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September 1988

Vegetables and Specialties

Situation and Outlook Report

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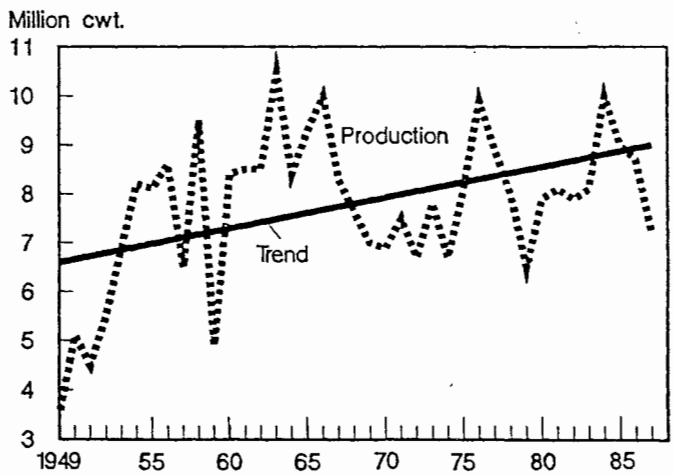
Water and California Vegetables, see p. 11

Florida Watermelon Production Trends Upward As Industry Adopts Changes



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Situation Coordinator
Shannon Reid Hamm (202) 786–1886

Principal Contributors
Gary Lucier (202) 786–1884
Catherine R. Greene (202) 786–1886
Amy W. Allred (202) 786–1886
Glenn Zepp (202) 786–1882

Statistical Assistant
Barbara Johnson (202) 786–1886

Electronic Word Processing
Cynthia Taylor (202) 786–1886

Commodity Economics Division, Economic Research Service
U.S. Department of Agriculture, Washington D.C. 20005–4788

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SUMMARY

The index of grower prices for fresh vegetables rose from 110 in June (1977=100) to 122 in July and then to 148 in mid-August. The summer-quarter (July-September) index to date could average as much as a tenth above the same period last year. Vegetable prices tend to decline in the summer as supplies increase, especially in July. However, this year's extremely dry weather, coupled with minimal irrigation in the North Central States, reduced supplies and put upward pressure on prices in midsummer.

As local supplies tighten, consumers likely will be more dependent than usual on vegetables shipped from more distant areas. The consumer price index (CPI) for fresh vegetables, including potatoes, rose 4 percent from June to July and 5 percent from last July. The most important fresh vegetables in the index are potatoes, lettuce, and tomatoes. Retail potato prices, which were up seasonally in July, have been boosted slightly by the drought's impact on the summer crop. Lettuce prices tend to be seasonally low in July, and were slightly lower this July due to large California supplies. Tomato prices tend to be down in July, as tomatoes are the most commonly grown vegetable in home gardens, which reduces summer retail demand. However, the drought boosted this July's prices.

The consumer price index (CPI) for processing vegetables, generally flat in the summer, rose 1 percent in July to 111 (1982-84 = 100). The CPI for processing vegetables is expected to continue rising through next year as higher wholesale prices work through the marketing channels. However, price rises this fall at the wholesale and retail levels will be mitigated somewhat, as carryin stocks for canned green peas, snap beans, and sweet corn were about 14 percent of the 1987/88 combined packs. This will supplement this year's low packs for about 50 days into the new marketing year, assuming last year's demand schedule.

Harvested acreage of all fresh market vegetables (including honeydews, but excluding onions) is expected to be up about 2 percent this year, based on increased winter, spring, and summer acreages and a slight increase in fall acreage. Summer acreage of the 7 major fresh market vegetables (broccoli, carrots, cauliflower, celery, sweet corn, lettuce, and tomatoes) dropped slightly from last summer's 272,800 acres. With a small increase in honeydew acreage factored in, summer acreage is about even with a year earlier. This follows a 3-percent increase in winter acreage and a 5-percent increase in spring acreage. Assuming lettuce acreage remains near last fall's 54,400, total fall acreage could top last year's 150,900 acres, in response to strengthening 1988 prices.

The 1988 drought has had its greatest impact on snap beans, sweet corn, and green peas for processing in Wisconsin, Minnesota, Michigan, and Illinois. Most of these States' vegetable acreage is devoted to canning. The 1988 prospective canning acreage as of July 1 fell short of last year's plantings. Harvested area and preliminary output estimates indicate even further reductions.

The impact of hot, dry weather this summer on the three principal canning crops was exacerbated by the lack of irrigation in the North Central States (irrigation estimates are for both fresh and processing acreage). Irrigation is minimal on green peas, with just 15 percent of harvested area irrigated. Since peas are generally out of the ground by June, irrigation requirements are usually light. However, the drought developed early this summer and ravaged many fields. More area is irrigated for sweet corn, about 38 percent in four North Central States. Among the three crops, snap beans hold the largest percentage of land irrigated, with roughly 50 percent.

U.S. potato production is expected to decline in 1988 despite strong winter and spring outputs. Drought across much of the United States, in tandem with reduced harvested area, is expected to cut production of summer potatoes by 14 percent. Excessive heat is also taking a toll on the all-important fall crop by reducing the size of potatoes, dropping potential yields. The fall crop accounts for about 88 percent of all U.S. potato production. Assuming current expectations for fall-harvested area and a conservative 3-to-5 percent cut in yields from the 314 cwt of 1987, total 1988 potato production could decline at least 5 to 7 percent. If realized, the U.S. potato crop could be the lowest since 1983--the last year drought struck the heart of the country.

Prices received by potato growers likely will average above a year earlier during the 1988/89 season as the smaller fall storage crop results in reduced stocks and stronger competition for available supplies from both processing and tablestock users. During the past season, strong production combined with sluggish demand to leave stocks at or near record levels. This kept downward pressure on prices during the 1987/88 crop year and resulted in a season-average price below the $5.03 of 1986/87.

While dry edible bean production is expected to fall dramatically from the previous 3-year average this year in Michigan, Idaho, and North Dakota, California production is expected to be up slightly. Production increases are also anticipated in Colorado and Nebraska. Michigan, where few bean acres are irrigated, is expected to suffer the most damage from the drought, with a 13-percent decline in yield from the previous year, and a 50-percent drop in production. California, where most bean acreage is irrigated, increased acreage slightly when the drought threatened other areas, and is expected to have a 6-percent increase in yield and slightly more production than last year.

U.S. mushroom production continued its upward trend in 1987/88, rising nearly 4 percent to 637 million pounds. The output this year for button mushrooms (called Agaricus) was up by 4 percent to 632 million pounds, leaving 5 million pounds to production of specialty mushrooms. For the first time, USDA production estimates were broken out for specialty mushrooms, which include Shiitake, Oysters, and others.

Total per capita use of fresh and processed vegetables (farm-weight basis, excluding potatoes) during 1987 totaled 192.2 pounds, compared with 193.1 pounds the previous year and 182 pounds a decade ago. A slight reduction in total vegetable production, combined with stronger exports for most vegetables in 1987, led to the 1-percent decline.

FRESH VEGETABLES

Acreage Rising in 1988

Harvested acreage of all fresh market vegetables (including honeydews but excluding onions) is expected to be up about 2 percent this year, based on increased winter, spring, and summer acreages and a slight increase in fall (table 1). Summer acreage of the 7 major fresh market vegetables (broccoli, carrots, cauliflower, celery, sweet corn, lettuce, and tomatoes) was down slightly from last year's 272,800 acres. With a small increase in honeydew acreage factored in, summer acreage is slightly higher than a year earlier. This follows a 3-percent increase in winter acreage and a 5-percent increase in spring acreage. Assuming lettuce acreage this fall remains near last fall's 54,400, fall acreage could top last year's 150,900 acres, in response to strengthening 1988 prices.

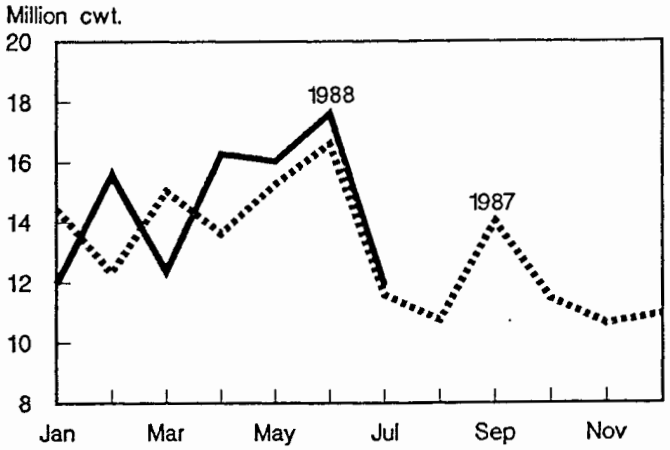
Sweet corn for the fresh market typically comprises about a third of summer acreage and is one of the commodities most vulnerable to drought. Acreage for harvest dropped 4 percent this summer to 104,500. Sweet corn is grown in most States. New York acreage captures the largest share, at 24 percent, and was damaged by the drought. Only 38 percent of all sweet corn acreage is irrigated, according to the 1982 Census of Agriculture. New York accounts for 10 percent of the irrigated acreage.

The only other fresh vegetable acreage to drop was carrots, down 8 percent to 23,900. California acreage, at 32 percent of the U.S. total, was unchanged from last summer. Acreage fell in Michigan, which produces 28 percent of the crop and was hard hit by the drought. Acreage also was lower in Washington and Wisconsin.

Total cauliflower and celery summer acreage remained constant, following California, the acreage leader. Increases in California summer broccoli, honeydew melon, lettuce, and tomato acreage led to increases in U.S. acreage of these crops.

Nearly every State produces some supplies of summer fresh vegetables. Shipments of the principal fresh-market vegetables totaled 143 million cwt through

Monthly Fresh Vegetable Shipments



Includes carrots, celery, lettuce, sweet corn, onions, and tomatoes.

June of this year, up 4 percent from last year (table 5). Fresh-market shipments through July were level with shipments for the same period last year.

The impact of the drought on total vegetable output has been blunted since summer supplies of fresh vegetables still origniate largely in California. California growers are facing the 1988 drought very well, since virtually all of their vegetable land is irrigated. Summer supplies from California have been ample, with shipments running ahead of last year through July.

However, the drought has affected some fresh-market vegetables grown in the North Central States. Little acreage in this area is irrigated, since the growing climate is favorable for dryland production. Shipments of sweet corn, tomatoes, and carrots from Michigan are running slightly behind a year ago. Reduced acreage during the April-July period left shipments of the heavily irrigated Michigan celery crop below last year.

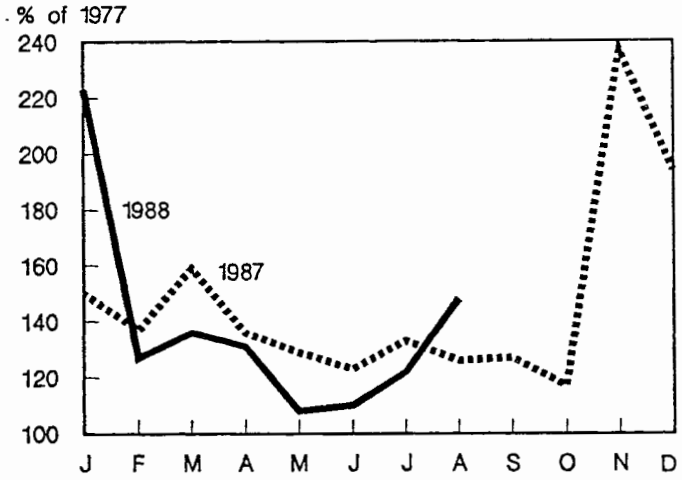
Fresh-Market Vegetable Prices Up

Through the middle of August, prices received by farmers for fresh-market vegetables averaged 1 percent above the previous year (table 8). The winter-quarter (January-March) grower price index was 9 percent above last year, largely because of weather and disease-impacted lettuce prices. As lettuce production moved into other areas, shipments increased and the spring-quarter grower price index for all fresh-market vegetables fell 10 percent.

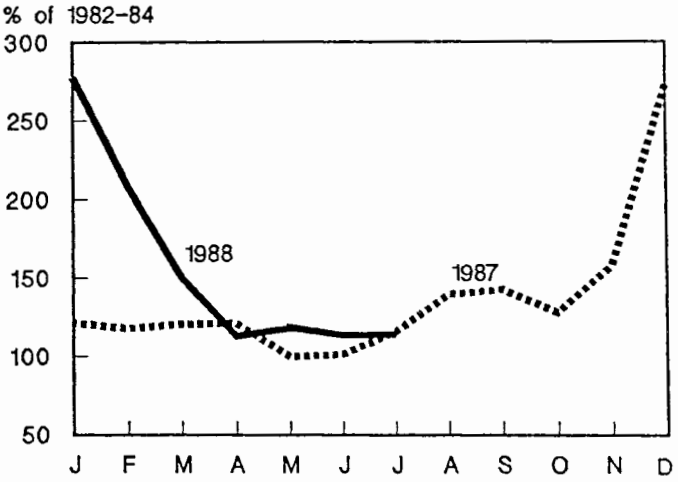
The index of grower prices for fresh vegetables rose from 110 in June (1977=100) to 122 in July and then to 148 in mid-August. The summer-quarter (July-September) index could average as much as a tenth above the same period last year. Vegetable prices tend to decline in the summer as supplies increase, especially in July. However, this year's extremely dry weather, coupled with minimal irrigation in the North Central States, reduced supplies and put upward pressure on prices in midsummer.

As local supplies tighten, consumers likely will be more dependent than usual on vegetables shipped from more distant areas. The consumer price index (CPI) for fresh

Commercial Fresh Vegetables: Prices Received by Farmers

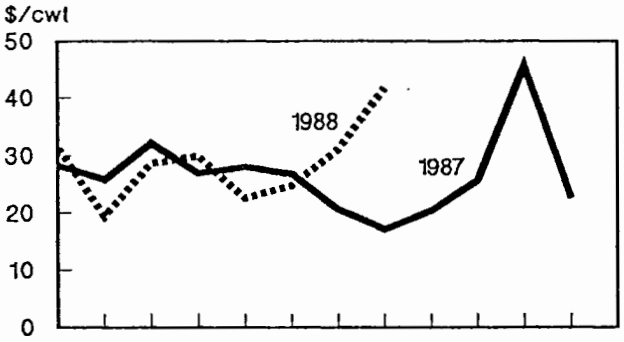


Lettuce: Consumer Price Index

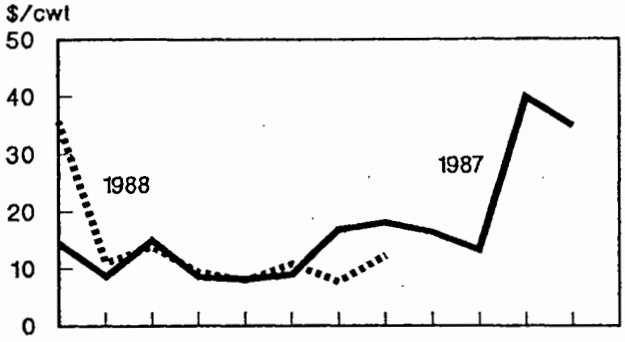


Prices Received by Farmers for Selected Fresh Vegetables

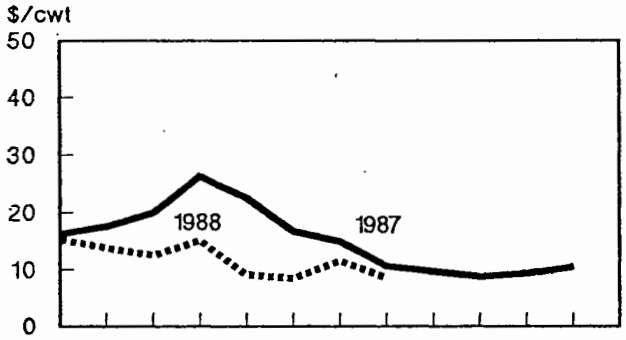
Tomatoes



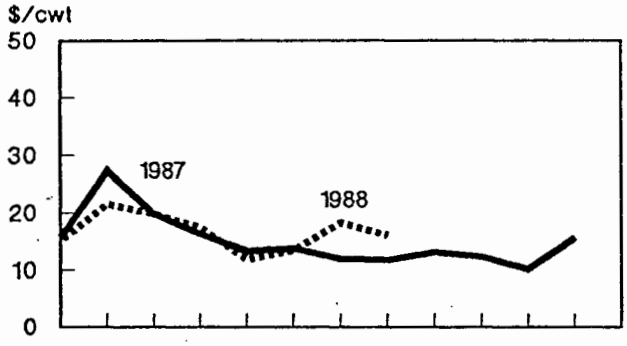
Lettuce



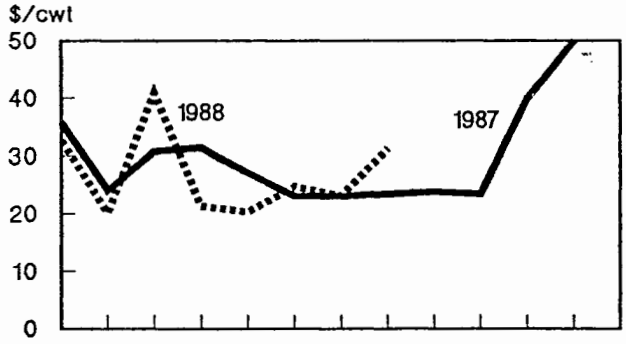
Onions



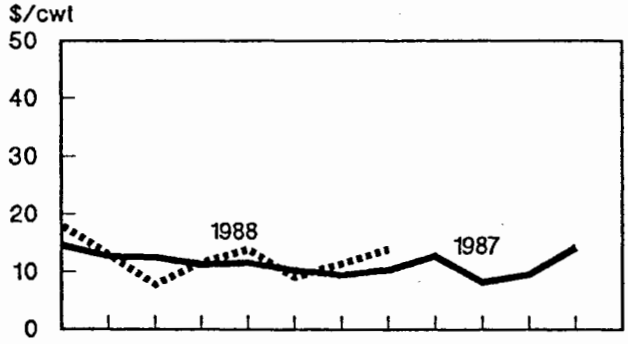
Sweet Corn



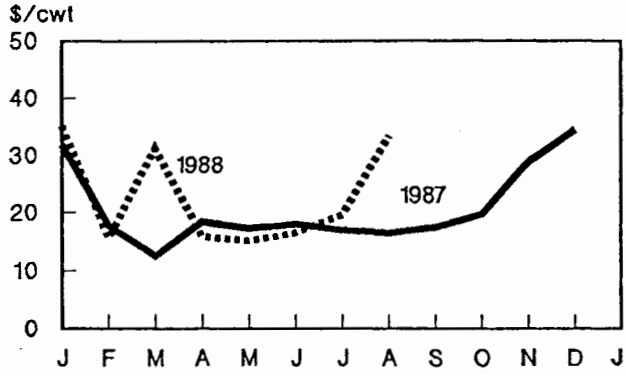
Cauliflower



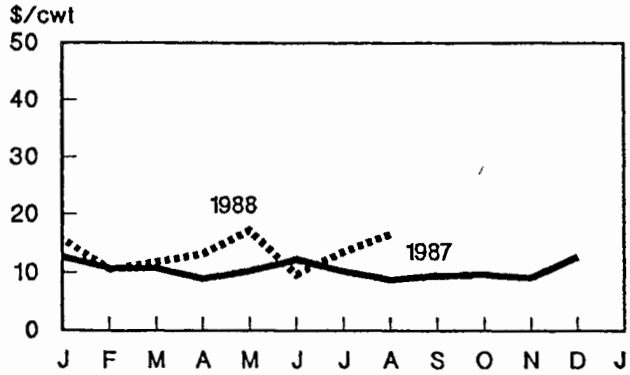
Celery



Broccoli



Carrots



vegetables, including potatoes, rose 4 percent from June to July and 5 percent from last July (table 9). The most important fresh vegetables in the index are potatoes, lettuce, and tomatoes. Retail potato prices, which were up seasonally in July, have been boosted slightly by the drought's impact on the summer crop (see potato section for more detail). Lettuce prices tend to be seasonally low in July, and were slightly lower this July because of large California supplies. Tomato prices tend to be down in July, as tomatoes are the most commonly grown vegetable in home gardens, which reduce summer retail demand. However, the drought boosted this July's prices.

