and (4) to obtain some information on growth and fruiting characteristics of the plant.

GENERAL METHODS

The studies were started in 1949 and were continued through 1951. Studies of varieties and of nitrogen rates were conducted in field plots 1/65 acre in size with four replications, while those of soil fumigation, spacing, fertilizers, organic materials, and irrigation were conducted in field bins of 1/320 acre each. The soil was composited among all bins and within each bin. Treatments in field bins, except where noted, were replicated four times.

The brining studies were conducted in vats of a commercial processor.[1] Ratings for brining quality were given by representatives of a commercial pickle company, the Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, United States Department of Agriculture; and the Agricultural Experiment Station of the Alabama Polytechnic Institute.[2]

Cucumbers were harvested three times weekly. They were graded, counted and weighed, and samples were taken for pressure tests and brining studies.

The experiments were conducted on a light sandy loam Chesterfield soil of low to medium fertility.

In calculating values, the prices offered by the company at the brining vats in 1950 and 1951 were used – namely: $100 per ton for No. 1's, $40 for No. 2's, $15 for No. 3's, and $5 for culls. Number 1 size included cucumbers 18/16 inch in diameter and below; No. 2 size included those from 19/16 to 26/16 inch; and No. 3 size, those 27/16 inch and above. In grading cucumbers, quality factors as well as size factors were observed.

Further details on specific methods are given in connection with each phase of study.

PRESENTATION OF RESULTS

Growth and Fruiting Characteristics

The studies on growth and fruiting characteristics were designed only to provide certain simple but basic information of importance to growers and processors.

[1] W&W Pickle Company, Montgomery, Alabama.

[2] Ratings were given by W. T. Wells, W&W Pickle Company; J. H. Etchells, U. S. Department of Agriculture; and Hubert Harris, A.P.I. Agricultural Experiment Station.

Data included days from planting to harvest, days of harvest, percentage set of fruit, growth rate of fruit, number of fruits per unit weight for different grade sizes, days from bloom to sizes corresponding to No. 1's, No. 2's, and No. 3's, and percentages of fruits meeting the requirements of different grades. The Packer variety was used principally in these studies, although limited observations were made on other varieties.

Days from Planting to Harvest and Days of Harvest. The planting dates and inclusive harvest dates for the several phases of the study are given in Table 1. The number of days from

Table 1. Planting Dates, Days from Planting to First Harvest, and Length of Harvest Season, All Series, 1949-51

Year[1]	Dates			Number days	
	Planted	Of first harvest	Of last harvest	To first harvest	Of harvest
1949	April 4	June 1	July 8	58	38
1950	April 10	May 31	June 30	51	31
1951	April 10	June 4	July 18	55	45

[1] Magnolia variety was used in 1949; Packer variety was used in 1950 and 1951.

planting to the first harvest date ranged from 51 to 58 days, and the number of days of harvest ranged from 31 to 45 days.

Percentage Set of Fruits. Records of the percentage set of fruits were obtained on a summer crop and on a fall crop. Results are given in Tables 2 and 3.

At two periods in the studies, female blooms were tagged the day they opened. These were examined and measured daily until the fruits reached No. 3 size and were harvested, or until they dropped. Only one bloom was tagged per branch; harvesting of other fruits continued normally. Of 55 blooms tagged, 34 or 62 per cent set fruit; however, only 26 or 47 per cent reached No. 3 pickling size.

In the fall study, all blooms were tagged and all cucumbers left on vines until they reached the lower size range of No. 3 grade. A total of 266 female buds was recorded in this study, of which 195, or 73.3 per cent, reached bloom stage. Of the 195 blooms, 130 or 66.7 per cent reached 10/16-inch diameter or No. 1 size; 116 or 59.5 per cent reached 19/16-inch diameter or No. 2 size; and 112 or 57.4 per cent reached 27/16-inch diameter or No. 3 size.

TABLE 2. NUMBER OF CUCUMBERS REACHING DIFFERENT GRADE SIZES BY GIVEN DAYS FROM BLOOM[1], PACKER VARIETY, JUNE 7-22 AND JUNE 22-JULY 2, 1951

Days from bloom	Number reaching different grade sizes by days[2]			
	Less than No. 1 size	No. 1 size	No. 2 size	No. 3 size
0	26	0	0	0
1	24	2	0	0
2	18	6	2	0
3	17	1	1	2
4	9	8	4	1
5	6	3	3	4
6	4	2	7	3
7	3	1	2	6
8	2	1	2	2
9	0	2	1	3
10	0	0	2	1
11	0	0	0	2
12	0	0	2	0
13	0	0	0	2

[1] There were 55 blooms tagged; 34 set fruit and 26 fruits reached No. 3 size. Only one cucumber per branch was tagged; others were harvested regularly.
[2] Sizes were as follows: No. 1 size from 10/16 to 18/16 inch; No. 2 size from 19/16 inch to 26/16 inch; No. 3 size 27/16 inch or above.

TABLE 3. NUMBER AND PERCENTAGE OF CUCUMBERS REACHING DIFFERENT GRADE SIZES BY DAYS FROM BLOOM, PACKER VARIETY, SEPTEMBER 17-OCTOBER 8, 1951

Days from bloom	Percentage reaching different grade sizes each day[1]					
	No. 1 size		No. 2 size		No. 3 size	
	No.	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
2	1	0.8	0	0.0	0	0.0
3	3	2.3	0	.0	0	.0
4	20	15.4	1	.9	0	.0
5	34	26.2	2	1.7	1	.9
6	12	9.2	8	6.9	0	.0
7	11	8.5	25	21.6	2	1.8
8-11	9.5	7.3	12.5	10.8	18	16.0
12-15	1.5	1.2	6	5.2	6	5.4
16-19	.7	.6	1.0	.9	2.5	2.2
20+	.5	.4	.5	.4	.75	.7
TOTAL NUMBER	130		116		112	

[1] Sizes were as follows: No. 1's ranged from 10/16 to 18/16 inch in diameter; No. 2's, from 19/16 to 26/16 inch; No. 3's, 27/16 inch and above.

RATE OF GROWTH OF INDIVIDUAL FRUITS. In Figure 1 are shown typical sizes of fruits from 1 to 10 days old, and also 10-day-old cucumbers. It is obvious that there is no uniformity in the rate of growth of individual fruits. Although all were the same age, the fruits shown in the lower part of Figure 1 ranged from No. 1 size to No. 3 size.