Onion Acreage Higher, Prices Lower

Harvested area for all onions is expected to reach 126,700 acres in 1988. This is more than 2 percent above 1987, but 2 percent below 1984's record acreage and 3 percent lower than the 1982–86 average. Poor weather in some areas has likely affected yields of the summer storage crop, but strong spring and summer nonstorage production could still leave production near year–earlier levels.

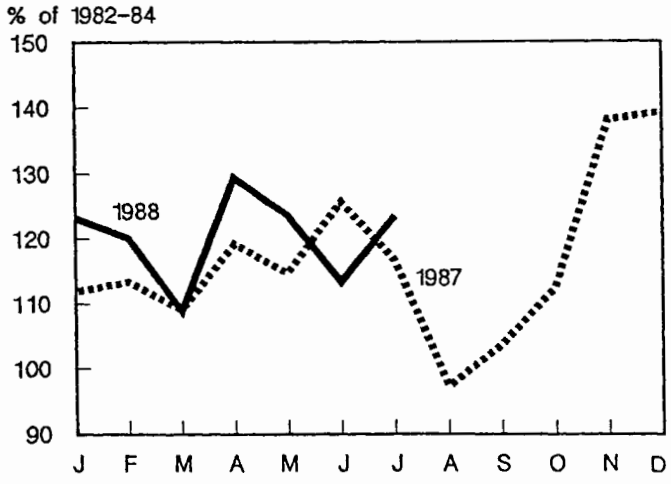
Since the storage crop accounts for about 85 percent of fresh and processing onion production, adverse weather during its formation tends to affect onion prices into the following spring. Grower prices this spring were weighed down by stocks from the solid 1987 storage crop and a large 1988 spring crop. Prices through mid–August of this year have averaged a third below the relatively high prices of 1987. Those were caused by the smaller 1986 storage crop marketed in 1987, reduced 1987 spring and summer nonstorage crops, a sudden surge in onion export volume, and continued strong consumer demand for onions.

Shipments through July of 1988 were running even with 1987, despite totals below a year earlier for 5 of the 7 months of this year. If the storage crop comes in around last year's level, onion shipments and prices would be expected to follow seasonal patterns for the remainder of the year. Season–average grower prices during the 1988 season could also average somewhat below the $12.50 per cwt realized during the 1987/88 season.

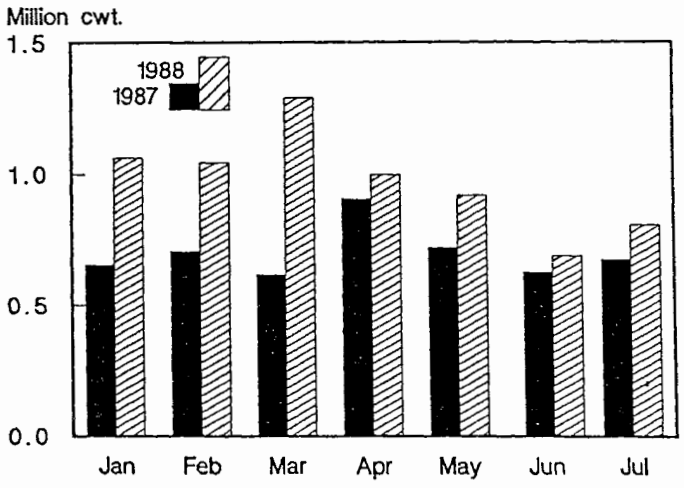
Specialty Vegetables

Shipments of specialty vegetables, including fancy lettuces, herbs, and Oriental vegetables, were ahead of the previous year's during every month of 1988 (see figure below). Shipments from January through June 1988 were 7 percent ahead of the same period last year, reflecting the general upward trend in specialty supplies during the 1980's (table 6). However, specialty shipments during March were more than double shipments during this month last year, possibly reflecting an increase in fancy lettuce production to supplement the unusually low iceberg supplies during the winter. In many supermarkets, customers were urged to try red and green

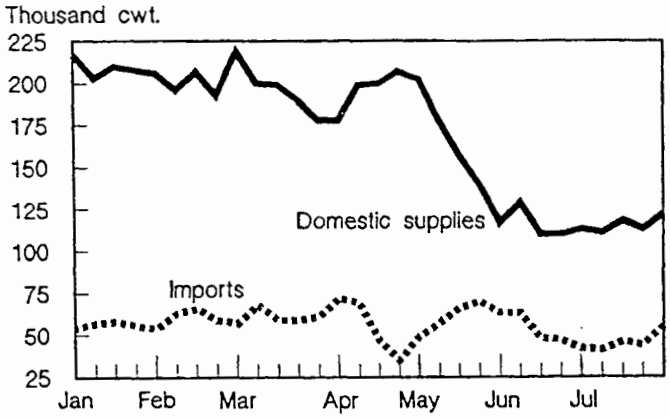
Fresh Tomatoes: Consumer Price Index



Specialty Vegetable Shipments



Weekly Specialty Vegetable Shipments, 1988



Includes fancy lettuce, greens, herbs, oriental and tropical vegetables, chili and colored bell peppers, and edible pod peas.

leaf lettuce and other fancy varieties when iceberg supplies dropped because of unexpected weather and disease problems.

Over 75 percent of specialty shipments this year have been from domestic sources (table 6). While domestic specialty shipments are substantially higher than imported shipments throughout the year, imported specialty shipments become more important during the summer (see figure above). Domestic specialty shipments have ranged from 81 percent of total specialty shipments during the first week of January to 69 percent during the last week of July.

CASH RECEIPTS

Record Receipts in 1987

The final 1987 estimates of cash receipts for all vegetables, including potatoes, indicated an increase of 7 percent from 1986 to a nominal-dollar record $9.2 billion (table a). After adjusting for inflation, receipts in this diverse subsector of U.S. agriculture rose for the first time since 1984. Largely because of reduced receipts for program crops and stronger performances by lettuce, potatoes, and onions, vegetables were able to snare 15 percent of total U.S. crop cash receipts. This contrasts with less than 14 percent in 1986 and the 1982–86 average of 12 percent. With $1.6 billion or 17 percent, potatoes again captured the largest share of vegetable receipts (see figure below). The second and third most important crops in terms of receipts were tomatoes (both fresh and processed) with 14 percent and lettuce with 9 percent of 1987 receipts.

Through May of 1988, vegetable cash receipts are estimated to have declined 3 percent from the same period in 1987. Receipts were strong this past January due to elevated prices for many fresh commodities, especially lettuce. This pushed the first quarter up 4 percent from the $2.3 billion of a year earlier. However, since the January high, cash receipts have fallen below a year earlier for each succeeding month. Weak prices

Crop and Vegetable Cash Receipts, 1987

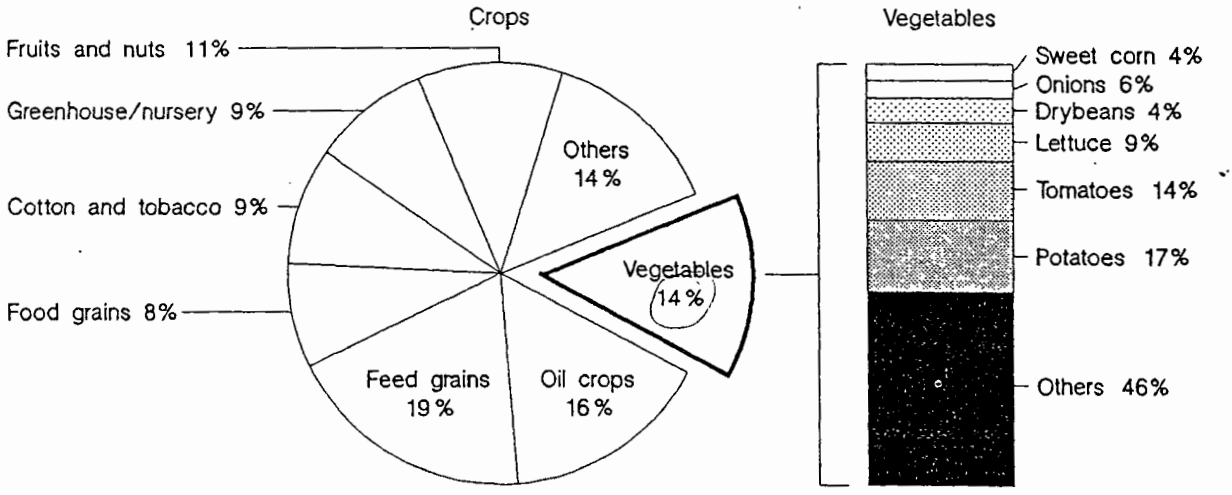


Table a.-Importance of vegetable cash receipts, 1982-86 and 1987

State	Vegetable cash receipts 1982-86	Vegetable cash receipts 1987	Percent of crop receipts 1/ 1982-86	Percent of crop receipts 1/ 1987
	Thousand dollars		Percent	
AL	87,467	90,160	11.6	15.3
AK	2,310	2,506	14.7	13.4
AZ	219,526	286,377	24.5	28.4
AR	17,544	20,789	1.2	2.0
CA	2,941,734	3,117,140	29.9	28.9
CO	175,035	198,740	17.4	22.8
CT	16,485	17,969	11.8	10.6
DE	29,695	27,959	22.2	24.5
FL	1,009,285	1,259,201	28.3	30.5
GA	140,492	160,058	9.2	12.7
HI	28,044	31,646	6.1	6.7
ID	467,578	439,211	36.8	39.2
IL	41,269	42,578	0.8	1.1
IN	62,366	74,093	2.5	3.7
IA	8,139	9,896	0.2	0.3
KS	19,406	22,271	0.8	1.2
KY	18,528	21,698	1.4	2.4
LA	46,942	59,566	4.3	6.6
ME	102,613	114,381	67.9	67.3
MD	41,613	49,977	10.8	12.7
MA	30,107	35,227	11.8	13.1
MI	310,671	256,652	20.0	21.1
MN	157,935	167,387	5.4	7.7
MS	25,452	27,626	2.3	2.9
MO	9,162	11,761	0.6	0.8
MT	14,659	13,937	2.2	2.4
NE	75,316	89,842	2.9	4.5
NV	17,963	16,156	23.3	21.3
NH	4,733	5,000	13.9	13.2
NJ	125,953	116,302	30.8	27.5
NM	76,965	100,995	23.2	30.6
NY	266,068	269,825	36.2	37.2
NC	156,169	145,525	7.8	8.9
ND	113,692	139,462	5.9	9.0
OH	121,203	118,840	5.7	6.6
OK	32,662	37,229	3.6	5.3
OR	239,587	268,109	21.7	22.2
PA	75,189	77,522	8.6	8.6
RI	7,151	8,181	13.8	12.9
SC	57,544	48,303	9.3	10.3
SD	9,714	13,513	1.0	1.7
TN	43,112	43,894	4.4	5.3
TX	400,331	390,284	10.9	12.9
UT	14,915	15,682	10.8	11.7
VT	2,864	2,916	9.1	8.2
VA	45,568	41,512	7.8	9.3
WA	404,036	438,962	21.0	23.6
WV	1,136	1,100	2.3	2.1
WI	242,361	265,804	26.3	33.4
WY	11,311	9,292	9.8	8.2
US	8,569,603	9,223,056	12.4	14.9

Source: ERS. 1/ The percentage of State crop cash receipts represented by vegetables for each State.

relative to a year ago likely outweighed stronger shipments and led to the reduction in gross receipts.

Fresh Vegetable Exports Surge 15 Percent During First-Half 1988

During the first half of 1988, exports of fresh vegetables and melons rose 15 percent from a year earlier to 772.4 million pounds. If this pace continues, total 1988 exports of fresh vegetables and melons could range from 1.4 to 1.6 billion pounds. This would be the strongest volume since 1984 and the third consecutive annual increase since the big decline of 1985.

During the first half, substantial volume increases of 40 percent or more were noted for brussels sprouts, garlic, asparagus, and lettuce. The 40-percent increase for lettuce was most significant, since lettuce typically accounts for about a fourth of total fresh export volume. Reduced volume was recorded for peppers, sweet corn, and onions.

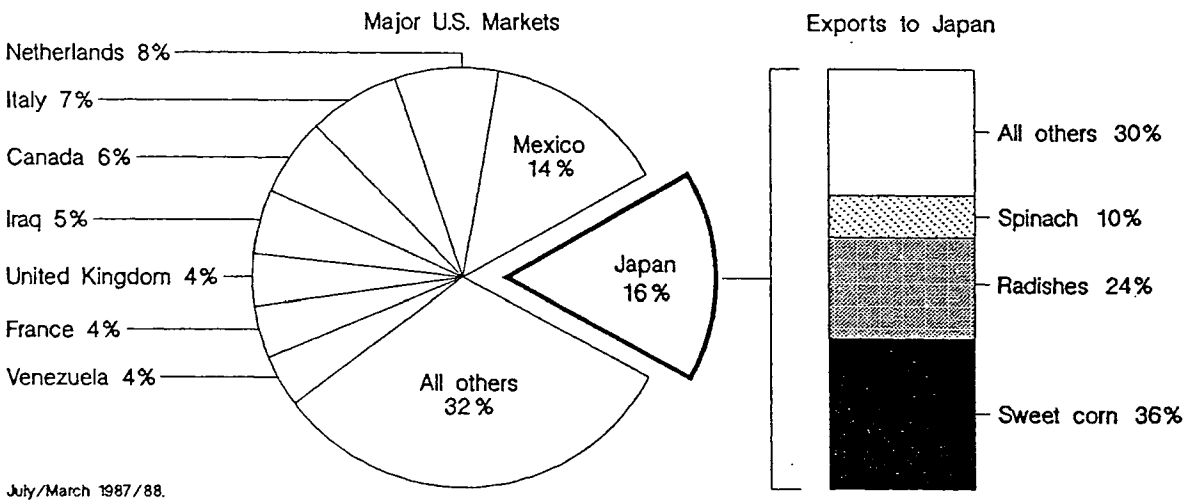
In contrast to fresh exports, fresh imports lost steam during the first half of this year. During this time, total fresh vegetable and melon imports declined 3 percent from the 2.6 billion pounds of a year earlier. The most important decline came in tomatoes, which fell 20 percent. Tomatoes, which usually account for about a quarter of all fresh imports, started off strong in January but have since trailed previous-year totals each month. Mexico, which supplies roughly 97 percent of U.S. fresh tomato imports, is shipping lower volumes for the second consecutive year as Florida and other competing areas have been able to increase shipments.

Vegetable Seed Exports' Value Up, Quantity Down

The volume of vegetable seed exports fell 3 percent during July-March 1987/88 from the 46.2 metric tons of 1986/87. With unit values increasing, the value of vegetable seed exports rose 7 percent to $125.4 million. Japan, the United Kingdom (U.K.), the Netherlands, Mexico, and Italy were the top five markets for U.S. vegetable seeds in 1987/88, accounting for 51 percent of total volume and 49 percent of total value.

Exports to Japan and Mexico were more diversified than the other top countries (see figure below). Radishes accounted for 30 percent of vegetable seed exports to Japan, while sweet corn accounted for 30 percent of the volume to Mexico. Vegetable seed exports to the Netherlands fell 26 percent in 1987/88. Beans accounted for 72 percent of the vegetable seeds sent to Italy. The United Kingdom was the most concentrated of the top markets, with 83 percent of their vegetable seed exports in green peas.

U.S. Vegetable Seed Export Values



July/March 1987/88.

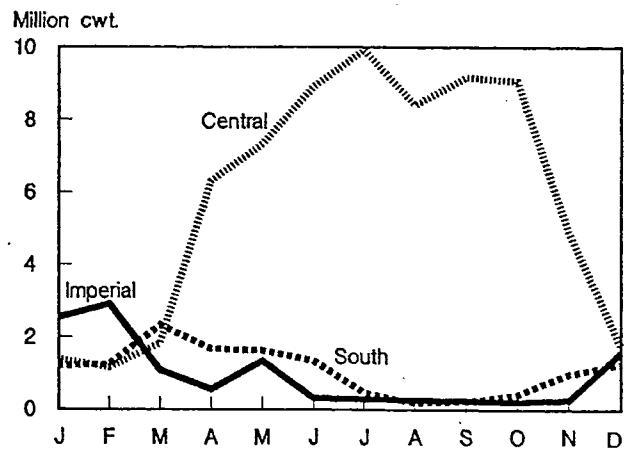
California Vegetables: Water Needs in 1989

Paige D. Rausser*

The United States relies heavily on California for fresh vegetables. California is the most important producer, accounting for 49 percent of the U.S. total in 1987. Cash receipts from the sale of California vegetables totaled $3.1 billion in 1987, fully one-third of all U.S. vegetable receipts. According to the 1982 Agricultural Census, California accounted for 27 percent of all 1982 vegetable acreage in the United States and 100 percent of California's vegetable crops are irrigated (table b).