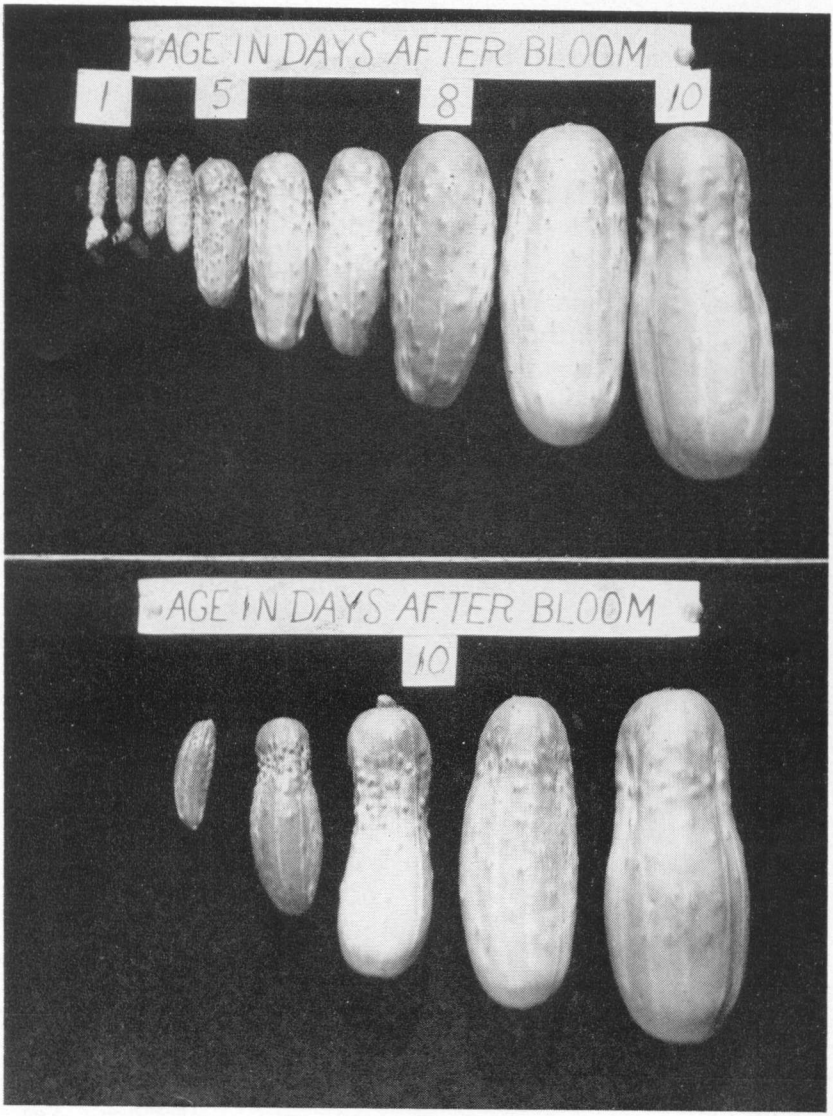

FIGURE 1. Upper: Typical sizes of cucumbers from 1 to 10 days from bloom. Lower: Sizes of cucumbers all 10 days from bloom.

The data in Table 2 show the numbers of cucumbers reaching the three grade sizes by days for the summer crop. Two fruits had reached No. 1 size 1 day after bloom, No. 2 size 2 days after bloom, and No. 3 size 3 days after bloom. In contrast, it was 9 days after bloom before the last two fruits had reached No. 1

size, 12 days before they had reached No. 2 size, and 13 days before they had reached No. 3 size.

Records for the fall period are given in Table 3. There were 130 fruits under observation. The average length of time from bloom to No. 1 size was 7.48 days; to No. 2 size, 10.25 days; and to No. 3 size, 11.79 days. An average of 2.77 days was required for a No. 1 size cucumber to reach a No. 2 size and 1.54 days for a No. 2 size to reach a No. 3 size.

There were considerable differences among individual cucumbers in the length of time from bloom to the No. 3 size. For the fall crop, 18.5 per cent of the cucumbers reached No. 1 size through the 4th day from bloom, 62.4 per cent through the 7th day, and 91.6 per cent through the 11th day. There were 9.5 per cent reaching No. 2 size through the 6th day, 31.1 per cent through the 7th day, 74.3 per cent through the 11th day, and 95.1 per cent through the 15th day. Reaching No. 3 size were 2.7 per cent through the 7th day, 66.7 per cent through the 11th day, and 88.3 per cent through the 15th day.

NUMBER OF FRUITS BY GRADE SIZES. Records were kept of the number and weight of fruits in each grade in several experiments. Results are given in Table 4. The average number of fruits per 100 pounds, for example, for the Packer in the fertilizer, organic, and irrigation study was 2,000 for the No. 1 size, 700 for the No. 2 size, and 231 for the No. 3 size. It, therefore, required 2.86 cucumbers of size No. 1 to give the same weight as one

TABLE 4. NUMBER OF CUCUMBERS PER 100 POUNDS IN DIFFERENT GRADE SIZES FOR DIFFERENT VARIETIES, 1950[1]

Varieties	Cucumbers per 100 lb.			Ratio		
	No. 1's	No. 2's	No. 3's	1's to 2's	1's to 3's	2's to 3's
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
Packer	2,070	617	214	3.35	9.67	2.88
Model	1,960	621	256	3.16	7.66	2.43
Producer	2,162	720	288	3.00	7.51	2.50
Earliest of All	1,696	587	218	2.89	7.78	2.69
Ohio 31	2,014	632	294	3.19	6.85	2.15
Magnolia	1,920	651	248	2.95	7.74	2.63
National Association Pickling	1,936	631	234	3.07	8.27	2.70
Improved National Pickling	1,830	637	243	2.87	7.53	2.62
Packer[2]	2,000	700	231	2.86	8.66	3.03

[1] Records are for one full season from variety series.

[2] Records are from fertilizer, manure, and irrigation series.

No. 2 cucumber; it required 8.66 No. 1's to give the same weight as one No. 3 and 3.03 No. 2's to give the same weight as one No. 3.

Analysis of the data in the table reveals much from a practical viewpoint in respect to returns from cucumbers harvested at different sizes. Since the prices paid per 100 pounds were $5 for No. 1 size, $2 for No. 2 size, and $0.75 for No. 3 size, the value per cucumber of the Packer variety was 0.250 cent for No. 1's, 0.286 cent for No. 2's, and 0.325 cent for No. 3's. Thus 88 per cent as much was paid per cucumber for No. 1 as for No. 2 size, or 77 per cent as much per cucumber for No. 1 as for No. 3 size. The price paid per cucumber for No. 2 size was 88 per cent of that for No. 3 size. To get $5, therefore, a farmer at the foregoing prices would have to pick and deliver 2,000 No. 1 size fruits weighing 100 pounds, or 1,750 No. 2 size fruits weighing 250 pounds, or 1,540 No. 3 size fruits weighing 667 pounds.

Varieties

The variety studies included replicated tests and observational studies. There were 15 varieties in the replicated test in 1949 (Figure 2), 8 in 1950 (Figure 3), and 6 in 1951. In the obser-

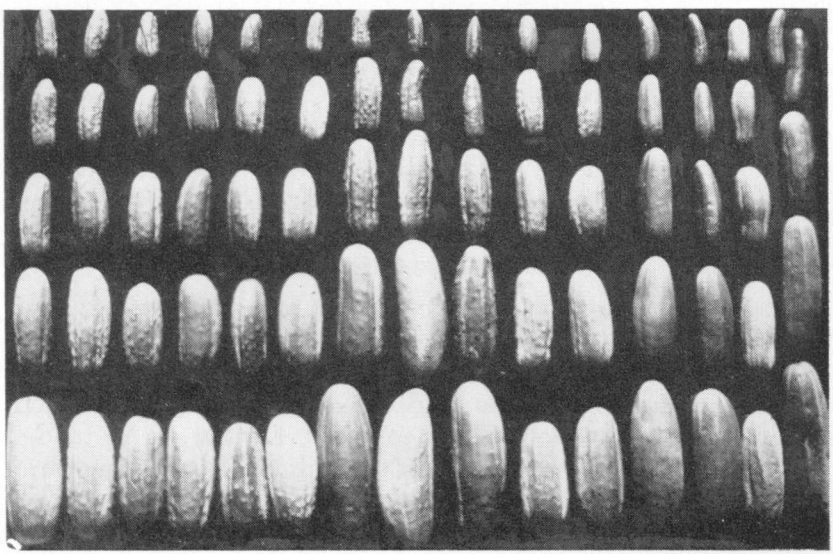

FIGURE 2. Varieties from left to right are Magnolia, National Association Pickling, Snow's Perfection Pickling, Packer, Model, Producer, Chicago Pickling, Earliest of All, Black Diamond, Ohio 31, Improved National, Robin 40, Robin 20, Pickling "G" and Hickmore.