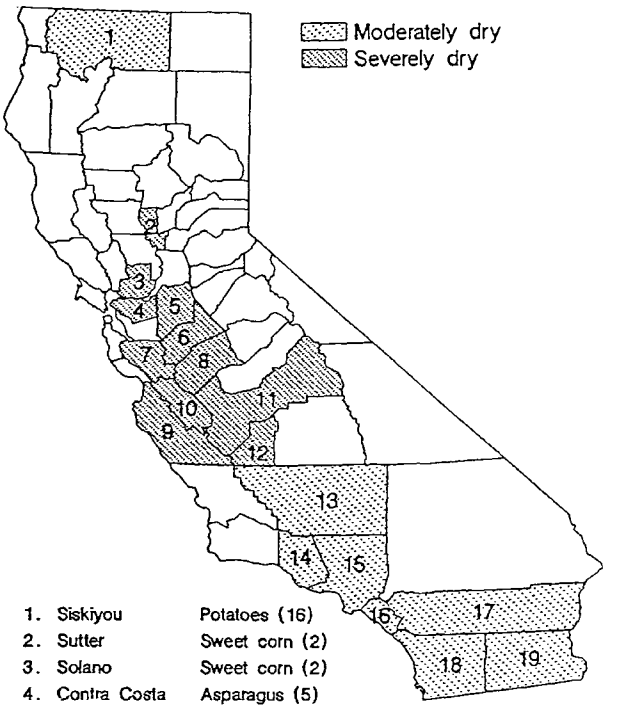
California commercially produces over 40 different kinds of vegetables, many of which are shipped to the rest of the United States and to other countries. California's ability to produce such a wide range and abundant quantities is attributed to its favorable climate and productive lands. California growers must irrigate their crops for most of the year as the majority of percipatation falls within a 4-month (December to March) period. However, the largest portion of vegetable production takes place outside this period. Since the past 2 years have been unusually dry and vegetable production is extremely dependent on irrigation water, availability of water for the 1989 vegetable crop needs to be examined.

California Vegetable Shipments by Region, 1987



*Paige Rausser was a summer intern with ERS and is a UC-Berkeley student in political economy of natural resources.

California's Major Fresh Vegetable Producing Counties



1.	Siskiyou	Potatoes (16)
2.	Sutter	Sweet corn (2)
3.	Solano	Sweet corn (2)
4.	Contra Costa	Asparagus (5)
5.	San Joaquin	Asparagus (42), tomatoes (22)
6.	Stanislaus	Cauliflower (6)
7.	Santa Clara	Sweet corn (6)
8.	Merced	Sweetpotato (74), tomatoes (15)
9.	Monterey	Broccoli (51), cauliflower (47), lettuce (45), celery (29)
10.	San Benito	Lettuce (1)
11.	Fresno	Cantaloup (45), onions (35)
12.	Kings	Cantaloup (2)
13.	Kern	Potatoes (45), carrots (36)
14.	Ventura	Celery (48)
15.	Los Angeles	Onion (4)
16.	Orange	Sweet corn (8)
17.	Riverside	Sweet corn (30)
18.	San Diego	Tomato (8)
19.	Imperial	Cantaloup (33), carrots (28)

Numbers in parentheses are percent of California's total. Palmer Drought Severity Index as of August 6, 1988.

Water Supply

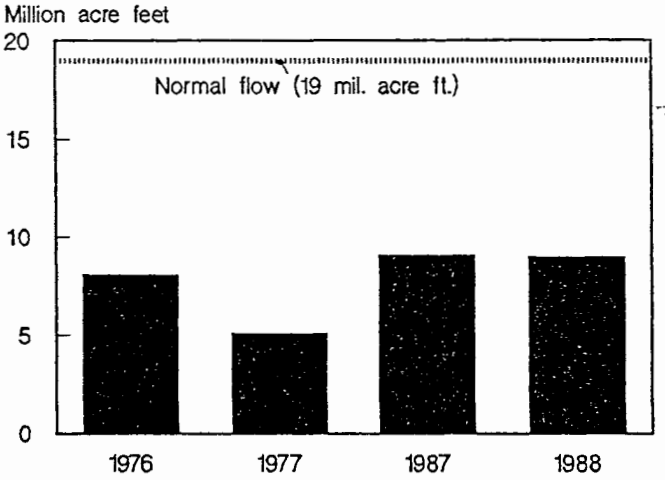
California's water supply comes from over 151 reservoirs and 400 groundwater basins. Reservoirs receive water from both rainfall and snowpack. Good snowpacks in the mountainous regions of the State and other Pacific Northwest States are necessary to provide water during the important growing season. The runoff from the melting snowpacks replenishes depleted reservoirs and helps to recharge aquifers during the spring, making summer and fall vegetable production

Table b.--Importance of California's vegetable crops

Crop	California	United States	California as a percent of U. S.	Major producing county	County share of State
	Acres harvested		Percent		Percent
Antichokes	11,192	11,204	100	Monterey	79
Asparagus	34,718	97,202	36	San Joaquin	55
Lima beans	22,594	56,113	40	Stanislaus	32
Snap beans	12,073	277,538	4	Stanislaus	23
Broccoli	65,796	80,277	82	Monterey	51
Brussels sprouts	5,936	6,138	97	Monterey	51
Cabbage	7,118	90,360	8	Ventura	42
Cantaloupes	59,763	113,981	52	Fersno	42
Carrots	32,582	83,601	39	Kern	36
Cauliflower	33,537	50,168	67	Monterey	52
Celery	23,311	39,455	59	Ventura	43
Sweetcorn	15,860	642,168	2	Riverside	29
Cucumbers	7,179	113,849	6	San Joaquin	17
Garlic	13,354	15,379	87	Fresno	42
Lettuce	164,203	229,887	71	Monterey	42
Onions	28,627	117,453	24	Kern	31
Green peas	8,259	281,350	3	Stanislaus	28
Spinach	8,491	34,915	24	Ventura	34
Tomatoes	252,432	403,469	63	Yolo	22
Watermelons	17,954	184,043	10	Imperial	17

Source: 1982 Census of Agriculture, U.S. Department of Commerce.

Sacramento River Index: Normal Flow and Drought Years



possible. Agriculture accounts for 85 percent of the State's water use.

California is in the second year of critically dry weather, due to low winter precipitation and below-average snowpacks in the Sierras and elsewhere. The Sacramento River Index is an important measure of water flow, and is comprised of the Sacramento, Feather, Yuba, and American Rivers (see figure above). If the index is sufficiently below the normal level of 19 million acre feet, as in this year and last, then the year can be considered critically dry, though other factors are also considered.

The water supply as of August 1, 1988 was 69 percent of normal, with the decline expected to taper off because the peak demand period is over. Between May and August of a normal year, water levels tends to fall the most; this year's level dropped 19 percent. This year's supply reduction is due primarily to nearly nonexistent snowpack runoff, which otherwise softens high demand in these months.

Current Situation

California's water situation is not as severe as it was during the 1976–77 drought, as measured by the Sacramento River Index. Experts believe there is only a 1- to 2-percent chance of 1989 being as dry as 1977.

The impact of the recent dry year has not yet been felt by producers of vegetables and other commodities because agricultural water use was not officially cut back or rationed. Because California's water year begins in January, which is near the middle of the wet season, it is difficult to determine, especially after one dry season, whether agricultural water users will receive their full entitlement

for the coming year. Growers invest so much time and money planting and preparing for production that knowledge of water entitlements is critical.

Agricultural water users and water districts decide on the amount of water to be delivered throughout the year, yet the total amount is paid for up front whether or not it is used. The lack of self-enforced conservation results from California irrigation water being highly subsidized. Because the pricing structure of water is not based on market value, growers tend to purchase as much as they can.

The problem began when 1988 turned out to be another dry year, following 1987's abnormal dryness. In January, California had received enough water so that growers were told they would receive 100 percent of their entitlements. But shortly after the entitlements were distributed, the weather turned less favorable, with most of the State being classified as in severe need of water according to the long-term Palmer Drought Index (see map).

California is trying to prepare for the possibility of a dry 1989 with carryin water supplies drastically low. However, no water restrictions have been put in place and farmers have used their full entitlements. Water restrictions could be enforced in the beginning of the 1989 water year, if supplies are as low as 50 to 60 percent of normal.

Outlook

If conditions do not improve in early 1989, California vegetable growers will undoubtedly face some restricted water use. Water would likely be allocated to perennial crops such as fruits over annual crops such as vegetables, due to the higher costs associated with the establishment and production of tree crops. Even so, in the 1976-77 drought there was no significant reduction in vegetable acreage; in fact, several crops had higher acreage. This suggests that water levels would have to be drastically low before vegetable acreage would be reduced. One reason for the minimal impact is that most of vegetable acreage lies in central and southern California.

Most vegetable crops in southern California do not feel the effects of drought as badly as those in northern California. Southern California receives most of its water from the Colorado River, and has extensive reservoir diversions from the north to fulfill its water needs. During the drought of 1977, a large amount of water was diverted from the Colorado River to meet the needs of southern California. Part of the water was routed to the Central Valley for some agricultural uses. Diversion from the Colorado River in the 1989 season may be limited as water will be flowing to the recently completed Salt River project in Arizona.

A limited alternative for certain counties will be to supplement their needs by pumping extra groundwater. California's extensive groundwater system, which lies below most agricultural areas, is a primary and secondary source of water for irrigation. When surface water is not available farmers drill wells and pump groundwater, but when too much is pumped the system becomes overdrafted. When there is too much overdrafting, problems occur, such as salt water intrusion near the coast and land subsidence in poor soil areas. Even though these problems exist, farmers continue to pump groundwater because of the monetary benefits to their crops.

If 1989 is dry and California vegetable producers are faced with severe water restrictions, then consumers may face higher fresh vegetable prices in the second and third quarters of the year. Most of California's spring and summer production comes from central California, which is the area hardest hit by the water shortage. (see map) The crops in the Central Valley and along the Central Coast which may suffer lower yields are broccoli, cauliflower, and lettuce. Even though tomatoes are a late summer crop coming mainly from the dry Central Valley, there may not be huge yield reductions because tomatoes' high value allows farmers to pay more for water.

No impact on fresh vegetable consumer prices from dry weather will be felt in the first quarter, as most of California's vegetable production comes from the Imperial Valley, whose water supplies from Colorado River are adequate. During this time vegetable supplies are also supplemented by Florida and Mexico. In the early winter months, January and February 1989, celery, carrots, and sweet corn likely will not suffer shortages due to the drought, because of their concentration in the Imperial Valley.

PROCESSED VEGETABLES

Drought Reduced 1988/89 Processed Vegetable Production

The 1988 drought has had its greatest impact on snap beans, sweet corn, and green peas for processing in Wisconsin, Minnesota, Michigan, and Illinois. Most of these States' vegetable acreage is devoted to canning. The 1988 prospective canning acreage as of July 1 fell short of last year's plantings (table 17). Harvested area and preliminary output estimates indicate even further reductions.

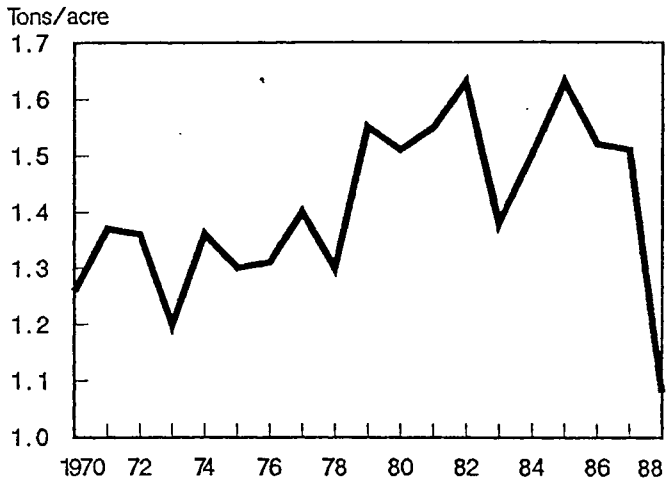
The impact of hot, dry weather this summer on the three principal canning crops was exacerbated by the lack of irrigation in the North Central States (irrigation estimates are for both fresh and processing acreage). Irrigation is minimal on green peas, with just 15 percent of harvested area irrigated. Since peas are generally out of the ground by June, irrigation requirements are usually light. However, the drought developed early this summer and ravaged many fields. More area is irrigated for sweet corn, about 38 percent in four North Central States. Among the three crops, snap beans hold the largest percentage of land irrigated, with roughly 50 percent.

Green pea production plummeted 32 percent below 1987's 436,870 tons, and was 9 percent below the 1982–86 average. The hardest hit States were Minnesota and Wisconsin, which accounted for nearly half of last year's crop. Both harvested area and yields were cut by the drought, as peas are extremely sensitive to hot, dry weather. Acreage fell 9 percent and yields were cut in half in Wisconsin, the leading State.

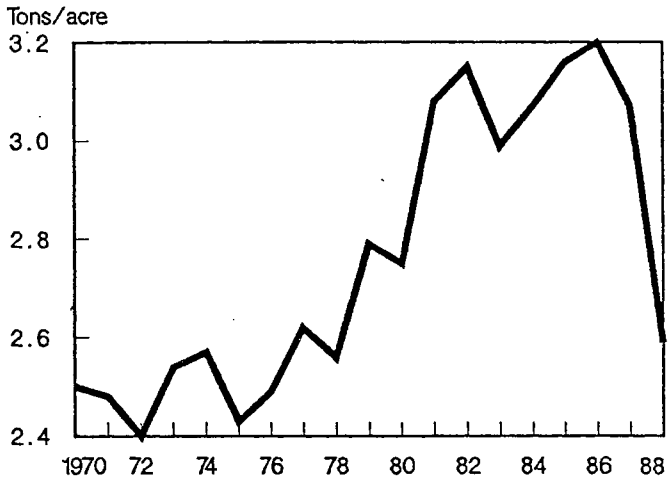
Snap bean output produced under contract is forecast down 14 percent from last year. Contract production accounted for 90 percent of last year's total. Combined production in Michigan, Minnesota, and Wisconsin is forecast down 20 percent. Half of the 1987 crop came from these three States.

The West Coast States provide the only bright spot in this year's snap bean crop. Oregon's harvest started late but yields and quality were good. Processing plants in California and Washington report good–to–ideal growing conditions.

Processing Green Pea Yields



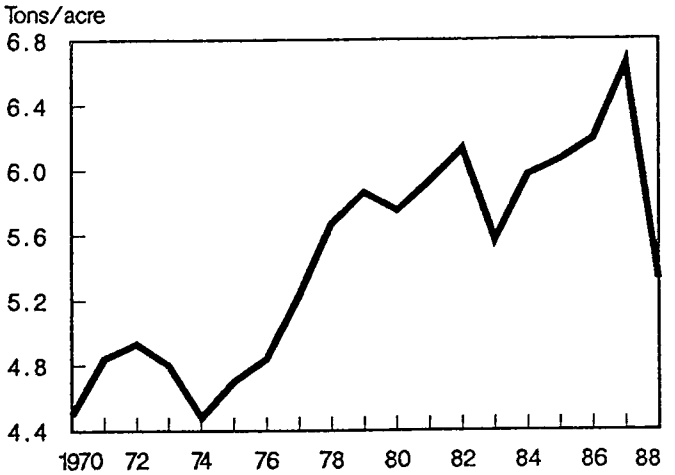
Processing Snap Bean Yields



Since several crops of snap beans can be harvested in a season, growers seized the opportunity to boost receipts by planting a second crop. Therefore, 1988 contracted acreage harvested rose 2 percent above 1987 to 203,300 acres. The drought took its toll on yields, reducing them 16 percent to 2.59 tons per acre.

Sweet corn for processing production dropped to 2.4 million tons, 17 percent below last year and 8 percent below 1986. Even though harvested area rose 4 percent to 446,000, yield dropped 20 percent to 5.30 tons per acre and offset the larger area harvested. Drought across the Mid–west and into New York reduced yields in those States.

Processing Sweet Corn Yields



Canners' Prices Move Up Through Summer, Grower Prices Set

By mid-August canners were quoting f.o.b. prices 25 to 35 percent higher than at the beginning of the summer for peas, snap beans, and sweet corn (table 2). The most dramatic price hikes were in the Midwest region where the drought's impact was most pronounced. Even though most of the canning takes place in the Midwest region, f.o.b. prices for freezing vegetables also moved up.

The consumer price index (CPI) for processing vegetables, generally flat in the summer, rose 1 percent in July to 111 (1982-84=100) (table 18). The CPI is expected to continue rising through the summer as higher wholesale prices work through the marketing channels. However, price rises at the wholesale and retail levels will be mitigated somewhat, as carryin stocks for canned green peas, snap beans, and sweet corn were about 14 percent of the 1987/88 combined total use.

This year's low packs will be supplemented for about 50 days into the upcoming marketing year from the combined carryover stocks, assuming last year's demand schedule. The carryover of canned sweet corn was the smallest since 1981, with only 13 percent of last year's total use or a 47-day supply. Canned green pea carryover was 15 percent of last year's total use or a 55-day supply. Canned snap bean carryover was 17 percent or a 62-day supply.

Even though processor and retail prices for processed vegetables have moved up this summer, and likely will remain up until the 1989 processing crops are harvested, growers did not generally receive higher prices this year due to the drought. Grower prices for processing vegetables are negotiated at the beginning of the processing season, and are usually renegotiated only at harvest for quailty and yield discrepancies. Since the drought lowered both quality and quantity, grower contracts may have been further reduced. Growers will, however, receive significantly higher contract prices in the 1989/90 season, as stocks will be very low going into the contracting spring season.

Any price strength that green pea and sweet corn growers saw during this past contract year was from lower carryin stocks, while snap bean growers faced slightly lower prices as carryin stocks were higher. Overall cash receipts for green pea, sweet corn, and snap bean growers will be down in 1988 as the quantity reductions far exceeded any modest increases in grower prices. With the likelihood of higher grower prices in 1989, processing vegetable cash receipts for the coming year should rise above the 1988 level.

Processing Tomato Tonnage Up for 1988

Tomato processors contract for tonnage rather than acreage, and this season they upped their tonnage 9 percent to 8.2 million tons, while acreage was up 6 percent (table 17). About 88 percent of U.S. tomato production is grown in California. California acreage is virtually all irrigated and was not affected by this summer's drought.

The total supply this year for processing tomatoes will be higher, even though carryin stocks were down 40 percent from last year (table 14). Stock levels for tomatoes are the lowest since 1975. Low carryin likely contributed significantly to the higher tonnage contracted. Tomato stock data will not be reported by the industry, as the California League of Food Processors (CLFP) has suspended its statistical reports. Since California data constitute at least 50 percent of the U.S. total, the National Food Processors Association (NFPA) will no longer publish total industry statistics.

Last year's low tomato stocks helped to

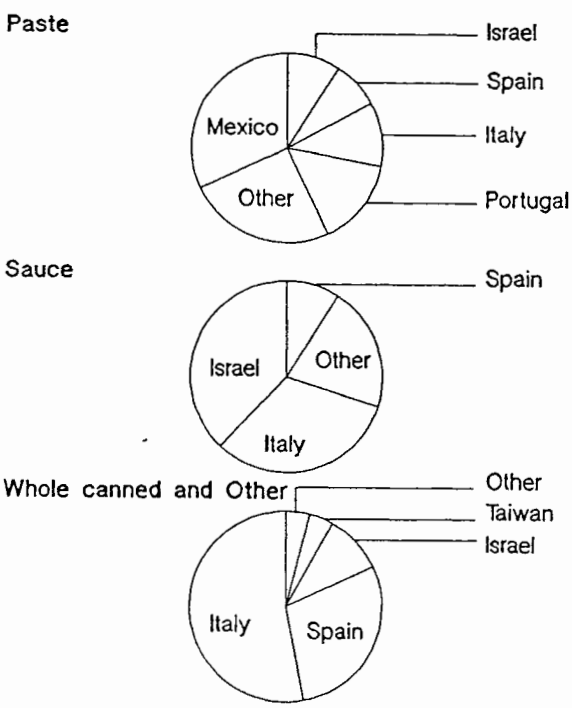
stabilize prices for paste, which takes the bulk of tomato tonnage, and strengthened whole tomato prices (table 19). Prices for tomatoes, particularly paste, have slumped over the years as the pack has increased and large imports have glutted the market.

Imports of tomatoes have been declining as prices slumped and the dollar has weakened against major exporting countries, making imports less competitive in the United States (table 3). Paste imports have been hurt the worst. Tight supplies relative to world demand for paste lowered imports 6 percent for processed tomatoes in first-half 1988 from a year earlier, to 144 million pounds. U.S. exports, although small by comparison, were up 28 percent during this period with the bulk of the increase going to Canada. Imports of processed tomatoes come primarily in the form of whole canned, and are mostly from Spain (see figure above/below). Paste imports are the next largest category and come largely from Italy.

World Processed Tomato Output Expected Up for 1988

The USDA forecast was for a 10-percent increase in 1988 Mediterranean Basin processing tomato production to 7.7 million tons. The market for processed tomatoes in the Mediterranean Basin has changed from years of high stocks coupled with low prices to a market of higher prices and increased demand for paste in Europe.

Processed Tomatoes: Average Share of U.S. Imports, 1987



Changes in the European Community (EC) tomato policy over the past few years has affected the processed tomato market. In 1985, the European Council decided that processors' aid would only be granted for quantities that come under threshold levels. Threshold quotas have remained stable since their inception. The only change has been a slight re-allocation within the tomato processing quota for Greece and Italy for 1988/89. The total national raw material usage remains equal to previous years.

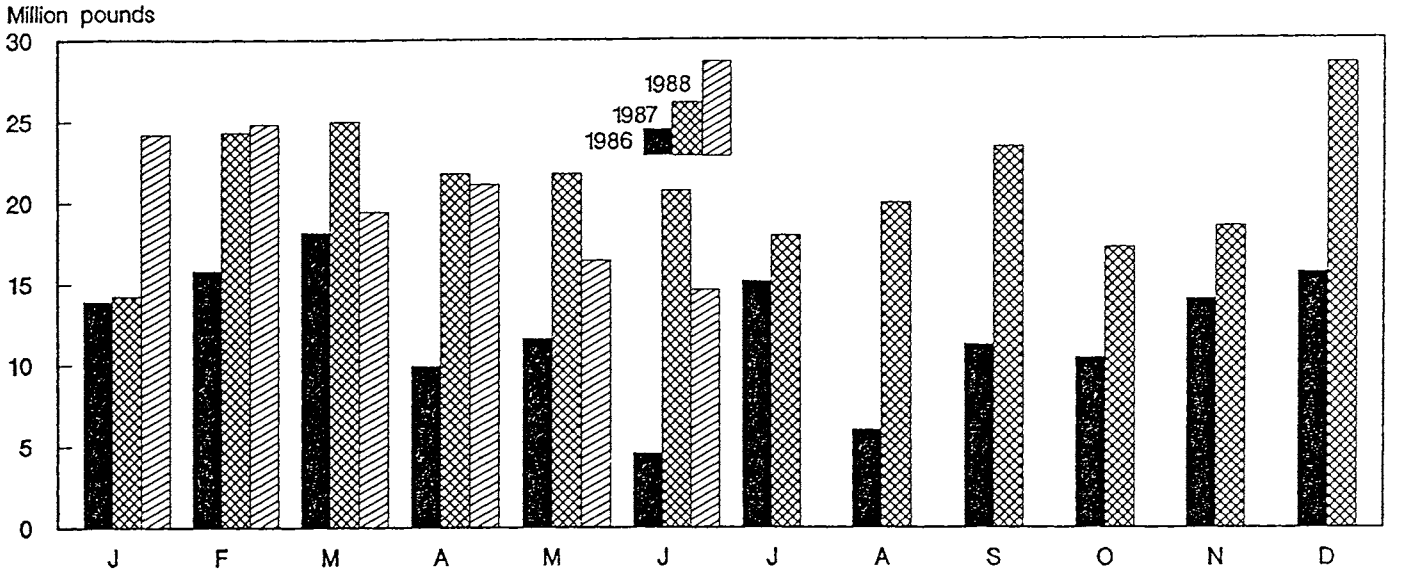
Italian tomato output prospects for 1988 are 1.3 percent higher than last year's 3.5 million tons, as stocks are tight and are no longer a burden to the industry. Stocks for canned tomatoes have been eliminated, while those for paste have been reduced to a minimal level.

Prices rose somewhat during 1987 and are expected to continue to do so as long as the export market remains buoyant. Lower paste output in other Mediterranean countries last year stimulated exports and facilitated the dramatic drawdown in stocks.

The financial downturn through the early 1980's in the Italian tomato sector and strict processing quotas have forced many smaller private plants to close. The number of plants decreased to about 300 in 1987 from 420 in 1986, with over 60 of the remaining plants being cooperatives. Since their budgets are guaranteed by the different regional governments, they can keep producing even at a loss, creating additional difficulties for the remaining private plants. The processors' association and the Italian Ministry of Agriculture are still considering implementing a program to phase out noncompetitive plants, both private and cooperatives.

Spain's 1988 production of processing tomatoes is forecast at 781,200 tons, 5 percent above the 1987 crop which was damaged by storms and unseasonably cool weather. However, anticipating possible weather-based reductions in this crop, as in the preceding years, growers and producers

Frozen Broccoli and Cauliflower Imports



have precontracted a higher quantity of raw tomatoes than needed for the expected pack.

Frozen Broccoli and Cauliflower Imports Soften in 1988

Imports of frozen broccoli and cauliflower have increased dramatically over the past few years. The bulk of the imports come from Mexico, which in 1987 accounted for 84 percent of total U.S. imports. Total frozen vegetable imports dropped 10 percent in first-half 1988, with frozen broccoli and cauliflower imports down a combined 6 percent.

The increased amount of frozen broccoli and cauliflower supplied to the United States over the past few years was from Mexico, which has had two decided effects on the market. Larger total supplies (which are defined by U.S. processing production plus beginning stocks plus imports) have softened U.S. grower prices for both broccoli and cauliflower. Prices have been trending down since the early 1980's. Also, the percentage of imported frozen broccoli and cauliflower available for consumption (which is defined as imports divided by total supplies) has increased from 6 percent in 1980 to 32 percent in 1987. This significant increase has recently received both industry and government attention.

The long-term trend for higher shares of frozen broccoli and cauliflower available for consumption is enhanced by multinational companies having established freezing plants in Mexico, primarily in the Bajio region. This region's vegetables compete aggressively in U. S. markets due largely to lower labor and land costs and the severe depreciation of the peso vis-a-vis the dollar.

POTATOES

Drought, Lowered Acreage Portends Production Decline

U.S. potato production is expected to decline in 1988 despite strong winter and spring outputs (table 21). Drought across much of the United States, in tandem with reduced harvested area, is expected to cut production of summer potatoes by 14 percent. Excessive heat is also taking a toll on the all-important fall crop by reducing the size of potatoes, dropping potential yields. The fall crop accounts for about 88 percent of all U.S. potato production. Assuming current expectations for fall-harvested area and a conservative 3-to-5 percent cut in yields from the 314 cwt of 1987, total 1988 potato production could decline at least 5 to 7 percent. If realized, the U.S. potato crop could be the lowest since 1983--the last year drought struck the heart of the country.

Although accounting for just 6 percent of total potato output, the summer potato crop is an important supply bridge between the fall

storage crop of the previous year and the upcoming fall crop. Despite the severity of drought in many States, irrigation and timely rainfall in some States will allow the summer crop to about match that of the spring season. The most severe damage to the summer crop was experienced in Michigan, Alabama, Illinois, and Nebraska, where yields were pared by the hot, dry weather. Progress of the crop was slowed in New Mexico due to unusually wet conditions. Yields were strong in Virginia, the only summer State to register increased production. The reduction in the summer crop was an important factor keeping potato prices high through the start of the fall season.

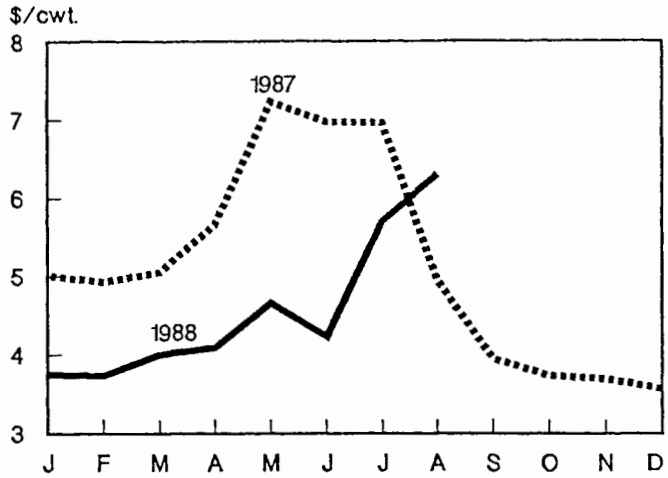
Total acreage harvested for all seasonal groups is expected to total 1.2 million acres, down 3 percent from 1987 (table 22). In a reversal of 1987, the winter crop was the only seasonal group with higher area harvested in 1988. Fall acreage is expected to decline 2 percent from the 1.1 million acres of 1987, with 20 of the 23 fall States expecting to harvest fewer or as many acres as a year ago. Washington and Oregon, two States which produce heavily for the processing market, expect to harvest 7 and 16 percent fewer acres this fall, respectively. On the flip side, Idaho, which accounts for more than a fourth of total potato acreage, is expected to harvest nearly 3 percent more acres this year.

The Midwest and Central States, which account for about a third of the acreage and a fifth of potato production, have been hit hardest by the drought. Although 64 percent of U.S. potato acres are irrigated, less than a third of the acreage in these regions is covered. According to 1982 Census data, North Dakota potato acreage under irrigation is less than 1 percent. New England growers also rely heavily on natural rainfall, with just 4 percent of potato acreage under irrigation.

Changes in Varieties Used

The percentage of acres planted to round white potatoes increased to 27 percent this year from 26 percent in 1987. This shift reversed the trend of the past few years, which saw white cultivars steadily losing ground to russets and (to some extent) reds. This year, the shift occurred largely at the expense of russet varieties. Maine was the primary source, with plantings of whites accounting for 80 percent of the State's

Potatoes: Prices Received by Farmers



potato area--a stunning increase from the 69 percent of a year earlier. Russet potatoes account for the remainder of Maine's crop. The change likely occurred because of a temporary decline in processing capacity caused by a change in plant ownership, the success of programs promoting Maine white potatoes in States such as Florida, and an increase in chipping contracts requiring white varieties such as Monona. Michigan also planted more round white potatoes and fewer russets this year, due mostly to the closing of an important potato processing plant in the State last year.

Acreage entered for certification as seed potatoes fell 3.6 percent this year to 167,132. Since this is just below the acreage actually certified in 1987, it assures that the acreage of certified seed potatoes in 1988 will fall at least 3 to 6 percent below last year. If higher market potato prices spur producers to increase acreage in 1989 and certified seed availabilities are lower, prices paid by growers for all potato seed, certified and uncertified, will increase from the $7.12 per cwt average paid this spring.

Prices Likely To Rise in 1988/89

Prices received by potato growers likely will average above a year earlier during the 1988/89 season as the smaller fall storage crop results in reduced stocks and stronger competition for available supplies from both processing and tablestock users. During the past season, strong production combined with sluggish demand to leave potato stocks at or near record levels. This kept downward

pressure on prices during the 1987/88 crop year and resulted in a season-average price below the $5.03 of 1986/87.

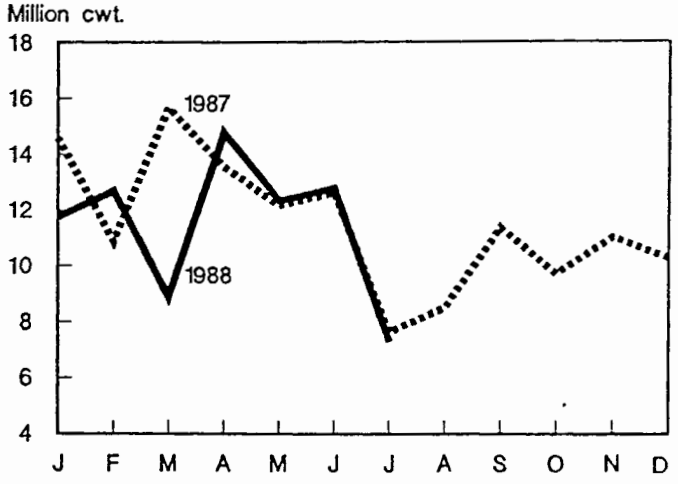
Through the first half of 1988, prices received by potato growers for all uses averaged $4.08 per cwt, 30 percent below the same period last year (table 23). Potato prices remained fairly static from March to June, hovering around the $4.00 level. However, the drought has affected the summer and fall crops, with smaller production for both apparent. As a result, prices moved to a season high of $6.30 per cwt in mid-August, still 27 percent below August 1987.

Retail prices are also expected to rise in the coming year, reflecting the tighter supply-demand picture. Through July of this year, the CPI for fresh potatoes averaged 7 percent below a year earlier, despite a 2-percent decline in fresh shipments caused mainly by a sharp drop in shipments during March (table 24). Wholesale prices for frozen french fries were also down, averaging 2 percent below the first half of last year.

Potato Trade Still Hot;
Frozen Exports Up 29 Percent

U.S. exports of frozen potatoes (mostly french fries) have continued their rise through the first half of 1988, increasing 29 percent from first-half 1987. The volume of french fries, which accounted for 85 percent of first-half frozen potato exports, rose to 1.22 million cwt. Japan continues to be the primary destination for frozen potato products, accounting for 86 percent of first-half volume. French fry exports during the last half of 1988 may receive a further boost, since South Korea recently lifted its extremely low import quotas on frozen french fries. The timing coincides with an expected surge in demand for fries and other fast foods from patrons of the Olympics in Seoul. South Korea, a relatively youthful country, could eventually prove to be a strong market for U.S. frozen french fries.

Fresh Potato Shipments



Fresh potato exports have not fared as well as frozen this year. The volume of fresh exports declined 37 percent during the first 6 months of 1988 to 499,800 cwt. In comparison, last year at this time fresh export volume was up 51 percent, and on its way to a 23-percent gain for the entire year. The volume shipped into Canada, the United States' primary export market for fresh potatoes, declined 39 percent but still accounted for 93 percent of U.S. fresh potato exports. Canadian demand has been off, due in part to their near record 65.9 million cwt 1987/88 crop which was induced by record yields.

U.S. imports of fresh potatoes (for food and seed) dropped 13 percent during the first half of 1988 to 3.2 million cwt. Canada continues to be the major source of fresh imports, providing nearly all of first-half volume. Processed potato imports increased 21 percent through the first half of 1988. Imports of frozen products rose 24 percent, while dried potato imports surged 62 percent. However, this was partially offset by a 62-percent decline for dehydrated, flour, and other potato products.

Costs of Producing Potatoes, 1985

Nearly 1.1 million of the 1.4 million acres planted in potatoes in 1985 and 353 million of the 407 million cwt of potatoes produced were harvested during the fall. Idaho led all States in acreage and production. Other major fall producing States were Colorado, Maine, Michigan, Minnesota, New York, North Dakota, Oregon, Washington, and Wisconsin.

The cost and returns estimates are based on data obtained from the 1985 Farm Costs and Returns Survey (FCRS) and from various secondary sources. The 1985 survey, conducted in February and March of 1986 by the National Agricultural Statistics Service (NASS), contained a sample of potato farms from the major fall producing States. The FCRS simultaneously obtains financial data, production practices data in sufficient detail to develop enterprise budgets, and type of operation and operating characteristics.

Costs were estimated with the enterprise budget technique. Individual farm budgets were computed and weighted by planted acres to arrive at region and state estimates.

Estimates were derived for 15 areas: 1) Northern Maine; 2) New York State (Long Island); 3) New York State (upstate); 4) Michigan; 5) Wisconsin; 6) Red River Valley; 7) Colorado; 8) Idaho (seed region -- defined as production in Butte, Fremont, and Teton Counties); 9) Idaho (other eastern counties); 10) Idaho (central); 11) Idaho (western counties including Malheur Co., Oregon); 12) Oregon (Kalamath Basin); 13) Oregon (central); 14) Oregon (northern); and 15) Washington State.

Receipts Low in 1985

Average gross receipts ranged from lows of $554 per acre in the Red River Valley and $585 in Maine to highs of $1,741 in Washington, $1,592 in Wisconsin, and $1,577 in Northern Oregon (table c). Receipts were the average for all potato sales reported by the surveyed farmers, and sometimes included returns for storage, grading, packing, and

Table c.-Potatoes: Summary of cash costs and returns per planted acre, selected regions, 1985

Region	Gross receipts	Cash expenses	Receipts less cash expenses	Capital replacement	Receipts less cash expenses and cap. repl.
	Dollars per planted acre				
Northern Maine	585.72	811.13	-225.41	166.10	-391.51
New York State					
Long Island	959.58	1491.08	-531.50	206.90	-738.40
Upstate	913.66	1180.70	-267.04	149.38	-416.43
Michigan	1275.29	996.77	278.52	127.91	150.60
Wisconsin	1592.17	1180.66	411.51	147.55	263.95
Red River Valley	554.88	591.57	-36.69	73.09	-109.79
Colorado	1142.69	974.54	168.15	120.28	47.87
Idaho					
Seed region	661.46	709.67	-48.21	159.43	-207.64
Eastern	906.09	934.18	-28.09	129.96	-158.05
Central	935.16	1072.18	-137.02	78.02	-215.04
Western	1265.08	1159.10	105.98	96.59	9.39
Oregon					
Kalamath Basin	1161.90	1123.80	38.10	202.10	-164.00
Central	1309.74	992.65	317.09	137.39	179.70
Northern	1577.20	1585.93	-8.73	83.61	-92.34
Washington State	1741.06	1539.62	201.44	144.32	57.12

selling when these services were provided by the grower. Part of the reason for the low receipts was that the Red River Valley and Maine tend to have lower yields than the other areas, and part was due to low prices.