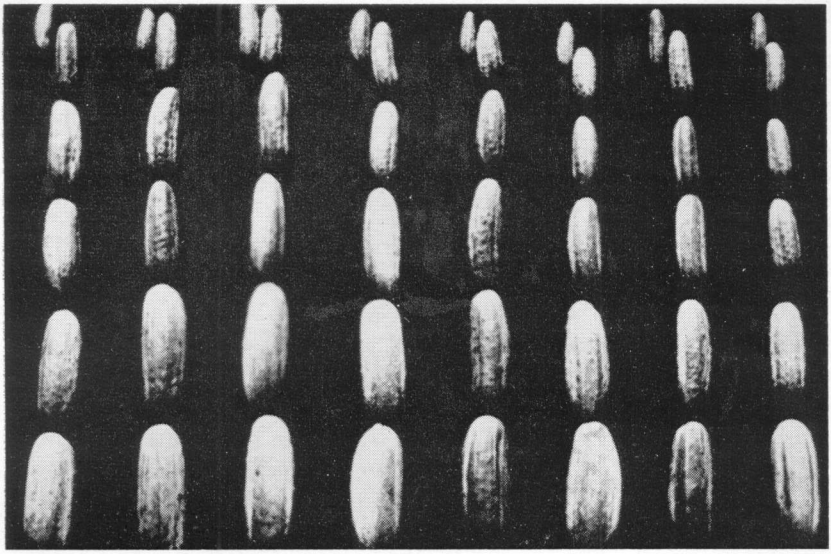

FIGURE 3. Varieties from left to right are Improved National, National Association Pickling, Magnolia, Ohio 31, Earliest of All, Producer, Model, and Packer.

vational plantings, there were 8 strains in 1949 and 7 varieties in 1950.

After 1949, seven of the varieties in the yield test were discontinued because the cucumbers did not conform to the type required by the processors.

In Table 5 are given the yields by years of all 8 varieties, average yields of the 6 varieties on test for 3 years, and average yields of the 8 varieties in a 2-year test. In Table 6 are given the total yield by weeks of the different varieties. The data show relative earliness of the varieties.

Plants of the eight varieties compared were considered to be vigorous enough for good production. However, there were characteristic differences in plant growth of the different varieties. Also there appeared to be decided differences in the bloom behavior of some varieties. For example, Earliest of All tended to make stronger vines, and fewer and larger blooms than varieties developed in other sections primarily for the production of cucumbers for pickling purposes.

Breeding strains and varieties grown for observational purposes consisted of SC6, SC6F, Mincu, Early Michigan 517FF, A.C. 617-EE, M.S.C.-DD, one unnamed, Pickling A, Davis Blend,

TABLE 5. YIELDS BY GRADES AND BY YEARS AND AVERAGE YIELDS OF DIFFERENT CUCUMBER VARIETIES

Variety	Grade	Yields per acre by grades				
		1949	1950	1951	Av. 1949-50	Av. 1949-51
		Tons	*Tons*	*Tons*	*Tons*	*Tons*
Model	No. 1's	1.560	.780	--	1.170	--
	No. 2's	1.809	2.764	--	2.287	--
	No. 3's	1.643	1.546	--	1.595	--
	Culls	.337	1.582	--	.959	--
	Total	5.349	6.672	--	6.011	--
Producer	No. 1's	1.876	1.115	--	1.496	--
	No. 2's	1.825	3.115	--	2.470	--
	No. 3's	.936	.991	--	.963	--
	Culls	.366	2.096	--	1.231	--
	Total	5.003	7.317	--	6.160	--
Earliest of All	No. 1's	1.286	.657	.489	.972	.811
	No. 2's	1.456	1.955	.842	1.706	1.417
	No. 3's	2.117	1.455	2.332	1.786	1.968
	Culls	.572	2.035	2.709	1.303	1.772
	Total	5.431	6.102	6.372	5.767	5.968
Improved National Pickling	No. 1's	1.404	.662	.444	1.033	.837
	No. 2's	1.814	2.085	.902	1.950	1.600
	No. 3's	1.910	1.517	1.981	1.714	1.803
	Culls	.803	1.616	1.446	1.209	1.288
	Total	5.931	5.880	4.773	5.906	5.528
Magnolia	No. 1's	1.274	.925	.652	1.099	.950
	No. 2's	1.636	2.686	1.221	2.161	1.848
	No. 3's	1.211	1.462	2.294	1.337	1.656
	Culls	.493	2.403	1.921	1.448	1.605
	Total	4.614	7.476	6.088	6.045	6.059
National Association Pickling	No. 1's	1.387	.656	.612	1.022	.885
	No. 2's	1.862	2.083	1.262	1.972	1.736
	No. 3's	1.728	1.831	2.567	1.780	2.042
	Culls	.552	2.074	2.589	1.313	1.738
	Total	5.529	6.644	7.030	6.087	6.401
Ohio 31	No. 1's	1.591	.647	.637	1.119	.958
	No. 2's	1.750	2.256	1.262	2.003	1.756
	No. 3's	2.238	1.213	2.553	1.726	2.001
	Culls	.721	1.969	2.256	1.345	1.649
	Total	6.300	6.085	6.708	6.193	6.364
Packer	No. 1's	1.050	.500	.675	.775	.742
	No. 2's	1.732	1.774	1.375	1.753	1.627
	No. 3's	3.442	1.666	4.440	2.554	3.183
	Culls	.836	2.099	2.781	1.468	1.905
	Total	7.060	6.039	9.271	6.550	7.457
Least significant difference for total yields at			.05 level .01 level		1.285 1.572	1.772 2.520

Black Diamond, Brice Special, York State, Double Yield, and Brice. Some of these were definitely slicing types. None appeared to possess enough promising qualities for pickling to replace any of the varieties already included in the replicated test.

Summarized results with the various variety experiments, including the judgment of the technical and field forces of the pickle company, indicate that of all varieties studied Earliest of All, Model, and Packer are most likely to supply grades and qualities best suited for pickling purposes.

TABLE 6. TOTAL YIELDS[1] BY WEEKS OF DIFFERENT CUCUMBER VARIETIES, 1949-50

Variety	Yield per acre by weeks						
	1	2	3	4	5	6	Total
	Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
Earliest of All	.185	.710	1.837	1.670	1.005	.360	5.767
Improved National Pickling	.334	.754	1.854	1.714	.948	.302	5.906
Magnolia	.601	1.023	1.795	1.646	.760	.220	6.045
Model	.518	1.034	1.765	1.640	.790	.264	6.011
National Association Pickling	.329	.834	1.855	1.872	.894	.303	6.087
Ohio 31	.409	.824	1.746	1.845	1.126	.243	6.193
Packer	.144	.620	1.700	2.334	1.307	.445	6.550
Producer	.661	1.145	1.692	1.722	.744	.196	6.160

[1] Includes No. 1's. No. 2's, No. 3's, and culls.

EFFECTS OF SOIL FUMIGATION

Soil fumigation studies were started in 1949 and were continued for 3 years. The treatments consisted of a check, a row treatment, and solid treatment. Ethylene dibromide was used as the fumigant. The material was applied at the rate of 1.5 cc. per foot. In the row treatment, the material was applied in rows 3 feet apart, while the solid treatment was applied in rows 1 foot apart. The fumigant was applied in 1949 and 1951, but was omitted in 1950.