Cash receipts fell below the long-term average in some of the study areas in 1985, particularly areas such as northern Maine and Long Island where a large portion of the crop is sold in the open market. Open-market prices typically decline during large-crop seasons. The 1985 potato crop was the largest on record, and prices fell precipitously from previous seasons. Receipts appeared to hold up better in areas such as western Idaho, northern Oregon, and Washington State where a large part of the crop is contracted. Contract prices tend to hold up better than open-market prices during large-crop years.

Revenues also held up better in areas where a large portion of the crop is sold in the calendar year following harvest. Receipts in this survey were those reported by farmers for calendar 1985 and included revenue for 1984-crop potatoes sold after January 1, 1985. Due to a short 1984 crop, prices in early 1985 were relatively high, which tended to sustain 1985 gross receipts. Similarly, some of the low returns from 1985 sales were postponed to 1986.

Wide Range in Cash Expenses

Cash expenses ranged from $591 per planted acre in the Red River Valley, where yields on survey farms averaged 169 cwt, to $1,585 in northern Oregon, where yields averaged 503 cwt per planted acre. Average for all areas was $1,539. Cash expenses included variable and fixed expenses and a capital replacement charge. They represent short-run out-of-pocket costs and indicate the minimum return needed to break even.

The wide variation in cash expenses among regions was due to differences in production intensity and different marketing practices. Most potato production in the Red River Valley and in Maine is on nonirrigated land, and hence there are no water or irrigation labor and equipment costs. In addition, inputs such as seed, fertilizer, pesticides, and fuel usually were used less on nonirrigated than on irrigated land.

Marketing practices seemed to be the other important factor affecting costs. Long Island growers, for example, market almost all of their crop as fresh potatoes, selling f.o.b. the packingshed. Therefore, their costs include expenses for storage, grading, packing, and selling as well as for growing and harvesting, and are higher than for areas in which the grower provides fewer marketing services.

Cash variable expenses are those such as outlays for seed, fertilizer, chemicals, custom operations, fuel and lubrication, repairs, hired labor, purchased irrigation water, and land rent that are incurred only when production takes place. Fixed cash expenditures include outlays for items such as taxes, insurance, overhead, interest, rent, and leases for which the operator or landlord pays regardless of whether production takes place.

Many Negative Cash Flows in 1985

Eight of the 14 study areas reported negative average cash flows on potatoes for 1985 (column 4 of table c). Cash flow positions ranged from an average of $-531 per acre in Long Island to an average $411 net return in Wisconsin. The average for all areas was $201. Cash flow was estimated as cash receipts minus cash expenses.

In Long Island, where most potatoes are marketed during the fall for fresh use, prices fell to near packing-cost levels in late 1985. Consequently, gross receipts included mostly returns from the low-priced 1985-crop sales and a relatively small amount of receipts from the higher priced 1984 potatoes sold in 1985. In contrast to Long Island's marketing pattern, other areas such as the Red River Valley, Maine, and Wisconsin sell a larger portion of the crop in the calendar year following harvest; hence a larger share of their 1985 receipts represented returns from 1984 potatoes sold after January 1, 1985. In addition, contract pricing for part of the crop likely contributed to the higher returns in areas growing potatoes under processor contracts. Producers tend to receive higher returns for contracted potatoes than for open-market sales during large-crop years.

Return to Owned Inputs Low in 1985

Only four of the study areas reported a

positive return to owned inputs in 1985 (table c, column 6). Equity return ranged from an average of $-738 per acre in Long Island to $263 in Wisconsin. The average for all areas was $57. Although growers do not have to have a positive net return every year in order to continue in business, years like 1985 need to be offset by other years in which returns are positive.

Equity returns were estimated as gross receipts less cash expenses and the capital replacement charge. They represent the net proceeds available to compensate unpaid labor, management and risk, and equity investment in land, equipment, buildings, and production inputs.

The capital replacement is a set-aside for new equipment purchases needed to maintain the production plant. Though machinery replacement may be deferred in any given year due to the income and tax position of the operator, typically some equipment will be replaced each year. New machinery purchases during a given year come from the fund of machinery replacement set-asides. In general, capital replacement was highest in areas that marketed a high proportion of their potatoes for fresh use, because it included costs for buildings and equipment used in storage and packing as well as those for growing and harvesting.

Cost Comparisons Among Areas

Although costs and returns per acre provide a measure of producers' financial condition during a given year, frequently the point of interest is comparison of costs among regions. Table d provides a summary of total economic costs per cwt for growing and harvesting in the various study areas.

Producers in Maine reported the lowest average total cost ($2.84 per cwt), while producers in Long Island reported the highest ($4.05). The average for all regions was $3.50.

Table d.-Potatoes: Estimated growing and harvesting costs per hundredweight, selected regions, 1985

Region	Yield, cwt per acre	Cash expenses	Capital replacement	Cash plus capital replacement	Returns, owned assets	Total economic costs
			Dollars per hundredweight			
Northern Maine	280	2.26	.35	2.61	.23	2.84
New York State						
Long Island	294	4.05	.50	4.54	.58	5.12
Upstate	275	3.52	.40	3.92	.37	4.29
Michigan	275	3.01	.34	3.36	.38	3.74
Wisconsin	352	2.42	.31	2.72	.26	2.98
Red River Valley	169	2.74	.29	3.03	.32	3.35
Colorado	290	2.94	.34	3.28	.53	3.81
Idaho						
Seed region	214	2.87	.47	3.33	.39	3.72
Eastern	259	2.96	.32	3.28	.57	3.85
Central	327	3.09	.28	3.37	.66	4.03
Western	389	2.98	.25	3.23	.62	3.85
Oregon						
Kalamath Basin	356	2.62	.34	2.97	.66	3.63
Central	339	2.80	.30	3.10	.37	3.47
Northern	503	2.98	.15	3.13	.45	3.38
Washington State	534	2.57	.21	2.78	.32	3.10
All regions		2.81	.28	3.08	.42	3.50

Maine producers generally reported lower labor, fertilizer, fuel, and land rental costs than the other areas. Long Island's higher costs were the result of high hired labor, chemical, fuel, land rental, and overhead expenses.

Total economic cost included, in addition to cash expenses and capital replacement charges, the contribution of owned assets such as unpaid operator and family labor and equity investment in land, equipment, and operator capital. The value of the owned assets' contribution, sometimes referred to as allocated returns, represents the earnings these inputs likely would have yielded if used for something other than potato production. Generally the values were estimated as the market returns on similar resources such as average land rental rates, returns to capital in all agriculture, or the wage rate paid to hired farm workers in the area. The economic costs defined here do not include a return for risk and management input.

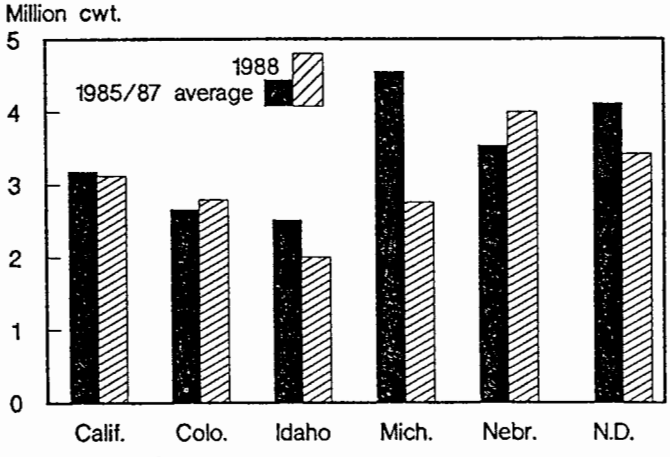
PULSES

Drought Prevails, Midwest Dry Bean Production Falls

Dry edible bean growers planted smaller crops this past spring because of sagging exports and bean prices, which had fallen to a 5-year low (table 28). Michigan planted acreage for 1988 was only 55 percent of 1987 planted acreage. Idaho planted acreage was only 86 percent of last year's acreage and California indicated a 5-percent acreage reduction. When the threat of a drought materialized early this summer, some growers enlarged their original planting intentions.

Bean production is expected to fall dramatically below the previous 3-year average this year in Michigan, Idaho, and North Dakota, while California production is expected to be down slightly. Production increases are also anticipated in Colorado and Nebraska (see figure below). Michigan, where few bean acres are irrigated, is expected to suffer the most damage from the drought, with a 13-percent decline in yield from the previous year, and a 50-percent drop in production. California, where most bean acreage is irrigated, increased acreage slightly when the drought threatened other areas, and is expected to have a 6-percent increase in yield and slightly more production than last year.

Dry Edible Bean Production



Top six producing States.

Since Michigan primarily grows navy beans, this variety is expected to show the greatest drought-related drop in production this year. Navy shortages could influence food processor decisions on new bean products this year. Navy shortages could also influence promotion programs.

A disaster payment program was introduced in Congress this summer to deal with drought damage to crops. This program is similar to the 1986 flood program, except that loopholes in that program have been closed.

Prices Gain Momentum

Dry edible bean prices received by growers fell to a 5-year low in December 1987 of $13.10 per cwt (table 23). In contrast, bean prices have climbed every month this year, increasing from $13.40 per cwt in January 1988 to $27.50 per cwt in July. Prices started climbing faster in June, after the drought had started. Navy bean prices, for example, climbed from $26.00 per cwt in late June to $43.00 per cwt in mid-July.

While bean prices have picked up this year, low export levels have persisted. Dry bean exports fell 30 percent in volume and 34 percent in value during October-April 1987/88 from the previous year, to 223,263 metric

tons. Purchases by Latin America and Western Europe, the largest importers of U.S. beans, fell, but imports by Asia and Africa rose.

Falling Exports, Canadian Subsidies Cause Concern

Canada's Tri-partite subsidy program was expanded to cover dry beans in 1987. Producers collaborate with the Canadian Federal Government and participating provincial governments to subsidize the difference between the market prices for beans and the cost of production; each pays one-third the cost of the program. The cost of this program in 1987 is estimated to be twice as high as originally anticipated, at $20-$30 million. U.S. growers are concerned that this program could keep Canadian bean acreage unrealistically high, since Canadian growers only pay one-third the cost of the program. Also, in years when bean prices are low, as in 1987, Canadian supplies could come into the United States or compete for U.S. export markets.

Dry bean production in 1989 could increase substantially if stocks get very low and prices remain high. There were 3.6 million cwt of dry beans in storage in commercial elevators in Michigan on December 31, 1987, up 137 percent from the previous year. Stocks were at a low in 1986 because of flooding damage to beans in Michigan. Dry edible bean stocks are dropping this year because of drought-related damage to 1988 production.

A continued strong soybean market, however, could cause a reduction in dry bean acreage again next year. Implementation of the Endangered Species Act, perhaps as early as 1989, could also cause some reduction in future dry bean acreage. The use of certain pesticides important in dry bean production could be restricted in specific areas of counties containing endangered species. Although the areas which are currently expected to be affected by this program are soybean, wheat, and other cropland areas, EPA can continue to add species which could coincide with dry bean area.

Dry Peas, Lentils, and Chick Peas Planted Area Mixed

Overall planted acreage of regular green, small Sieve, and yellow peas in 1988 was 6 percent above last year's acreage. Planted acreage of regular green peas increased 10 percent to 160,151 acres, yellow peas increased 3 percent to 21,215 acres, while small Sieve green peas declined 42 percent to 6,032 acres (table 29). Prices received by growers for both green and yellow peas have trended upward during 1988. Green peas were $7.15 per cwt in January and $8.00 per cwt by June, while yellow peas increased from $7.70 per cwt in January to $9.30 per cwt in March, the last reported price (table 23).

Planted acreage of lentils in 1988, however, is only 48 percent of last year's 192,115 acres (table 29). Only once in the last 10 years have so few lentil acres been planted. Lentil prices have increased over 100 percent during the first half of this year, from $7.70 per cwt in January to $15.50 per cwt in June (table 23).

A change was made this year in U.S. standards for lentils, in order to help U.S. lentil growers compete in the world market. The standards now include an additional grade level, U.S. No. 3, which permits slightly more defective and heat-damaged lentils per load, and slightly more skinned lentils. This grade became effective on August 1, 1988.

Exports of dry peas were up from October-April 1987/88 compared with the previous year, but lentil exports were down. Dry pea exports increased 18 percent to 76,325 metric tons during this period, with much of the increase in exports going to India, Taiwan, and the United Kingdom. Lentil exports declined 13 percent during this period, with both Western Europe and Asia importing fewer lentils.

Planted acreage of chick peas for 1988 is only 48 percent of last year's 11,675 acres. Acreage of chick peas, which had been rising since 1984, has fallen this year, in part because of an acreage moratorium on chick peas in Idaho.

MUSHROOMS

Mushroom Production and Value Rise in 1987/88

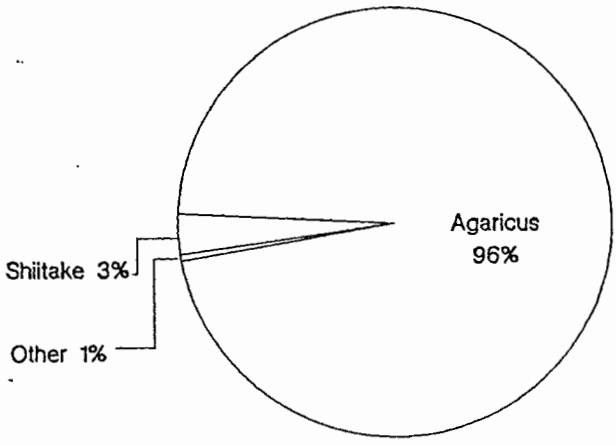
U.S. mushroom production continued its upward trend in 1987/88, rising nearly 4 percent to 637 million pounds. This year's output of button mushrooms (called Agaricus) was up by 4 percent to 632 million pounds, leaving 5 million pounds to production of specialty mushroom. For the first time USDA production estimates were broken out for specialty mushrooms, which include Shiitake, Oysters, and others.

Specialty Mushrooms' Share Represents 4 Percent of Total

Value of sales for commercially grown specialty mushrooms (Shiitake, Oyster, and all other exotics), totaled $22.2 million, a 4-percent share of total value and nearly level with last season (see figure). Shiitake mushrooms comprised the largest share of specialty value, 86 percent in 1987/88, up from 84 percent in 1986/87. Oyster mushroom value was $2.0 million, down 23 percent from the previous year.

Sales volume for the specialty mushrooms totaled 4.8 million pounds, 4 percent below the 1986/87 volume. Virtually all specialty mushrooms are sold for the fresh market. Shiitake mushrooms were grown on 371,000 natural wood outdoor logs, 25,000 natural wood undercover and indoor logs, and 991,000 square feet of other media. Oyster and the other specialty mushrooms were produced on other media, primarily sawdust, at 168,000 and 86,000 square feet, respectively. This year's survey included 64 specialty growers with commercial production in 16 States. This compares with 61 growers in 16 States last season.

Mushroom Value by Type, 1987/88



Intentions for specialty mushrooms in 1988/89 were estimated at 494,000 natural wood outdoor logs, up 33 percent, 96,000 natural wood undercover and indoor logs, up 284 percent, and all other producing area, up 12 percent to 1.4 million square feet. All the intentions for natural wood, both outdoor and indoor, are in Shiitake production. The industry appears to be rapidly expanding its indoor capacity, as yields are much higher in controlled climates. Oyster mushroom producing area is expected to expand 32 percent to 221,000 square feet, while other specialty mushrooms are expected to increase 34 percent to 115,000 square feet.

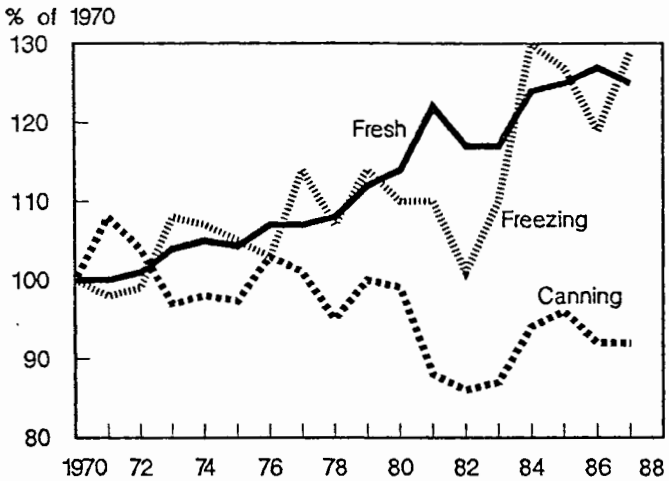
PER CAPITA UTILIZATION

Total per capita use of fresh and processed vegetables (farm-weight basis, excluding potatoes) during 1987 totaled 192.2 pounds, compared with 193.1 pounds the previous year and 182 pounds a decade ago (table 32). A slight reduction in total vegetable production, combined with stronger exports for most vegetables in 1987, led to the 1-percent decline.

Fresh vegetable use last year totaled 88 pounds per person. Even with the decline between 1986 and 1987, the trend toward higher fresh vegetable use remains upward. The trend for more fresh vegetables started in the early 1970's as consumers began substituting fresh vegetables for canned (table 32).

Canning vegetable use for 1987 totaled 87.1 pounds per person, down slightly from 87.7 pounds in 1986. Canning vegetable use continues to deteriorate except for processing tomatoes (table 31). Tomatoes for canning are the only item maintaining utilization levels of the mid-seventies (table 31). The demand for processed use, which requires a high number of tomatoes, has resulted from the growth in the ethnic population and consumers' desire to try ethnic foods.

Per Capita Vegetable Utilization



Freezing vegetable use last year totaled 17.1 pounds per person, also up from 1986's 15.8 pounds. The upward trend in freezing use resulted from consumers' perception that frozen vegetables are nearly equivalent to fresh in quality. Most of the growth in freezing use came from broccoli and cauliflower, as production and imports have increased (table 31).

Revisiting Per Capita Use Calculations

Per capita vegetable utilization numbers are calculated using the same methodology, so the numbers are comparable. The data are on a farm-weight basis, which simply reflects the raw or unprocessed weight going into either the fresh or processing market. For example, the 64.6 pounds of processing tomatoes in table 29 simply says that each person has 64.6 pounds of tomatoes for processing available for consumption before any canning is performed.

The per person numbers are derived by dividing total available utilization (AU) by total population, including military. The mathematical formula for total available utilization looks like this:

$$AU = (P+I+BS) - (E+ES)$$

where P = production, I = imports, BS = beginning stocks, E = exports, and ES = ending stocks.

Higher Share of Vegetables Utilized Comes from Imports

As total vegetable imports have grown over recent years in response to the stronger vegetable market, their share of per person use has also grown. However, fresh imports have been important in fresh use for several decades, as the supply of fresh vegetables during the winter months comes mainly from imports. In 1980 imports' share of total fresh vegetable supplies was 5 percent, while by 1987 it had risen to just 7 percent. Imports' share of total frozen vegetable supplies, excluding potatoes, was 1 percent in 1980 and 6 percent in 1987. Imports are not significant for canned vegetables except for tomatoes. Processed tomato imports were less than 1 percent of supplies in 1980 and rose to 3 percent in 1987.

THE USE OF PESTICIDES IN THE PRODUCTION OF VEGETABLES; BENEFITS, RISKS, ALTERNATIVES AND REGULATORY POLICIES

Leonard P. Gianessi
and
Catherine R. Greene*

ABSTRACT: The continued availability of many pesticides used in vegetable production is currently under consideration by State and Federal agencies. This paper examines the use patterns and current economic importance of pesticides to the vegetable industry, describes some of the health risks associated with pesticides, and outlines potential alternatives to chemical pesticides. Results from recent Environmental Protection Agency surveys of pesticide use on vegetables are compared with a 1979 USDA survey, and show similar pesticide usage patterns between the two time periods.

KEY WORDS: Vegetable production, pesticides, pesticide residues, integrated pest management, organic farming, and biotechnology.

For 40 years, widespread use of pesticides has helped growers meet the expectations of food processors and the public for a large quantity and variety of relatively inexpensive and attractive vegetable products. However, many pesticides may be severely restricted or eliminated by Federal and State agencies, because of growing concern about groundwater contamination, farm worker safety, and pesticide residues on food.

The current importance of pesticides to the production of vegetables is indicated by use patterns described below. Some of the reasons for the recently increased consumer concern about the tolerance levels for pesticide residues on food, as well as economic impacts on the vegetable industry and the marketplace of potential bans on pesticides, are discussed below. The economic effects of damage to wildlife and vegetation, and human health risks associated with groundwater contamination from pesticides and farmworkers' handling of pesticides are not addressed because of data limitations.

*Leonard Gianessi is a fellow in the Quality of the Environment Division, Resources for the Future, Inc., Washington, D.C. Catherine Greene is an agricultural economist with the Economic Research Service, USDA, Washington, D.C.

Use Patterns

Currently, there is limited information on pesticide use. There has been no systematic multi-State survey of pesticide use for vegetable crops since 1979 [11] [32]. A few States--Ohio, Wyoming, Wisconsin, and North Dakota--have released reports that include use estimates for selected vegetables [27, 30, 44, 34]]. In addition, the Agricultural Research Service (ARS) collected information from Cooperative Extension Service personnel for many vegetables by State as part of its 1984 Weed Survey [2].

The United States Environmental Protection Agency (EPA) periodically releases national estimates of the use of specific active ingredients by crop. EPA also has contracted with a company to develop crop-by-crop and State-by-State use profiles for selected active ingredients. Information from these limited sources are compared to the 1979 USDA survey findings.

Herbicides

Weeds compete for moisture, nutrients, sunlight, and space, and can reduce vegetable yields. Some small-seeded vegetables (such as lettuce and carrots) may not survive under weed pressure [39]. Uncontrolled weeds encourage insects and diseases and make harvesting difficult and slow [20]. For certain crops (snap beans), weeds between rows can be

controlled by cultivation while weeds remaining within the rows are controlled with herbicides [31]. In other cases (green peas), the rows are too close together for mechanical control [33]. Vegetables faced with serious uncontrolled weed infestations are usually not harvested.

Several active ingredients that were widely used in 1979 (table 1) have been voluntarily withdrawn by manufacturing companies. These include nitrofen (the most widely used herbicide for onions in 1979) and CDEC (the most widely used herbicide for carrots in 1979). Other herbicides registered for use on vegetables that have been withdrawn or cancelled since 1979 include alachlor for potatoes and propham for lettuce. The 1984 data (table 2–1 through 2–13) show significant use of dinoseb; however, EPA banned it in 1986. (A recent court ruling permits use on crops in the Northwest.)

On the other hand, several new registrations include pendimethalin and metolachlor for snap beans, ethalfluralin for cucumbers and watermelons, and metolachlor for green peas.

For most States, there are only three or four commonly used herbicides for individual crops. In certain cases, there is only a single herbicide to treat all of a State's crop acreage. Paraquat used on Florida lettuce is an example. Active ingredients registered for weed control for individual crops are not perfect substitutes for one another in most States. For example, certain herbicides control only grasses (bensulide) while others control only broad-leaf weeds (bentazon, naptalam). Herbicides, generally to combat the most troublesome weeds, are used in conjunction with cultivation and hand-weeding to produce acceptable growing conditions.

Certain herbicides do not work very well in some soils. Trifluralin does not work in soils high in organic content (muck soils), where all of Michigan's carrots are grown and farmers use linuron. In Texas and Washington, trifluralin is used for carrots because the soil is different.

Some herbicides show very specialized use. Pronamide is used exclusively on lettuce. This situation limits grower flexibility to follow a crop like lettuce with a crop for which the herbicide might produce an illegal residue.

Two of the most widely used herbicides in vegetable production are bensulide and trifluralin. Bensulide is used in significant quantities on 13 vegetables, while trifluralin is used on 21 vegetables. Bensulide is a relatively low-volume herbicide (1.0 million lbs/yr) used primarily on vegetables while trifluralin is a high volume herbicide (37.7 million lbs/yr) mainly for soybeans and cotton. Only 1 million lbs/yr of trifluralin is used on vegetables [15].

In selecting herbicides, growers must consider that certain weeds have developed resistance, and the possibility of crop injury. For example, vegetables must be shielded from paraquat sprays. One alternative is to regularly rotate vegetable crops in fields where weed pressure has been lessened. Another alternative is to use soil fumigants, which often control weeds.

Insecticides

Vegetables are subject to infestation by numerous insects. The damage varies by region, season, year, and crop. In some locations, a single type of insect could destroy fields of vegetables without insecticides [28]. Insects can reduce yields by damaging roots, stems, flowers or leaves. Vegetables sold for fresh markets generally must be blemish free. Thus, even minor insect damage that does not reduce the yield of a product can drastically reduce its marketability. Insects that do not affect yield or damage processing vegetables directly need to be controlled, since they may be picked up in harvesting and passed through the processing plant to contaminate the final product. Insects can also transmit several plant diseases.

Table 3 shows estimates of insecticide use for 13 crops surveyed in 1979 by USDA. Table 4 shows recent survey data for insecticide use on potatoes in four States. Table 5 shows recent survey data for insecticide use on five vegetable crops grown in Wisconsin, the State with the largest processing vegetable acreage. The following observations can be made based on these data.

Although vegetables are generally treated

with a significant number of insecticides, the acreage covered is usually small because of the localized nature of many infestations. Most of the insecticides that were in common use for vegetable crops in 1979 are still registered and applied. However, the relatively small use of toxaphene and lindane was ended by EPA restrictions.

Fungicides

Black rot, root rot, leaf spotting, and other diseases can destroy roots, as well as other parts of the plant. To be effective, fungicides need to be on the plant before the infection takes place. Most fungicides kill or inhibit growth of fungi, and those with copper are also toxic to bacteria [17].

Table 6 shows the use of fungicides on 13 vegetable crops in the 1979 USDA survey. The major fungicides identified in that survey, chlorothalonil and the EBDC's, maneb, zineb, mancozeb, and metiram, are still applied.

Chlorothalonil and the EBDC's will receive special EPA reviews in the near future. Few effective new fungicides have been developed to replace them [24]. Currently used fungicides control nearly all pathogens of vegetables found in the United States. They are inexpensive, have few phototoxic effects, and have no problems with pest resistance [24].

Benefits

In most situations, vegetable growers have the choice of several pesticides. However, not all are equally efficacious nor cost the same. In calculating the benefits of a particular pesticide, most studies estimate the value of production lost and the increased costs associated with the use of alternative pesticides.

Several recent EPA studies show that substantial economic losses would result from the removal of the insecticide aldicarb and the herbicide dinoseb from the market [41, 42]. Alternatives to aldicarb were estimated to increase potato production costs by $11–$15 million/year. The economic losses of withdrawing dinoseb from the market and substituting other herbicides are estimated to be $500,000 in snap beans; $5.7 million for potatoes; and $1.2 million for green peas.

A recent benefit assessment of the fungicide chlorathalonil also indicates that large economic losses would result if it was removed from the market [12]. If Maneb/Mancozeb was substituted for cholorathalonil, the increase in production costs plus the value of production lost was estimated at $119 million for tomatoes; $37 million for potatoes; $33 million for curcurbits; $30 million for celery; and $8 million for cole crops.

The results from the benefit analyses above were based on the assumption that alternative pesticides would be available. However, if all pesticides used to control a given pest were removed, the economic impact would likely be much greater. The benefit assessment of chlorathalonil, for example, reported that if no other fungicides were available, the increase in production costs and the value of production lost would be $775 million for tomatoes, $225 million for potatoes, $414 million for curcurbits, $131 million for celery, and $160 million for cole crops. Another recent study reported that if no herbicides were available for use on tomatoes in New Jersey, yields could be maintained but the cost of weed control would be 33 times higher [19]. Hand weeding would have to be substituted for chemical control.

An Office of Technology Assessment study published nearly 10 years ago, estimating the benefits of pesticides used on vegetables, also reported dramatic economic impacts from the removal of all pesticides from the market:

> If pesticides were no longer available in the United States some production of vegetables would be possible, but yield and quality would be low. Cultivation and hand weeding could be substituted for herbicides at high cost but with little other effect on production. Lettuce, cole crops, and potatoes would continue to be produced but at much greater cost and lower quality. Processing tomatoes would cease to be grown in the United States and demand for tomato products would be met by imports

from nations where pesticides were permitted [29].

Benefit analyses of pesticides are based on use estimates, estimates of the efficacy of alternatives, and estimates of socioeconomic effects from national and regional economic models of vegetable industries. However, pesticide use and efficacy estimates are often dated and are not available for all the important pesticides used on vegetables. Also, most published models of the vegetable industries are old. The most recently developed model of the tomato industry, for example, was published in 1977; the most recent models of the asparagus, brussels sprouts, onion, pepper, and potato industries were also published in the 1970's [18].

Cosmetic Standards

Another consideration in measuring benefits of pesticide use is the cosmetic appearance of vegetables. Surveys indicate that the public places a high value on the appearance of the food supply [14]. Uncontrolled pests could damage the appearance of a product, making it unmarketable, and growers would suffer income losses.

High cosmetic standards for vegetable products are set by food processors and grocers. Even with current pesticide use, many vegetables do not meet these standards and are either not harvested or are discarded. For example, a large percentage of the tomatoes grown in Florida for the fresh market are not harvested because of their appearance. In California, entire truckloads of processing tomatoes are dumped if there are any instances of black rot [21]. This is cheaper than sorting out the good tomatoes. To prevent such damage, vegetables are typically treated with insecticides and fungicides late in the growing season. Small insect feeding marks on the surface of a tomato that do not really change its size, nutritional content, or taste will render it useless for the fresh market [16].

If such late spraying of pesticides were to be restricted, and larger amounts of blemished products were produced, the food industry might not change its standards of acceptability for many vegetables, but rather accept the reduced supply and raise the price. In the winter of 1987/88, an uncontrolled virus in many California fields resulted in a mottled whitish appearance of lettuce. This was largely a cosmetic change [1], but lettuce shipments fell by about 33 percent, and the price rose by four or five times [43].

Many of the cosmetic standards of food processing companies go well beyond governmental regulations for food defect levels. For example, one green pea processing company in Minnesota has a threshold standard of one insect per 10,000 cans of processed product, which is equivalent to one insect per 3.14 acres of peas harvested [8]. Other processors publicly insist that there is no allowable threshold.

Health Risks

EPA is responsible for registration of all pesticide products distributed or sold in the United States, and for establishment of pesticide tolerances for food and feed commodities. The Food and Drug Administration (FDA) is responsible for sampling domestic and imported produce supplies to check for shipments containing residues above the pesticide tolerance levels set by EPA. While FDA detected pesticide residues in 48 percent of the fruits and vegetables sampled nationwide from 1982 to 1985 [22], very few samples contained residues above the legal tolerance levels. A Government Accounting Office study of 101,191 food samples between 1979 and 1985 found only 2.9 and 6.1 percent from domestic and imported sources, respectively, contained illegal pesticide residues. An FDA review of its own samples of tomatoes, apples and oranges found only 1 out of 4,347 samples containing pesticide residues above legal tolerance levels between 1984 and March 7, 1987 [49].

However, much of the recent consumer concern about pesticide residues focuses on whether the current pesticide tolerance levels are safe, rather than whether residues in produce supplies are under the legal tolerance level [5]. A recently published study by the National Academy of Sciences (NAS) on dietary oncogenic (tumor-producing) risk from pesticides has contributed to this increased public concern [24].

The NAS study indicated that tomatoes, potatoes, lettuce, snap beans, and carrots were rated in the top 12 foods with the greatest estimated oncogenic risk. Because of data limitations, the study was designed to use worst-case assumptions to estimate dietary exposure to pesticides [24]. One assumption is that all the vegetable acreage is treated with pesticides, although State and USDA pesticide surveys indicate that most pesticides are used on only a fraction of the acres for which they have registered uses (tables 1-6). The second assumption is that residues in foods always are present at tolerance levels, at the time of consumption. Pesticide residues rarely are present at tolerance levels, and in many cases may be undetectable by the time the food products reach the consumer [9]. For example, the outside leaves of cabbage, which are tested for residues in the field, are stripped off before reaching the consumer [35].

Another issue which has increased public concern about the currently set tolerance levels is that, for some pesticides, these levels were set before modern residue testing methods were developed. The EPA is currently reevaluating the tolerance levels for the older, previously registered pesticides. However, EPA estimates that this reevaluation may take another 10-20 years [9]. Thus, there will continue to be some uncertainty regarding the health effects of some of the older pesticides used on vegetables.

Regulatory Policies

EPA regulates the use of pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) of 1972, and the Miller Amendment of 1954 to the Federal Food, Drug, and Cosmetic Act (FDCA). EPA is currently reexamining the health and environmental safety of currently registered pesticide products, and reregistering acceptable pesticides. A problem for the vegetable industry, as a result of the reregistration process is that chemical manufacturers are unwilling to conduct the newly required studies in support of existing minor use registrations, due to the low return on investment in data development [3]. (All vegetables are in the minor use category.)

Newly registered pesticides are often used by growers to replace older pesticides to which pests have developed a resistance. EPA has provided certain incentives for registering new pesticides for minor use crops (published in the *Federal Register*, April 1986). EPA also participates in a cooperative effort with USDA and other government agencies and States, the Interregional Research Project Number 4 (IR-4 Project), to obtain clearances for minor pesticide uses.

Regardless of these incentives, it is likely that certain minor uses will continue to lack commercial feasibility to the pesticide industry. Thus, EPA has encouraged grower organizations to become more directly involved in assisting in the development of data needed to register new minor uses or reregister existing ones [3]. One of the major concerns with herbicide registrations for vegetables is product liability suits. A single crop injury claim could essentially negate 10 years of profits on low-volume herbicides used on vegetables [13]. In certain cases, growers are agreeing to sign waivers of liabilities in order to maintain registered uses of herbicides.

Meanwhile, research which tests new corn and soybean herbicides for vegetables is very promising [26] [23]. Several of these new compounds control weeds effectively without injury to vegetables. Whether vegetable use registrations will be sought for these products is unknown.

In addition to the reregistration process, certain pesticides used on vegetable crops are also subject to restrictions to protect groundwater, endangered species, and farm workers [25] [40].

Alternative Pest Management Systems

Integrated Pest Management

Integrated pest management (IPM) combines the use of natural predators, lures and traps, pest-resistant varieties, and cultural practices such as crop rotation with carefully monitored chemical pesticide treatments.

Pest monitoring is the most important of the IPM techniques. Pesticides are applied only if the pest population is above the economic threshold, which is the level that would cause an economic loss to the grower. Results of IPM programs in several States for

a variety of crops indicate that pesticide applications and costs can be reduced with no reduction in yield or quality.

Fresh–market tomatoes produced under an IPM program were compared with those from a conventional pest management system in Ventura County, California in 1981 [38]. An average of 3.7 insecticide applications were made on fields under IPM, compared with 6.7 for the control. The IPM savings were $84–120 per acre in pesticide costs with no decrease quality or yield. A similar comparison in San Diego County in 1980 and 1981 did not reveal as large a difference in pesticide applications, and the authors speculated that more of the San Diego tomato growers had been exposed to and influenced by IPM techniques.

A 1987 Massachusetts study indicated that potato growers in an IPM program used approximately 4.9 insecticide applications against aphids, compared with 7.5 applications outside the program [6]. Savings for IPM growers were estimated at $46 per acre, while maintaining comparable yields.

A 1987 sweet corn IPM program in Massachusetts, in its third year, used pest monitoring to reduce pesticide applications. Preliminary results indicated that although weed populations were higher, there was no effect on sweet corn yields.

Potato growers on Long Island who followed the IPM extension guidelines made 2.2 fewer insecticide applications in 1986 and saved $34–38 per–acre compared with other growers [36]. Similar results occurred for upstate growers following IPM guidelines. New York onion and snap bean growers using IPM recommendations in 1986 also made fewer pesticide applications and had lower input costs.

The USDA's Extension Service (ES) has been the primary coordinator of IPM research and program dissemination during the last 15 years [10]. In addition, private consultants and firms have begun to provide IPM services to growers, and growers have begun making financial contributions to Extension–sponsored programs, as the popularity of IPM has increased. Since 1983, there has been a steady increase in the number of acres under IPM programs for many vegetables (table 7).

Asparagus grown under an IPM system increased from 23,000 acres in 1983 to 34,000 in 1987 (table 7). Dry bean area went from 26,000 acres in 1983 to 181,000 in 1987. Acreages of snap beans, sweet corn, and tomatoes also increased in several States during this period.