In Table 7 are given the yields by grades for each of the 3 years. Average yields and percentage yields by grades and the average gross values at established prices are given for the 3 years under alternate-year treatments. The cost of the row treat-

TABLE 7. YIELDS BY GRADES, BY YEARS, AND AVERAGE YIELD AND VALUE FROM SOIL FUMIGATION WITH ETHYLENE DIBROMIDE, 1949-51

Soil treatment[1]	Grade	Yields per acre by grades				Av. percentage		Av. value per acre[2]
		1949	1950	1951	Average	of 1's, 2's&3's	of total	
		Tons	*Tons*	*Tons*	*Tons*	*Pct.*	*Pct.*	*Dollars*
None	1's	1.515	.382	.904	.934	22	12	93
	2's	1.005	1.715	1.259	1.326	31	17	53
	3's	.486	2.984	2.664	2.045	47	27	31
	Culls	.379	4.745	5.044	3.389		44	17
	Total	3.385	9.826	9.871	7.694	100	100	194
Row	1's	2.731	.515	1.046	1.431	23	14	143
	2's	2.565	2.137	1.635	2.112	34	20	85
	3's	1.171	3.409	3.403	2.661	43	26	40
	Culls	1.478	5.338	5.634	4.150		40	21
	Total	7.945	11.399	11.718	10.354	100	100	289
Solid	1's	2.117	.494	1.203	1.271	23	14	127
	2's	2.032	1.837	1.530	1.799	33	20	72
	3's	1.160	2.894	3.097	2.384	44	26	36
	Culls	.422	4.995	5.875	3.751		40	19
	Total	5.731	10.180	11.705	9.205	100	100	254
Least significant difference for total yields at				.05 level	1.958			53
				.01 level	3.248			88

[1] Row treatment consisted of application of 1.5 cc. of ethylene dibromide per foot per 3-foot row; solid treatment consisted of 1.5 cc. per foot in 1-foot rows. Treatments were applied in 1949 and in 1951.

[2] Listed are prices received: $100 per ton for No. 1's, $40 for No. 2's, $15 for No. 3's, and $5 for culls.

ment was approximately $18 per acre per year and for the solid treatment, approximately $54.

Yield increases in 1949 from row fumigation over no treatment were: No. 1's, 1.216 tons; No. 2's, 1.516 tons; and No. 3's, .685 ton. In 1950, without further treatment, yields of the No. 1's were .133 ton per acre higher on the treated than on the untreated plots; No. 2's, .422 ton higher; and No. 3's, .425 ton higher. In 1951, after the second treatment, yields of No. 1's were .142 ton higher on treated than on untreated plots; yields of No. 2's were .376 ton higher; and of the No. 3's .739 ton higher. Increases were not as high for the solid as for the row treatments.

For the 3 years, the average increase in gross value of the row treatment over no treatment was $95 and of the solid treatment over the no treatment, $60.

There was very little difference in the percentage yield in the three grades resulting from the treatments.

Effects of Spacing on Yield, Grade, and Value

Results of spacing studies are given in Table 8. Spacings in the row consisted of 12 inches, 24 inches, and 36 inches. Rows were 3 feet apart. Each spacing was compared with and without irrigation. All plots were fertilized with 800 pounds of 8-8-4 fertilizer and 6 tons of stable manure per acre.

Differences in yield from different spacings were not pronounced; this was true with and without irrigation. The total yields were a little higher at the 12-inch spacing than at the 24- or 36-inch spacing. It may be seen, however, that the differences in total yield were largely due to differences in the yield of culls. Combined yields of 1's and 2's were about the same for each spacing. Without irrigation, there was a difference in value of $32 per acre in favor of the 12-inch spacing over the 36-inch spacing, but very little difference was obtained with irrigation. The differences were not significant.

Table 8. Yields, Grades, and Value of Cucumbers from Different Spacings With and Without Irrigation, Packer Variety, 1950-51

Treatments[1]		Yields per acre by grades					Value per acre
Irrigation per week[2]	Spacing	No. 1's	No. 2's	No. 3's	Culls	Total	
Inches	*Inches*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Dollars*
0	12	1.775	3.527	6.238	7.083	18.623	448
0	24	1.549	3.331	6.681	5.865	17.426	418
0	36	1.627	3.262	6.432	5.311	16.632	416
1	12	2.322	4.985	8.948	8.837	25.092	610
1	24	2.346	4.671	9.054	7.329	23.400	593
1	36	2.586	4.859	8.565	6.724	22.734	615
Least significant difference at			.05 level			2.194	54
			.01 level			2.925	72

[1] Standard treatments for plots consisted of 6 tons of animal manure applied in February and 800 pounds of an 8-8-4 fertilizer per acre to the crop. All soil was treated with ethylene dibromide for nematode control.

[2] Irrigation consisted of 7 applications in 1950 and 5 in 1951, each equivalent to 1 inch of rainfall.

Effects and Value of Fertilizers, Organic Materials, and Irrigation

The effects and value of fertilizers and organic materials were studied in two series, while the effects of irrigation were studied in a single series. In the first series, the effects of fertilizer rates

and organic materials used alone and in combinations were measured. In the second, the effects of fertilizers, organic materials, and irrigation each used alone and in different combinations were determined.

First Series. The first series was conducted on a soil that had been used since 1938 in a soil-improvement study involving truck crops. Cucumbers were grown 3 years. There was practically a complete failure the first year. The second and third years, the soil was treated with ethylene dibromide, principally for nematodes. Yields were good the second year and better the third year. Treatments used, and resulting yields and values are given in Table 9.

With no organic materials added, the average gross value per acre of the crop with no fertilizer was only $2. The gross value of the increased yield from the first 400 pounds of fertilizer was $165 per acre; from the second 400 pounds, $37; and from the third 400 pounds, $38.

Table 9. Average Yields by Grades and Total Value of Cucumbers from Use of Manures and Different Rates of Fertilizer, 1950-51

Treatments[1]			Yields by grades per acre					Average gross value per acre of total[4]
Fertilizer, 8-8-4 per acre[2]	Manures[3]							
	Kind	Per acre	No. 1's	No. 2's	No. 3's	Culls	Total	
Pounds		*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Dollars*
0	0	0	.002	.006	.008	.253	.269	2
400	0	0	.470	1.026	4.282	2.986	8.764	167
800	0	0	.772	1.850	2.133	4.170	8.925	204
1,200	0	0	.930	2.013	2.983	4.738	10.664	242
800	Animal	6	1.337	2.563	4.409	6.586	14.895	335
1,200	Animal	6	1.322	2.994	4.252	6.764	15.332	350
1,200	Animal	12	1.436	2.769	4.855	6.885	15.945	362
800	Vetch	6	.879	1.776	2.536	4.178	9.369	218
1,200	Vetch	6	.849	1.831	2.623	4.033	9.336	218
Least significant difference at			.05 level				.995	22
			.01 level				1.205	27

[1] All plots were treated with ethylene dibromide for nematode control.

[2] Fertilizer was applied as 6-8-4, one-half 1 week before planting and one-half 3 weeks after planting; nitrate of soda equivalent to 2 per cent nitrogen was applied 6 weeks after planting.

[3] Vetch was grown on a separate area and introduced.

[4] Listed are prices received: $100 per ton for No. 1's, $40 for No. 2's, $15 for No. 3's, and $5 for culls.

Six tons of animal manure increased the gross value $131 per acre at the 800-pound fertilizer rate and $108 at the 1,200-pound rate. An increase in gross value of only $12 per acre resulted from increasing the manure from 6 to 12 tons at the 1,200-pound fertilizer rate. No increased value resulted from turning vetch at either the 800- or 1,200-pound fertilizer rates.

SECOND SERIES. In the second series, there were three rates of fertilizer used, each with and without animal manure and irrigation. All plots were treated with ethylene dibromide before the experiment was started. The study was conducted in field bins. Treatments and results are given in Table 10.

The gross value of the crop was increased $102 by increasing the fertilizer from 400 to 800 pounds per acre. A decrease in gross value resulted from increasing the rate from 800 to 1,200 pounds per acre. However, where irrigation was added, increasing the fertilizer rate from 400 to 800 pounds per acre gave a gross value gain of $188, and increasing the rate from 800 to 1,200 pounds resulted in a value increase of $75. After 6 tons of animal manure had been added, increasing the fertilizer rate from 400 to 800 pounds per acre gave no increase without irrigation but gave $73 increase in gross value with irrigation. Increasing the rate from 800 to 1,200 pounds per acre resulted in value increases of $25 without irrigation and $109 with irrigation.

The gross value of the increased yield from 6 tons of manure per acre at the 400-pound fertilizer rate was $127 without irrigation and $214 with irrigation; at the 800-pound fertilizer rate, the increased values from manure were $25 without irrigation and $99 with irrigation; and at the 1,200-pound rate, $78 without and $133 with irrigation.

The gross value of the increased yield from irrigation was higher with each higher fertilizer rate both without and with the addition of manure. Furthermore, the increases were in all instances higher at the same fertilizer rate with manure than without it. The value of the increased yield from irrigation without manure was $16 at the 400-pound rate, $102 at the 800-pound fertilizer rate, and $205 at the 1,200-pound rate. With manure added the gross value of the increased yield from irrigation was $103 at the 400-pound rate, $176 at the 800-pound rate, and $260 at the 1,200-pound rate.

TABLE 10. AVERAGE YIELDS BY GRADES AND TOTAL VALUE OF CUCUMBERS FROM USE OF ANIMAL MANURE, IRRIGATION, AND DIFFERENT FERTILIZER RATES, PACKER VARIETY, 1950-51

Treatments[1]			Yields by grades per acre						Gross returns per acre all grades[4]
Fertilizer, 8-8-4 per acre[2]	Animal manure	Irrigation per week[3]	No. 1's	No. 2's	No. 3's	Culls	No. 1's, 2's & 3's	Total	
Pounds	*Tons*	*Inch*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*	*Dollars*
400	0	0	1.104	2.373	3.986	5.248	7.463	12.711	291
800	0	0	1.438	3.184	6.121	5.996	10.743	16.739	393
1,200	0	0	1.328	3.141	5.378	5.167	9.847	15.014	365
400	6	0	1.695	3.272	5.991	5.578	10.958	16.537	418
800	6	0	1.549	3.331	6.681	5.865	11.561	17.426	418
1,200	6	0	1.697	3.453	7.145	5.683	12.295	17.978	443
400	0	1	1.078	2.606	4.558	5.409	8.242	13.651	307
800	0	1	1.948	3.978	7.231	6.617	13.157	19.774	495
1,200	0	1	2.168	4.951	7.981	7.095	15.100	22.195	570
400	6	1	2.105	3.894	7.821	7.553	13.820	21.373	521
800	6	1	2.346	4.671	9.054	7.329	16.071	23.400	594
1,200	6	1	2.830	5.865	9.617	8.141	18.312	26.453	703
Least significant difference at			.05 level				1.773	2.194	54
			.01 level				2.365	2.925	72

[1] All plots were treated with ethylene dibromide for nematode control.

[2] Fertilizer was applied as 6-8-4, one-half 1 week before planting and one-half 3 weeks after planting, nitrate of soda equivalent to 2 per cent nitrogen was applied 6 weeks after planting.

[3] Irrigation consisted of 7 applications in 1950 and 5 in 1951, each equivalent to 1 inch of rainfall.

[4] Listed are prices received: $100 per ton for No. 1's, $40 for No. 2's, $15 for No. 3's, and $5 for culls.

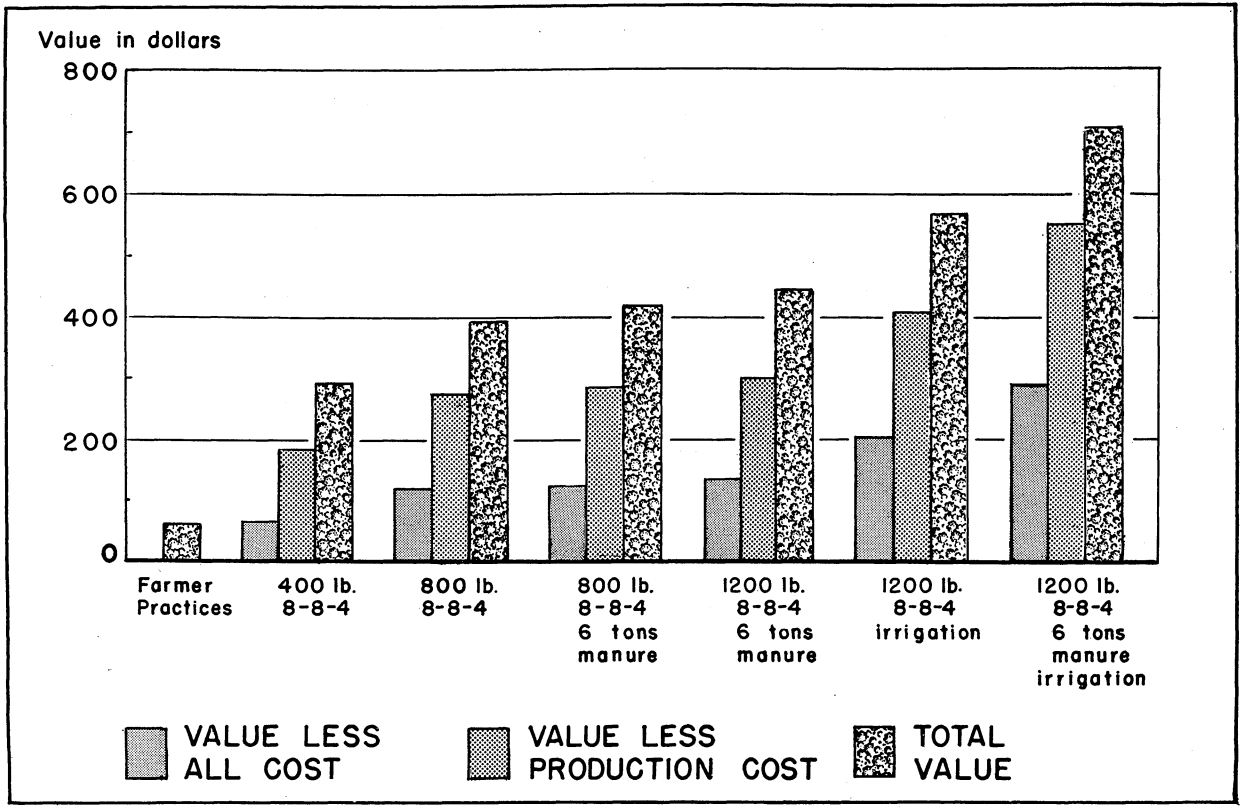

FIGURE 4. Total value, value less production cost, and value less all cost for cucumbers receiving different treatments.

Value of Combined Practices

With few exceptions each practice increased the value of the others. In all instances, the value of irrigation was increased by use of higher fertilizer rates and was increased at each fertilizer rate by use of manure. Likewise, irrigation in all instances increased the value of fertilizer and the value of manure. Each practice thus increased the efficiency of the others.

It is obvious also that highest gross returns resulted from use of more and more intensive practices. This is shown graphically in Figure 4. For example, the gross values of all grades were $291 from 400 pounds of fertilizer, $393 from 800 pounds of fertilizer, $418 from 800 pounds of fertilizer plus manure, $443 from 1,200 pounds of fertilizer plus 6 tons of animal manure, $570 from 1,200 pounds of fertilizer plus irrigation, and $703 from 1,200 pounds of fertilizer plus 6 tons of manure plus irrigation.