Grower adoption of IPM techniques varies considerably by vegetable. For example, while most California growers use IPM techniques, in Massachusetts the level is only 14 percent [6]. The number of acres influenced by IPM recommendations for most vegetable crops is considerably less than the total acreage (table 7). Thus, considerable savings in chemical costs may result from continued expansion of IPM for vegetable pest control.

Expert systems with sophisticated pesticide dosage equations for use on home computers are currently being developed, and may speed grower adoption of IPM. Also, IPM has traditionally focused on insect pests, but research is now being done to develop IPM techniques for weed control.

Organic Farming

Organic farming eliminates chemical pesticides entirely, and often does not maintain either the yield levels or quality standards achieved under conventional and IPM systems. However, organic vegetable farming uses only natural predators, bacterial and viral pesticides, lime sulphur, oils, soaps and detergents, and lures and traps to control pests.

A review of studies comparing organic and conventional pest management systems on grain and livestock farms indicates that the organic farmer is usually at an economic disadvantage [4]. However, this review indicated that several studies using actual yield data from grain farms in the north and central States showed that the organic system was competitive. There are no comparable studies for vegetable crops.

Like integrated pest management, organic control systems have been growing. Sales of organic produce in California increased from $1 million in 1977 to $40 million in 1987 [37]. An Extension Service survey indicates there are now approximately 900 organic growers in

California with over 30,000 acres [7]. Vegetables represent about 13 percent of the total organic acreage. This survey also showed that almost 30 percent of the growers had entered this market within the last 2 to 5 years.

Biotechnology

Biotechnology offers another pest management option. Biopesticides for various tomato, potato, sweet corn, and cabbage pests, genetically engineered pest-resistent and flavor-enhanced tomato varieties, frost-inhibiting bacteria, and other products are under development or nearing completion for market release. However, the agricultural biotechnology industry has inherited the current Government disposition towards regulation that developed in response to human health and environmental problems with pesticides. Products from the biotechnology industry must comply with regulations developed by several Government agencies.

Conclusions

The use of pesticides is currently an integral part of vegetable production in the United States, but concern over the safety of pesticides is mounting. Many questions about the future use of pesticides remain unanswered. Will the chemical industry quit registering pesticides for use on vegetables? Which pesticides will be banned by EPA? Will consumers accept more blemishes on produce in order to have fewer pesticides applied? Is there any level of oncogenic risk from pesticides which is acceptable? Can the biotechnology industry provide a safer alternative to pesticides in a timely manner?

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Table 1. Use of herbicides in vegetable production

Herbicide	Cabbage	Green Peas	Cantaloupes	Carrots	Celery	Onions	Cucumbers	Lettuce	Snap Beans	Tomatoes	Water-melons	Potatoes	Sweet Corn
	Percent of acres treated												
Alachlor	1											2	30
Benefit		1						16					
Bensulide	4		15			18	20	6		1	3		
Bentazon								1					1
CDAA					32	42							
CDEC	3				85			15					
Chloramben			1				5			1			
Chloropropham						21							
Chloroxuron						1							
Dalapon			4									1	
DCPA	7					28					1		
Diallate		1											
Dinoseb		11							34			5	
Diphenamid										5		1	
EPTC									42			14	4
Isopropalin						3							
Linuron				54								7	
MCPA		7											
MCPB		21											
Metribuzin										23		41	
Napropamide										1			
Naptalam			1				23				1		
Nitrofen	10			3	22	48							
Oryzalin		3											
Paraquat								9		15	1		
Pebulate										2			
Profluralin		1		1					4				
Prometryne				1	25								
Pronamide								8					
Propham								2					
Trifluralin	38	34	15	24					31	27	6	6	
Atrazine													35
Cyanazine													11
Butylate													10
2,4-D													4
Propachlor													1
Vernolate													3

Source: [1] and [2].

Table 2. Use of herbicides in vegetable production by State, 1984

2.1 Cabbage

	Wisconsin	Texas	North Carolina	New York	Florida	New Jersey	California
	Percent of acres treated						
Bensulide		90					
DCPA			40	15	95	50	
Trifluralin	100	80	40	85	10	30	25

2.2 Green Peas

	Georgia	Illinois	Minnesota	New York	Texas	Oregon	Delaware
Alachlor			30				
Bentazon	30		30				
Dinoseb				100		100	99
Fluchloralin		20					
MCPB			30				
Metolachlor	60	20					
Oryzalin				30			
Profluralin	10						
Propham				50			
Propachlor			15	5		50	
Trifluralin	60	50	30	95	20	10	25

2.3 Cantaloupes

	Arizona	Texas	California
Bensulide	40	95	10
DCPA	20		
Ethalfluralin		15	
Napropamide			10
Trifluralin	2		20

2.4 Carrots

	Texas	Oregon	Florida	Michigan	Washington	Wisconsin	California
Chloropropham				15		5	
Chloroxuron		20					
Linuron	100	80	100	75	40	100	90
Trifluralin	60	10			25		40

2.5 Celery

	Florida	Michigan	California
Linuron	100	30	
Prometryne	5	75	90
Trifluralin			10

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2.6 Onions

	New York	Oregon	Michigan	Colorado	Texas	California
Bensulide		60			90	
Bromoxynil		60		10		20
CDAA	100		10			
Chloropropham	60		60			
Chloroxuron						25
DCPA		60		40	30	
Oxyfluorfen	80	100	10	85	50	5
Paraquat		35				

2.7 Cucumbers

	North Carolina	Florida	California	Michigan	Texas	Georgia
Bensulide	10	40	10	60	90	10
Chloramben						50
Ethalfluralin	5				15	85
Naptalam	15	40	10	60		15
Trifluralin			20			

2.8 Lettuce

	California	New Jersey	Arizona	Florida	New Mexico
Benefit	50	10	65		75
Bensulide		25	15		
Paraquat				100	
Pronamide	60	50	35		15
Propham			20		

2.9 Snap Beans

	Florida	Michigan	New Jersey	Oregon	Tennessee	Wisconsin	California
Bentazon					20	20	10
Chloramben		40					
Dinoseb		10	75	30	20		
EPTC		10		70	10	60	70
Metolachlor	50	15	25		15	20	
Pendimethalin	30						
Trifluralin	40	20	70	70	35	70	50

2.10 Tomatoes

	California	Michigan	Florida	New Jersey
Chloramben		15		
Diphenamid	10			10
Metribuzin		50	100	15
Napropamide	90			25
Paraquat			100	
Pebulate	90	5		
Trifluralin	10	60		60

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2.11 Watermelons

	Georgia	Florida	Texas	Oklahoma	California
Bensulide	10		25		10
Ethalfluralin	85		15	60	
Naptalam	15	50			10
Trifluralin			50	30	20

2.12 Potatoes

	Colorado	Maine	Minnesota	Washington	Michigan	North Dakota	Idaho
Alachlor			10				15
Diallate			10			5	
Dinoseb		35			75		
EPTC	15	5		35		13	30
Linuron		30	10		30		
Metolachlor	5	5		30	15		
Metribuzin	60	25	20	45	70	3	62
Pendimethalin						4	7
Trifluralin			10	40		7	

2.13 Sweet Corn

	Illinois	Florida	Minnesota	Washington	New York	Wisconsin
Atrazine	25	90	15		90	80
Alachlor	50	30	20	20	40	40
Metolachlor	10	30			20	12
Butylate		20				10
EPTC			15	20	30	
Cyanazine			10		10	5
2,4-D			15	10		
Vernolate				20		

Source: [7]

Table 3. Use of insecticides in vegetable production, 1979

Insecticide	Cabbage	Cantaloupes	Carrots	Celery	Cucumbers	Green peas	Lettuce	Onions	Snap Beans	Sweet Corn	Tomatoes	Watermelons	Potatoes
	Percent of acres treated												
Methomyl	45	12	7	11	1	22	46	4	13	37	33	3	1
Methamidophos	38										24		24
Parathion	17	7	23	14		10	11	55	17	20	4	4	6
Permethrin	4			60			11				13		1
Dimethoate	1	14				3	4		3		4	2	2
Carbaryl	7	8	14		11	3	2	80	26	34	33	4	6
Endosulfan	7	3		11	2		15				21	1	2
Diazinon	5	1	19	7	2		4	22	1		7		1
Oxamyl				31							7		
Naled				14								3	
Mevinphos	3	2		9			14			1			
Methyl Parathion	1	1	1			5	6	15		9			1
Toxaphene	2	1	3				4	18		4	2		
Acephate				8			10		21				
Fonofos								9	6	10	1		7
Azinphos Methyl	7	1		5				6			19		10
Meta-systox	2									1			
Phosphamidon	1										1		2
Demeton	1	1											4
Disulfoton	7				1				4			2	23
Monocrotophos	2										2		2
Dicofol		7											
Malathion		1	1	8		1		6					1
Methoxychlor		1	4										
Lindane					2								
Phosdrin							1		1				
Ethion								5					
Carbophenothion								3					
EPN										4			
Phorate										5			16
Terbufos										2			
Aldicarb													28
Carbofuran													3
Fenvalerate													1

Source: [1] and [2].

Table 4. Use of insecticides for potatoes in selected states, 1983/85

Insecticide	Wyoming	North Dakota	Wisconsin	Ohio
	Percent of acres treated			
Disulfoton	37	1	17	
Fenvalerate	25	78	42	24
Phorate	20	5	36	10
Dimethoate	17			7
Parathion	8		4	7
Aldicarb	4	4	30	64
Carbaryl		7	6	57
Carbofuran		2	3	24
Diazinon		1		21
Endosulfan		2	4	
Monocrotophos		6		
Oxamyl		1		11
Permethrin		17	32	6
Phosphamidon		23		
Methamidophos			24	54
Mevinphos			5	
Azinphosmethyl				3
Fonofos				6
Phosmet				2

Source: [3] - [6]

Table 5. Use of insecticides for selected vegetables in Wisconsin: 1985 (% of acres treated)

	Snap Beans	Green Peas	Sweet Corn	Cabbage	Carrots
	Percent of acres treated				
Acephate	47				
Carbaryl	16		10		80
Phorate	15				
Dimethoate	5	29			
Methomyl	5		3		
Permethrin		4	25	51	
Fenvalerate		3	29	79	
Phorate			22		
Terbufos			8		
Malathion			7		
Fonofos			5	17	
Methamidophos				62	
Parathion				19	65
Methomyl					26

Source: [5]

Table 6. Use of fungicides in vegetable production, 1979

Fungicide	Cabbage	Cantaloupes	Carrots	Celery	Cucumbers	Green peas	Lettuce	Onions	Snap Beans	Sweet Corn	Tomatoes	Watermelons	Potatoes
	Percent of acres treaded												
Maneb	18	20	24	42	3		11	39		5	30	10	46
Chlorothalonil	10	12	20	98	4	1	40				51	14	12
Zineb	1		1					2			1		
Mancozeb	1	1	10	15	1		6	10		3	22	2	1/
Copper	2	3	7	44	4		2	3	34		48		3
Benomyl		18		17	1				8		7	5	
Folpet		8											
Captafol		4						1			22	4	8
Anilazine				17				5					1
Metiram	1										2		4
PCNB	1												
Difolatan					1							2	
Captan									1		3		
Nabam								4					
Thiram								1					
Ziram													
Fentin Hydroxide												7	

1/ Included in total for Maneb

Source: [1] and [2].

Table 7. Vegetable acreage influenced by integrated pest management, selected States, 1983-87 1/

Commodity	State	1983	1984	1985	1986	1987
				Year		
				Acres		
Asparagus	Washington	23,000	24,200	27,400	27,400	34,000
Broccoli	Maine	2,000	400	3,000	4,000	4,800
Cabbage	Delaware	NR	NR	400	500	500
	New York	NR	5,500	6,333	NR	NR
	Georgia	NR	82	1,507	900	2,730
Dry Beans	Idaho	15,000	15,000	15,000	15,000	15,000
	North Dakota	26,000	107,210	115,500	160,500	181,000
Potatoes	Colorado	NR	54,000	54,000	60,000	60,000
	Idaho	8,000	8,500	8,500	8,500	8,500
	Maine	133,000	128,000	130,000	113,000	113,000
	Massachusetts	NR	120	NR	400	345
	New York	16,000	10,700	10,505	13,214	31,200
	Rhode Island	3,000	2,700	2,700	950	1,250
	Wisconsin	NR	NR	NR	NR	14,700
Snap Beans	Florida	27,000	15,288	31,150	NR	32,940
	Georgia	NR	2,366	NR	NR	1,111
	New Jersey	15,000	27,000	27,842	33,800	10,200
	New York	8,000	30,540	31,000	31,500	29,000
	Oregon	10,000	26,616	6,400	6,800	NR
Sweet Corn	Connecticut	NR	3,903	3,507	6,546	2,557
	Georgia	NR	210	450	4,241	5,949
	Maine	1,000	250	325	325	350
	New Jersey	6,000	NR	NR	NR	8,000
	New York	10,000	13,700	5,950	NR	37,150
	New Hampshire	NR	800	NR	990	1,070
	Rhode Island	NR	30	30	1,000	1,000
Tomatoes	California	272,000	242,600	271,500	271,500	NR
	Florida	14,000	11,560	28,150	NR	38,440
	Georgia	NR	403	505	867	1,455
	South Carolina	NR	2,000	1,000	1,500	NR

1/ Vegetable acreage under IPM programs are from all sources, including the Extension Service, private consultants and firms, and industry fieldmen, these sources are summed and some overlap may result.

NR = Not Reported.

SOURCE: National Cooperative Extension Survey of State IPM programs.

WATERMELONS: A COMMODITY HIGHLIGHT

Amy J. Allred*

Abstract: Demand for fresh produce has increased over the past several years, although watermelon has not shared in this trend. Contributing factors to declining watermelon use have been a lack of organized marketing and promotion efforts by watermelon growers and consumers' preferences for more convenient, consistent, and high quality produce. However, the watermelon industry is responding to these concerns with a proposed national research and promotion program.

Key words: Watermelon, supply, demand, competition

Introduction

Watermelons have not shared in the strong uptrend in per capita consumption of many other fresh fruits and vegetables. After 1961, per capita use declined 1 percent per year to 12.3 pounds in 1981 (the USDA's last estimate). Two factors contributed to the decline: 1) a lack of organized marketing efforts nationally by watermelon growers, and 2) consumers' preferences for more convenient and high quality, consistent produce.

Future watermelon consumption will largely depend on efforts by the industry to promote its product. The industry is awaiting a grower referendum later this year on a proposed national research and promotion program. The Agricultural Marketing Service (AMS) is still reviewing the plan, which calls for grower and handler assessments of 2 cents per cwt to raise funds. The plan is expected to raise about $1 million annually. However, the assessment can be refunded to growers who do not want to participate, so the amount may not reach this goal.

Watermelon popularity will also depend on growers' responsiveness to consumer preferences. Consumer surveys have shown increasing demand for convenient and high-quality, consistent produce. The decrease in average family size has led to more consumer interest in smaller, "icebox" melons. Because smaller and seedless melons have met with positive reactions in consumer surveys and sales, growers have begun to shift to these varieties. Efforts to provide more consistent melons would help as well. *The Packer's* 1988 consumer survey indicated that 27 percent of the respondents considered watermelons inconsistent in overall quality and value.

History

The USDA collected watermelon statistics on planted and harvested acreage, yield, production, price, and value from 1939 until 1981, when the program was discontinued because of cuts in the Federal budget and concern about data reliability. Many fruit and vegetable growers shift in and out of watermelon production to supplement their income. Therefore, it was difficult to accurately identify and survey growers.

Since the elimination of the Federal estimating program, eight States have funded their own data collection and estimating activities. These States are Arizona, Delaware, Florida, Hawaii, Maryland, North Carolina, South Carolina, and Texas. In 1981, these States accounted for 61 percent of U.S. watermelon production, and are representative

*Agricultural economist, Economic Research Service, USDA.

of the industry in documenting changing supply patterns. 1/

Supply

U.S. production of watermelons, which stood at 2.6 million pounds in 1981, had been trending down since the mid-1950's. Significant shifts in production had occurred since 1949, with Florida's share in 1981 increasing from 19 percent to 31 percent of U.S. production. Meanwhile, Texas' share declined 12 percent, accounting for 18 percent of total watermelon output (see figure 1). Although California's production had fallen, the share remained near a relatively constant 10 percent. Minor shifts occurred in other States.

Florida is the leading producer, marketing twice as many melons as Texas, the second largest watermelon State (table 1). California, Alabama, Georgia, Indiana, and South Carolina are among 27 other States also involved in commercial production. The marketing season for domestic watermelons begins in early April and is completed by October, with 80 to 85 percent of the crop generally shipped from June to August.

Florida's production has trended upward, with 1988 shipments through July at 19 million cwt, about level with 1987 (see cover figure). This year's shipments likely would have been higher except for the pervasive heat and lack of rain. Florida and California shipments come on the market near the same time. Florida shipments were much higher than other States in 1987, but California shipments continued for a longer period due to the State's more favorable climate and extensive irrigation (see figure 2).

The Fourth of July holiday is traditionally the peak for watermelon shipments and sales. Supplies from the major producing States decline after that date, which allows imports to fill the gaps.

Imports of watermelons increased 5 percent annually, on average, between 1960

1/ The lack of national statistics since 1981 makes it virtually impossible to know exactly what has occurred since that time.