Although the pickled cucumber is a processed crop that as a rule offers lower returns than a fresh market crop, it is obvious that high gross returns may be obtained if intensive production methods are used. Value above costs are discussed in a later section.

Effects of Different Treatments on Earliness

In Table 11 are given total yields and value of cucumbers by weeks for the different treatments in the second series. Rates of fertilizer and manure did not materially affect earliness. Irrigation increased the total yield and the percentage of the total crop in the early harvests, but it did not prolong the harvest season.

Labor Requirements and Costs of Harvesting

To obtain data on labor requirements for harvesting, records were kept on the amount of labor used to harvest plots for five periods in the variety experiment and for two periods in the fertilizer-manure-irrigation experiment. The results of these studies are given in Table 12.

TABLE 11. YIELD AND VALUE BY WEEKS FROM USE OF FERTILIZER RATES, ANIMAL MANURE, IRRIGATION, PACKER VARIETY, 1950-51

Treatment[1]			Yield and value of all grades by weeks							
Fertilizer per A[2]	Animal manure	Irrigation[3]	1	2	3	4	5	6	7	Total
Lb.	*T.*	*In./wk.*								
			Yield per acre of all grades (Tons)							
400	0	0	.444	.999	2.256	2.731	2.022	2.369	1.890	12.711
800	0	0	.406	1.068	3.169	3.716	2.775	3.242	2.363	16.739
1,200	0	0	.307	.822	2.826	3.529	2.196	3.210	2.124	15.014
400	6	0	.680	1.363	2.897	3.480	2.342	3.201	2.574	16.537
800	6	0	.545	1.063	3.043	4.050	2.610	3.391	2.724	17.426
1,200	6	0	.465	1.348	3.393	4.324	2.309	3.522	2.617	17.978
400	0	1	1.448	1.904	2.476	2.701	1.935	1.851	1.336	13.651
800	0	1	1.603	2.616	4.492	4.112	2.396	2.805	1.750	19.774
1,200	0	1	1.428	2.823	4.926	4.988	3.339	2.744	1.947	22.195
400	6	1	2.082	2.673	3.890	4.175	3.052	3.428	2.073	21.373
800	6	1	2.245	2.963	4.888	4.895	3.205	3.189	2.015	23.400
1,200	6	1	2.203	3.214	5.692	5.819	3.318	3.970	2.237	26.453
			Total value per acre of all grades (Dollars)[4]							
400	0	0	16.99	41.06	62.63	66.56	40.05	51.51	12.58	291.38
800	0	0	17.21	43.28	96.78	85.56	54.13	76.68	19.32	392.96
1,200	0	0	12.52	35.40	85.41	87.49	56.78	72.61	14.74	364.95
400	6	0	26.33	58.70	86.61	83.52	53.83	86.70	22.46	418.15
800	6	0	20.66	43.54	97.51	94.91	57.90	81.28	21.97	417.77
1,200	6	0	16.19	54.53	100.32	106.19	52.56	93.55	20.08	443.42
400	0	1	50.64	64.07	59.51	52.77	32.52	38.44	9.53	307.48
800	0	1	59.46	100.22	129.22	90.70	51.50	51.01	13.37	495.48
1,200	0	1	58.55	112.38	140.59	114.41	68.04	58.11	17.96	570.04
400	6	1	69.32	96.27	107.81	96.64	66.75	70.18	14.39	521.36
800	6	1	74.82	113.44	137.97	117.53	65.74	71.36	13.05	593.91
1,200	6	1	77.31	129.64	174.53	137.81	74.99	92.18	16.12	702.58

[1] All plots were treated with ethylene dibromide for nematode control.

[2] Fertilizer was applied as 6-8-4, one-half 1 week before planting and one-half 3 weeks after planting. Nitrate of soda equivalent to 2 per cent nitrogen was applied 6 weeks after planting.

[3] Irrigation consisted of 7 applications in 1950 and 5 in 1951, each equivalent to 1 inch of rainfall.

[4] Listed are prices received: $100 per ton for No. 1's, $40 for No. 2's, $15 for No. 3's, and $5 for culls.

TABLE 12. LABOR REQUIREMENTS AND COSTS OF HARVESTING AND THE VALUES ABOVE HARVEST COST[1]

Date of harvest[2]	Grade	Amount harvested	Labor for harvesting	Value of yield	Cost of harvesting[3]	Average per 100 pounds		
						Value	Cost of harvesting	Value above cost
		100 lb.	*Hr.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*	*Dol.*
6/22/51	1's	1.01		5.05				
	2's	1.43		2.86				
	3's	.93		.70				
	Culls	.72		.18				
	Total	4.09	8.57	8.79	3.43	2.15	0.84	1.31
6/25/51	1's	4.05		20.25				
	2's	12.86		25.72				
	3's	29.15		21.87				
	Culls	12.69		3.17				
	Total	58.75	57.49	71.01	22.99	1.21	0.39	0.82
6/27/51	1's	.53		2.65				
	2's	.83		1.66				
	3's	1.57		1.18				
	Culls	1.65		.41				
	Total	4.58	8.16	5.90	3.26	1.29	0.71	0.58
6/29/51	1's	.94		4.70				
	2's	1.17		2.34				
	3's	1.47		1.10				
	Culls	3.29		.82				
	Total	6.87	8.30	8.96	3.32	1.30	0.48	0.82
7/13/51	1's	2.74		13.70				
	2's	5.17		10.34				
	3's	14.46		10.85				
	Culls	13.81		3.45				
	Total	36.18	45.13	38.34	18.05	1.06	0.50	0.56
Totals, all grades	1's	9.27		46.35				
	2's	21.46		42.92				
	3's	47.58		35.70				
	Culls	32.16		8.03				
	Total	110.47	127.65	133.00	51.05	1.20	0.46	0.74
Totals, 1's, 2's, and 3's	1's	9.27		46.35				
	2's	21.46		42.92				
	3's	47.58		35.70				
	Total	78.31	127.65	124.97	51.05			

[1] Area harvested was 0.3636 acre from variety experiment and 0.2125 from the organic, fertilizer, and irrigation experiment.

[2] Records on 6/25/51 and on 7/13/51 were from both studies; others were from variety study only.

[3] Wage rate was $0.40 per hour.

A total of 127.65 man-hours was required to harvest 11,047 pounds of cucumbers including culls or 1.15 man-hours required for each 100 pounds harvested. The total value of this quantity of cucumbers at the prices delivered to the brining vat was $133. At $0.40 per hour, the cost of harvesting 100 pounds was $0.46. The average price per 100 pounds for all grades including culls was $1.20. The difference between the cost of harvesting and the total value of the cucumbers was $0.74 per 100 pounds.

Costs and Values Above Costs

Based on the practices used in the production of cucumbers in these studies, it is calculated that the fixed cost of production, exclusive of fertilizers, manure, and irrigation, was $99.50 per acre. This included land rental, preparing land, fumigating soil,

Table 13. Estimated Costs, Gross Values and Values Above Costs from Fertilizer Rates, Manures, and Irrigation, Packer Variety, 1950-51

Treatments			Costs and values per acre				
Fertilizer, 8-8-4 per acre[1]	Manure per acre	Irrigation per week[2]	Gross value[3]	Production costs[4]	All costs	Value above	
						All costs	Production costs
Pounds	*Tons*	*Inch*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
400	0	0	291	109	227	64	182
800	0	0	393	118	274	119	275
1,200	0	0	365	128	267	98	237
400	6	0	418	124	278	140	294
800	6	0	418	133	295	123	285
1,200	6	0	443	143	310	133	300
400	0	1	307	142	269	38	165
800	0	1	495	151	335	160	344
1,200	0	1	570	161	367	203	409
400	6	1	521	157	356	165	364
800	6	1	594	166	384	210	428
1,200	6	1	703	176	438	265	527

[1] Fertilizer was applied as 6-8-4, one-half 1 week before planting and one-half 3 weeks after planting; nitrate of soda equivalent to 2 per cent nitrogen was applied 6 weeks after planting.

[2] Irrigation consisted of 7 applications in 1950 and 5 in 1951, each equivalent to 1 inch of rainfall.

[3] Listed are prices received: $100 per ton for No. 1's, $40 for No. 2's, $15 for No. 3's, and $5 for culls.

[4] Production costs include land rental, applying fertilizers, land preparation, planting, cultivating, soil fumigation, and dusting for all treatments plus fertilizer, manure, and irrigation for indicated treatments.

applying fertilizer, and planting, cultivating, and dusting the crop. Other production costs included fertilizers, manure, and irrigation as indicated for the different treatments. The fertilizer was charged at the rate of $9.40 for 400 pounds of 8-8-4 used; manure was charged at the rate of $30.00 per 6 tons, one-half being charged to the second crop grown in succession; irrigation was charged at the rate of $5.50 per acre-inch. Harvesting costs were based on $9.30 for each ton of total yield.

The data on gross value, production costs, all costs, values above production costs, and values above all costs are given in Table 13.

The ranges in costs and values per acre were: gross values, $291 to $703; production costs, $109 to $176; total costs, $227 to $438; values above production costs, $165 to $527; and values above all costs, $38 to $265.

Brining Studies

Studies were made during three seasons to determine pickling qualities of the cucumbers as related to varieties, fertilizer treatments, and manure treatments.

Tests were made on fresh and brined stock. Cucumbers for the brining studies were placed in mesh bags, labeled, and put in commercial brining vats the same afternoon of the day harvested or the following morning. After fermentation was complete, the samples were removed and evaluated as commercial brine stock.

Standards for the evaluations were based largely on the concept of the cooperating pickle company as to the characteristics of good brine stock. While firmness was regarded as the most important single factor, shape, skin color, condition of surface, and internal conditions were also considered. The company prefers a cucumber that is straight and not pointed at the end. The diameter-length ratio should be approximately 1 to 3. The color should be a medium-to-light green with yellow tinge. The surface should be dotted with characteristic cucumber "warts" that are medium in size, fairly numerous, and well distributed. Ratings on shape, skin color, and condition of surface were made by judging panels.

Firmness was determined by use of a pressure tester equipped with 5/16-inch plunger. Values were established from average

center punch readings, usually of 10 No. 1 and 10 No. 2 cucumbers from each sample of each harvest. Sizes selected for the tests were approximately 1 inch in diameter for No. 1 grade and approximately 1⅜ inches in diameter for the No. 2 grade.

Samples of each variety or fertilizer treatment on test were taken from each of a number of harvests during the season. Usually, the samples of only one harvest were brined in the same vat. By this arrangement, it was possible to eliminate from variety or fertilizer comparisons whole sets of samples from brine vats in which fermentation conditions were unsatisfactory.

BRINING QUALITY OF DIFFERENT VARIETIES. Of 15 varieties originally included in the brining studies, 7 were eliminated the first season as unacceptable for commercial pickling cucumbers. These varieties, together with their respective pressure tests and major faults found in the brined cucumbers, are given in Table 14.

TABLE 14. VARIETIES OF CUCUMBERS WITH MAJOR FAULTS FOR COMMERCIAL PICKLING[1]

Variety	Pressure tests[2]		Major faults in shape, color, and surface
	No. 1's	No. 2's	
	Lb.	*Lb.*	
Snow's Perfection	15.4	17.1	Too short and stubby, too dark
Chicago Pickling	14.5	16.1	Too long, little too warty, variable shades
Black Diamond	16.4	18.4	Too long, pointed, irregular, too dark, too smooth
Robin 40	14.0	15.4	Too long, too dark, too smooth
Robin 50	15.2	17.7	Too long, too dark, too smooth, crooked
Pickling G	16.0	17.1	Too long, pointed, surface covered with numerous unattractive small warts
Hickmoore	16.8	19.1	Too long, poor shape because of two sided fruits, too dark
L. S. D. .05 level	0.9	1.4	
.01 level	1.2	1.9	

[1] Samples are from different harvests of some of the varieties tested at Auburn during 1949 season and brined and rated at W&W Pickle Company.

[2] Values represent average center punch readings on 10 cucumbers of each grade from each of 5 harvests. Comparative readings on Packer variety were 17.3 and 19.7, respectively, for No. 1's and 2's.

Eight of the 15 original varieties were continued through a second season of experiments. Two of these, namely Producer and Model, were accidentally eliminated from the third season's tests as a result of mislabeled seed. Fortunately, the data obtained during the first two seasons had eliminated the Producer

as unacceptable and established the Model as acceptable with certain minor faults. Pressure tests on brined samples of the eight better varieties are given in Table 15. The Model, Packer,

TABLE 15. FIRMNESS OF BRINED SAMPLES OF EIGHT CUCUMBER VARIETIES

Varieties	Firmness as determined by pressure tests[1]							
	No. 1 grade[2]				No. 2 grade[2]			
	1949	1950	1951	3-yr. av.	1949	1950	1951	3-yr. av.
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Packer	17.3	16.3	15.8	16.5	19.8	18.9	18.9	19.2
Model	17.5	17.1	--	17.3[3]	19.9	19.6	--	19.8[3]
Producer	15.1	15.2	--	15.2[3]	17.3	16.5	--	16.9[3]
Earliest of All	17.4	16.6	15.1	16.4	19.3	17.6	17.9	18.3
Ohio 31	15.5	15.4	14.9	15.3	17.2	17.9	16.9	17.3
Magnolia	15.6	15.6	14.5	15.2	16.9	17.2	17.2	17.1
National Association Pickling	15.7	15.1	14.4	15.1	16.8	16.9	16.2	16.6
Improved National	15.1	15.7	14.8	15.2	16.6	17.6	16.4	16.9
Least significant difference at .05 level	1.0	1.4	1.4	0.7	1.5	1.4	1.1	0.6
Least significant difference at .01 level	1.4	1.8	2.0	1.0	2.0	1.9	1.6	0.8

[1] Values represent average pounds resistance on 5/16-inch plunger for center puncture of 10 cucumbers of each grade from each harvest. Samples were from 5 harvests in 1949, 1950, and 1951.

[2] Samples for No. 1 grade were approximately 1 inch in diameter and those for No. 2 grade, 1⅜ inches.

[3] Figures represent 2-year average yields.

TABLE 16. FIRMNESS OF FRESH SAMPLES OF EIGHT CUCUMBER VARIETIES

Varieties	Firmness as determined by pressure tests[1]					
	No. 1 grade[2]			No. 2 grade[2]		
	1950	1951	2-yr. av.	1950	1951	2-yr. av.
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Packer	16.1	16.0	16.1	19.0	17.9	18.5
Model	17.4	--	17.4[3]	20.6	--	20.6[3]
Producer	16.8	--	16.8[3]	18.3	--	18.3[3]
Earliest of All	16.3	16.2	16.3	19.4	18.3	18.9
Ohio 31	16.2	15.6	15.9	18.4	17.4	17.9
Magnolia	15.9	15.0	15.5	19.1	17.1	18.1
National Association Pickling	15.4	15.5	15.5	18.1	16.8	17.5
Improved National	15.9	16.3	16.1	18.3	17.9	18.1
Least significant difference .05 level	0.9	0.9	0.6	1.1	1.0	0.8
Least significant difference .01 level	1.2	1.2	0.8	1.5	1.3	1.1

[1] Values represent average pounds resistance on 5/16-inch plunger for center punctures of 10 cucumbers of each grade from each of 6 harvests during 1950 and 1951.

[2] Samples for No. 1 grade were approximately 1 inch in diameter and those for No. 2 grade, 1⅜ inches.

[3] Figures represent 1-year average.

and Earliest of All were considerably firmer than the other five varieties.

During the 1950 and 1951 seasons, fresh samples of the eight varieties were pressure tested to determine firmness of the fresh stock. These samples were usually taken from harvests alternately with the harvests used for brining studies. Results of the tests are given in Table 16.

As in the case of the brined samples, the Packer, Model, and Earliest of All were firmer than other varieties except the Producer. However, the differences were not as great in the case of the fresh samples.

EFFECT OF FERTILIZER TREATMENT ON PICKLING QUALITY. In 1949 and 1950, brining studies were made on cucumber samples from plots receiving different fertilizer and organic treatments. In 1950, samples of fresh cucumbers from these treatments were also tested. The Magnolia variety was used in 1949 and the Packer in 1950.

Results of pressure tests are given in Table 17. Firmness of cucumbers was not decreased either year by fertilizing the plants

TABLE 17. FIRMNESS OF FRESH AND BRINED CUCUMBERS GROWN WITH DIFFERENT RATES OF NITROGEN AND WITH MANURE, 1949-50

Treatment[1]			Firmness by pressure test[2]					
			1949 crop, Magnolia variety		1950 crop, Packer variety, average of 5 harvests			
Sodium nitrate per acre	Animal manure		Average of 4 harvests, No. 1 grade, brined	Average of 2 harvests, No. 2 grade, brined	No. 1 grade		No. 2 grade	
					Fresh	Brined	Fresh	Brined
Lb.	*Tons*		*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
0	0		13.8	15.9	16.4	16.4	18.7	19.2
185	0		12.9	15.2	16.5	16.8	18.2	19.6
370	0		13.9	16.2	16.1	17.2	18.9	19.5
370	12		14.2	17.1	16.9	16.9	18.8	19.7
740	0		13.5	14.4	--	--	--	--
Least significant difference at		.05 level	1.0	4.7	0.9	0.9	1.6	0.8
		.01 level	1.3	7.4	1.3	1.3	2.2	1.2

[1] In all plots, 500 pounds per acre of 6-8-4 fertilizer applied under and 500 pounds of 6-8-4 and the nitrate as side applications.

[2] Values represent average pounds resistance on 5/16-inch plunger for center punctures of 10 cucumbers of each grade from each harvest.

with manure or different rates of sodium nitrate. Although yields ranged from 6,920 to 18,403 pounds per acre, there were practically no differences in firmness of the cucumbers. Brined samples were slightly firmer than the fresh ones.

Rainfall

Rainfall records for the periods involved in the study are given primarily for their value in interpretation of results, Table 18. Rainfall was irregular and somewhat below average. Varia-

Table 18. Rainfall by Weeks for Each Year of the Experiment, Auburn, Alabama[1]

Month	Week	Rainfall by years		
		1949	1950	1951
		Inches	*Inches*	*Inches*
April	1	0.87	1.23	0.92
	2	.68	.20	1.28
	3	.12	.35	2.35
	4	7.03	1.42	.28
May	1	.72	1.50	.22
	2	.21	.53	.05
	3	.00	.67	.32
	4	1.82	.13	.74
June	1	.25	.95	.48
	2	1.07	1.12	.08
	3	.71	.50	4.65
	4	.67	.00	1.75
July	1	.06	.13	.59
	2	1.42	4.46	.06
	3	3.84	.83	.00
	4	.91	1.87	1.74

[1] Official weather data from Auburn Reporting Station within 200 yards of the experiment.

tions from the average, however, were not abnormal. In 1949 rainfall for May and June was somewhat below the long-time average for these months. In 1950, only 4.02 inches of rain fell during an 8-week period extending from the second week of May through the first week of July; in 1951, only 2.17 inches of rain fell in a 7-week period extending from the third week of April through the third week of June. The prolonged periods of drought in 1950 and 1951 provided conditions that would be expected to affect response to irrigation, length of the fruiting season, and magnitude of quality differences resulting from treatment differences.

SUMMARY

The two primary objectives of the 3-year study on pickling cucumbers were to determine means of economically increasing yields and of maintaining high quality in the finished products. Fruiting characteristics and costs were also studied.

The field studies included experiments on varieties, fertilizer rates, manures, spacing, irrigation, and soil fumigation. Records were also obtained on labor requirements, production costs, and fruiting habits.

The brining and laboratory studies included tests on firmness and other brining qualities of different varieties and of cucumbers receiving different fertilizer treatments.

Of the 15 varieties studied, the Packer, Model, and Earliest of All were best.

Under conditions of these experiments, the first harvest occurred 51 to 58 days after planting and the number of days of harvest ranged from 31 to 45 days.

During the summer period, 62 per cent of the female blooms set fruit and 47 per cent reached No. 3 size. In this study only one fruit was selected per branch for recording and all others were harvested normally.

During an early fall period when all fruits were allowed to reach No. 3 size before harvesting, 27 per cent of the pistillate buds dropped before reaching bloom stage; 67 per cent of the blooms set fruit that reached 10/16 inch in diameter, 60 per cent set fruit that reached No. 2 size, and 57 per cent set fruit that carried through to No. 3 size.

Some cucumbers reached No. 3 size within 3 to 4 days after bloom, others required 15 to 20 days. During the early fall period when all cucumbers were allowed to reach No. 3 size before harvesting, an average of 7 days was required to reach No. 1 size, 10 days to reach No. 2 size, and 12 days to reach No. 3 size.

Soil fumigation with ethylene dibromide to control nematodes increased the amount of cucumbers harvested $95 per acre at an average cost of approximately $18 per acre per year. Two applications were made in 3 years.

Only small differences were obtained in yield and value of cucumbers spaced 12, 24, and 36 inches apart in rows 3 feet apart.

With no manure or irrigation, the gross values of cucumbers at pickling prices were $291 per acre when a complete fertilizer was added at the rate of 400 pounds; $393 at the 800-pound rate, and $365 at the 1,200-pound rate. With irrigation added, the gross values were $307 at the 400-pound fertilizer rate, $495 at the 800-pound rate, and $570 at the 1,200-pound rate.

With irrigation and 6 tons of manure per acre added, the gross values were $521 at the 400-pound fertilizer rate, $594 at the 800-pound rate, and $703 at the 1,200-pound rate.

Six tons of manure per acre without irrigation increased the gross value from $291 to $418 at the 400-pound rate; there was no increase in value by increasing the fertilizer to 800 pounds, and a value increase of only $25 by increasing the fertilizer to 1,200 pounds.

The values of cucumbers were increased as more intensive practices were successively used. A gross value of $703 was reached when the crop was dusted regularly, the soil was fumigated with ethylene dibromide, and 1,200 pounds of fertilizer per acre, 6 tons of manure, and irrigation were added.

An average of 1.15 man-hours per 100 pounds was required to harvest cucumbers of all grades including culls. With pickling cucumbers priced at $5 per 100 pounds for No. 1's, $2 for No. 2's, $0.75 for No. 3's, and $0.25 for culls, the average price of all grades including culls was $1.20 per 100 pounds. The average value above cost of harvesting was $0.74 per 100 pounds.

Brining studies showed no injurious effects on firmness or on other brining qualities of cucumbers from treatments with high applications of sodium nitrate or from use of animal manure.