Figure 1
Shares of U.S. Watermelon Production

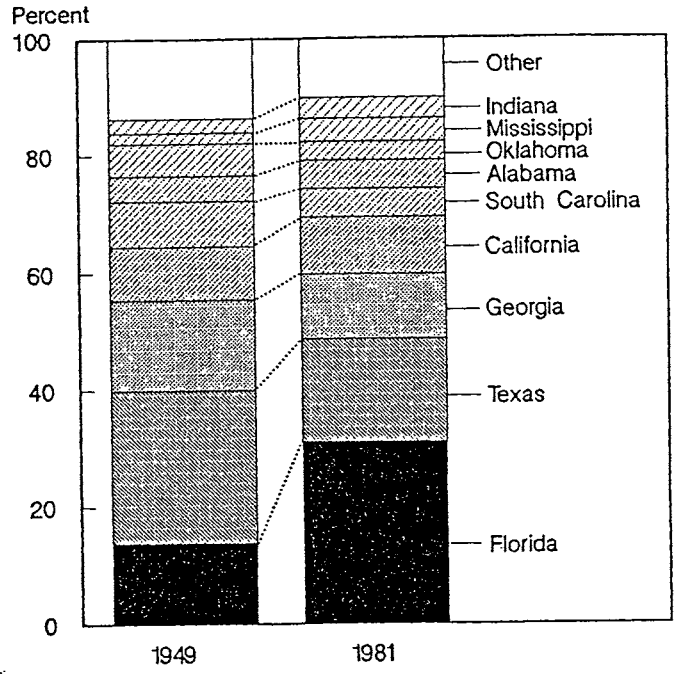
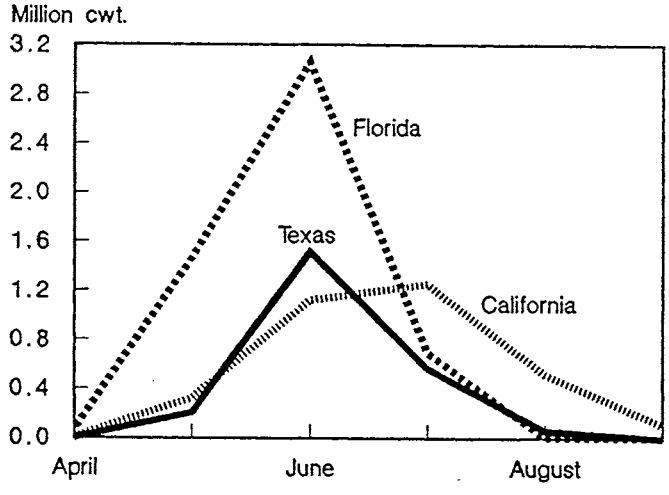


Figure 2
Watermelon Shipments, 1987

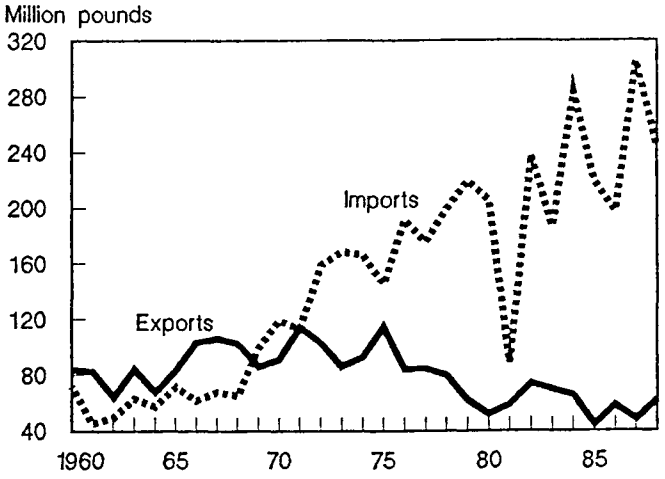


and 1987 (see figure 3). Imports rose from 72 million pounds to 308 million. However, imports are still small relative to domestic production, comprising up to 9 percent of total supply in the late 1970's through early 1980's. Most imports come from the Mexican states of Sonora, Sinaloa, Jalisco, and Veracruz, with some from Central America.

Demand

Per capita consumption of watermelons declined about 1 percent per year, from 16.3

Figure 3
Watermelon Imports and Exports



pounds in 1961 to 12.3 in 1981. The termination of USDA watermelon production estimates in 1982 has made it impossible to estimate per capita numbers since then. However, *The Packer's* "Fresh Trends 1988" survey supports the trend toward less watermelon use. Although 12 percent of the respondents listed watermelon as one of their three favorite fruits for snacking, more than half of those surveyed purchase it once a month or less when it is in season.

Market expansion through exports would also benefit watermelon sales. As growers adopt new varieties and transportation improves, shipments of watermelons will likely rise and be available earlier in the season when prices are highest. Although exports declined 2 percent per year between 1960 and 1987, (see previous figure) the outlook for export growth is bright. 2/ U.S. sales to Canada, the largest customer, were running 14 percent ahead of a year earlier during the first 6 months of 1988.

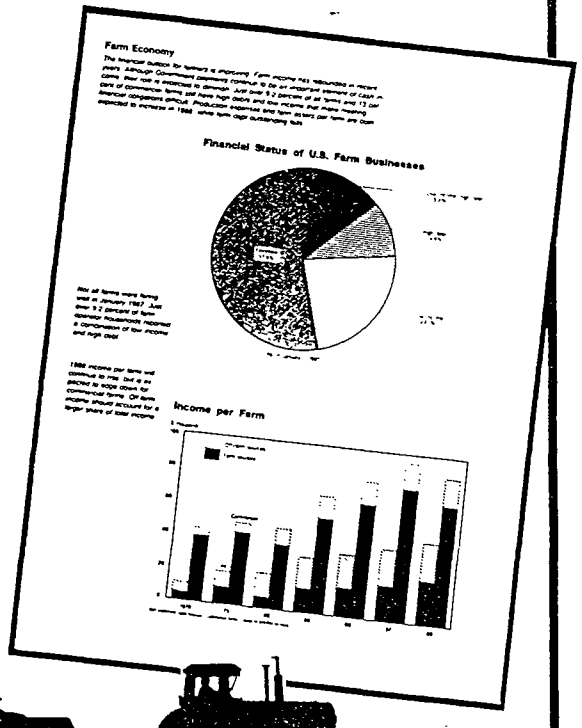
2/ Since the quality of data for U.S. exports to Canada has deteriorated, this drop in exports may not have been as severe as indicated.

1988 Agricultural Chartbook

The 1988 Agricultural Chartbook presents an overview of the current economic health of the American farm sector. Charts move from the national to the international arenas to farm economic health measures and crop and livestock trends. Background charts cover topics ranging from farm numbers and population to natural resources, the consumer, world production and trade, and domestic commodity trends.

All charts are reproduced in black and white, suitable for photocopying. AH-673. 112 pages. $5.00. Order SN: 001-019-00582-3 from Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Or call (202) 783-3238.

An enlargements version of this chartbook, with each chart on a page of its own, is also available from GPO.



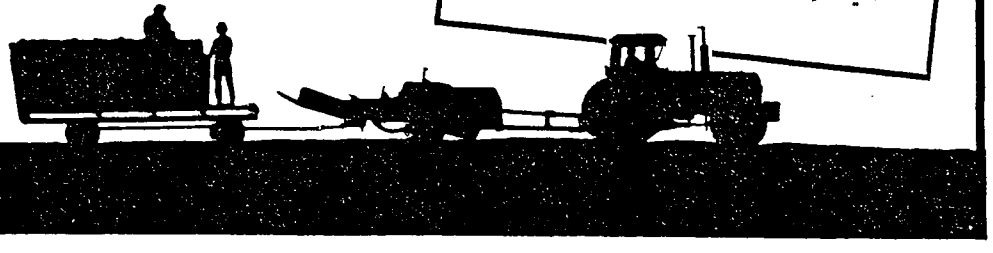


Table 1. --Fresh vegetables: Reported acreage of principal crops from major States, 1987 and indicated 1988

Season and crop	1987	1988	
		Indicated	Percent of 1987
	1,000 acres		Percent
Winter	188.7	193.6	103
Spring	170.8	177.8	104
Summer			
Broccoli 1/	19.4	21.0	108
Carrots 1/	26.0	23.9	92
Cauliflower 1/	13.6	13.6	100
Celery 1/	7.6	7.6	100
Sweet corn	108.6	104.5	96
Lettuce	48.4	49.1	101
Tomatoes	49.2	52.4	107
Total 7 vegetables	272.8	272.1	100
Onions			
Nonstorage	11.5	12.3	107
Storage	61.2	63.9	104
California 2/	29.0	26.6	92
Total summer onions 3/	101.7	102.8	101
Honeydew melons	19.6	20.8	106
Total 9 items	394.1	395.7	100

1/ Includes fresh market and processing. 2/ Primarily processing. 3/ May not add to total due to rounding.

SOURCE: Vegetables, NASS, USDA.

Table 2. — F.o.b. quotes by commodity and month for selected vegetables

Comodity/container	Mid-July 1987	Early June 1988	Mid-July 1988	Late-July 1988	Percent change from previous month 2/
	Dollars per case				
Canned sweet corn:					
Midwest					
Fancy whole kernel 24/303's	6.75	7	8 - 8.25	8.50 -9	25
Northwest					
Fancy whole kernel 24/303's	7.75 -8	7.5	9 - 9.25	9.25	22
New York					
Fancy whole kernel 24/303's	NR	7.75 - 8.25	NR	8.50	17
Canned green peas					
Midwest					
Fancy 4s 24/303's 1/	NR	7.75 - 8.25	9 - 9.25	10.25	28
Canned green beans					
Midwest					
Fancy cut 4s 24/303's	6.75 - 7	6.75 - 7	7.75 - 8	8 - 8.50	20
New York					
Fancy Cut 4s 24/303's	NR	7.25 - 7.5	8.60	8.25 - 8.60	14
Northwest					
Fancy Cut 4s 24/303's	7.5	7.5	8.25	8.25	10
Frozen cut corn:					
Northwest					
24/10 oz cartons	8.5	8.5	8.5 - 9.10	8.50 - 9.10	4
Frozen green peas:					
Northwest					
24/10 oz cartons	8.2	8.5	8.5 - 9.10	9.50 - 10.50	18
Frozen green beans:					
Eastern					
24/29 oz cartons	8.75	8.75	NR	9.02 - 9.16	4

1/ Quote for late May.
2/ When a price range is given, the percent is based on the average.

SOURCE: The Food Institute Report, American Institute of Food Distribution, Inc.

Table 3. --Processed tomatoes: U.S. imports by product, 1983-87

Year	Product			
	Paste	Sauce	Whole and other	Total
	1,000 pounds			
1983	160,742	23,626	186,709	371,077
1984	151,042	28,000	233,567	412,613
1985	111,400	33,586	220,028	365,013
1986	130,625	31,590	197,559	359,774
1987	101,274	17,201	178,581	297,062

SOURCE: Department of Commerce.

Table 4. --Canned vegetables: U.S. imports of green peas, snap beans, and sweet corn, 1983-87

Year	Item		
	Peas	Snap beans	Corn
	1,000 pounds		
1983	16,047	2,251	8,587
1984	30,844	6,108	9,934
1985	25,434	16,416	12,264
1986	20,130	14,409	14,132
1987	24,029	5,301	15,563

SOURCE: Department of Commerce.

Table 5. --Major fresh-vegetable shipments, first and second quarter average, 1987-88 1/ 2/

Crop	Quarter				Percent of year earlier	
	1987		1988			
	I	II	I	II	I	II
	1,000 cwt				Percent	
Broccoli	800	776	831	808	104	104
Cabbage	1,361	985	1,367	854	100	87
Carrots	1,426	1,454	1,265	1,394	89	96
Cauliflower	519	520	536	529	103	102
Celery	1,421	1,440	1,510	2,698	106	164
Sweet corn	123	1,176	160	1,319	130	112
Cucumbers	773	810	921	848	129	105
Lettuce	5,097	5,798	5,008	5,254	114	91
Onions	2,428	2,744	2,644	2,637	109	96
Peppers	827	672	792	703	118	105
Squash	477	279	560	311	122	111
Tomatoes	2,657	3,222	2,741	3,303	109	108
Total	17,909	19,876	18,335	20,699	104	103
Cantaloupe	259	2,423	478	2,252	185	93
Honeydews	103	432	214	680	161	157
Watermelon	308	3,832	341	4,788	111	125
Total	670	6,687	1,034	7,720	147	115

1/ Includes shipments from Mexico. 2/ Preliminary.

SOURCE: Fresh Fruits and Vegetables: Weekly Summary of Shipments and Arrivals, AMS, USDA.

Table 6.--U.S. shipments of fresh specialty vegetables, 1987 and 1988 1/

Commodity	1987			1988			Change from year earlier		
	I	II	First half	I	II	First half	I	II	First half
	1,000 cwt						Percent		
Chinese cabbage	76	40	116	74	30	104	-3	-25	-10
Escarole-endive	177	96	273	197	73	270	11	-24	-1
Garlic	29	183	212	32	184	216	10	1	2
Greens	715	281	996	742	184	926	4	-35	-7
Romaine lettuce	596	719	1315	688	703	1391	15	-2	6
Other lettuce 2/	486	643	1129	616	654	1270	27	2	12
Misc herbs	25	19	44	26	16	42	4	-16	-5
Misc oriental 3/	156	119	275	166	84	250	6	-29	-9
Tropical 4/	52	61	113	116	124	240	123	103	112
Parsley	91	46	137	119	31	150	31	-33	9
South and snow peas	28	40	68	48	49	97	71	23	43
Chili peppers	284	291	575	366	356	722	29	22	26
Miscellaneous 5/	143	138	281	148	112	260	3	-19	-7
Total	2,858	2,676	5,534	3,338	2,600	5,938	17	-3	7
	Percent								
Domestic share 6/	79	76	77	77	74	76	-	-	-

1/ Includes imports, exports, and domestic transfer. 2/ Includes Boston bibb, and red and green leaf lettuce. 3/ Includes sprouts, bokchoy, dikon, gobo, and labah. 4/ Includes apio, arum, batatas (boniatos), breadfruit, calabaza, chayote, dasheen, ginger root, honeyberry malanga, guenapas, taro, yams, and yucca. 5/ Includes alfalfa sprouts, carboon, celeriac, chicory root, jerusalem artichoke, jicama, oyster plant, and tomatillos. 6/ Share of total shipments originating from domestic production.

SOURCE: Fresh Fruits and Vegetables: Weekly Summary of Shipments and Arrivals, AMS, USDA.

Table 7. —Fresh vegetables: Seasonal acreage for harvest, major States 1986-88

Crop	Winter			Spring			Summer		
	1986	1987	1988	1986	1987	1988	1986	1987	1988
					1,000 acres				
Broccoli 1/	32.5	31.0	28.8	26.0	30.5	29.5	19.5	19.4	21.0
Carrots 1/	33.1	36.1	36.5	13.7	12.4	12.5	21.8	26.0	23.9
Cauliflower 1/	12.0	11.0	12.3	13.8	14.0	11.5	14.4	13.6	13.6
Celery 1/	8.0	7.5	7.9	8.6	8.4	9.3	6.7	7.6	7.6
Sweet corn	6.0	7.3	8.1	38.7	41.4	45.3	109.1	108.6	104.5
Lettuce	74.2	77.1	80.7	37.9	37.6	40.9	47.2	48.4	49.1
Tomatoes	15.9	18.7	19.3	29.6	26.5	28.8	48.6	49.2	52.4
Total 7 vegetables	181.7	188.7	193.6	168.3	170.6	177.8	267.3	272.8	272.1
Honeydews	-	-	-	7.0	4.6	6.5	17.3	19.6	20.8
Total	181.7	188.7	193.6	175.3	175.4	184.3	284.6	292.4	292.9

1/ Includes fresh market and processing.

SOURCE: Vegetables, NASS, USDA.

Table 8. —Commercial and fresh vegetables: Monthly average index of prices received by U.S. growers, unadjusted 1986-88 1/

Item		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
							1910-14=100						
Commercial 2/	1986	683	587	613	733	723	591	589	610	651	662	711	596
	1987	736	682	762	674	651	629	660	631	639	606	1,054	880
	1988	990	644	678	658	574	580	629	734				
Fresh	1986	865	718	760	963	949	720	716	751	827	826	905	729
	1987	990	904	1,046	895	849	808	875	828	838	769	1,560	1,278
	1988	1,465	838	898	859	712	723	802	976				
							1977=100						
Commercial 2/	1986	137	118	123	147	145	119	118	122	131	133	143	120
	1987	148	137	153	135	131	126	133	127	128	122	212	177
	1988	199	129	136	132	115	116	126	147				
Fresh	1986	131	109	115	146	144	109	109	114	126	126	138	111
	1987	150	137	159	136	129	123	133	126	127	117	237	194
	1988	223	127	136	131	108	110	122	148				

1/ 1985/86 revised, 1987 indexes are preliminary. 2/ Includes fresh and processing vegetables.

SOURCE: Agricultural Prices, NASS, USDA.

Table 9. --Fresh vegetables, including potatoes: Monthly retail price index, 1982-88 1/

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						1982-84=100						
1982	110.0	112.9	99.8	98.4	99.5	101.7	96.7	84.8	78.6	78.3	81.2	88.3
1983	88.0	89.2	95.9	103.0	104.6	101.5	96.5	95.8	96.9	99.6	97.0	103.2
1984	118.6	126.1	125.7	113.3	103.3	103.4	104.0	110.4	98.6	99.8	99.3	96.1
1985	105.8	112.9	111.5	111.1	102.5	100.9	103.7	98.3	93.5	93.9	97.8	110.3
1986	118.1	101.4	100.8	108.8	112.1	106.4	106.0	105.0	104.7	107.2	110.2	111.7
1987	116.2	123.2	118.9	123.7	123.6	129.2	121.0	114.5	114.6	112.5	121.2	140.2
1988	143.9	133.7	125.6	127.5	124.5	121.8	127.0					

1/ Consumer price index (CPI-U).

SOURCE: Bureau of Labor Statistics, Department of Labor.

Table 10. --Fresh vegetables: Average U.S. f.o.b. shipping point prices, 1987-88

		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug
					Dollars per cwt				
Carrots	1987	12.70	10.80	10.80	9.04	10.30	12.30	10.20	8.70
	1988	15.70	10.60	11.90	13.30	17.30	9.75	13.60	16.60
Celery	1987	14.60	12.70	12.50	11.30	11.60	10.20	9.52	10.30
	1988	18.00	13.00	7.77	11.60	13.90	9.04	11.40	13.90
Corn, sweet	1987	15.70	27.80	19.10	16.10	13.30	13.80	11.90	11.80
	1988	15.10	21.50	19.80	17.40	11.80	13.40	18.20	16.10
Lettuce	1987	14.50	8.60	14.90	8.43	8.05	8.91	16.80	18.00
	1988	35.60	11.10	13.80	9.33	7.89	10.70	7.62	12.20
Onions	1987	16.20	17.60	19.90	26.30	22.40	16.80	14.90	10.60
	1988	15.30	13.80	12.50	15.10	9.10	8.49	11.50	8.58
Tomatoes	1987	28.30	25.80	32.10	26.90	28.00	26.90	20.50	17.30
	1988	31.50	19.40	28.60	29.90	22.60	24.80	31.00	41.70

SOURCES: Agricultural Prices and Vegetables, NASS, USDA.

Table 11. --Fresh vegetables: Representative prices (wholesale lots), New York and Chicago, 1987-88

Market and commodity	Origin	Unit	1987			1988		
			May 11	June 16	July 7	May 10	June 14	July 5
			Dollars					
NEW YORK								
Beans, snap, green	Florida	Bu. hamper and crt.	—	—	—	19.00	—	
Broccoli,	Califorina	Ctn. 14 bn.	7.00	9.50	8.50	7.50	9.00	11.00
Cabbage, domestic round type	New York	Crt. 1-3/4 bu.	—	—	—	—	—	—
Cantaloups	California	1/2 ctn. 18's	—	11.00	6.00	—	10.00	10.25
Carrots, topped, washed	California	Ctn. 48-1 lb. film bag,	9.00	9.00	9.50	10.00	9.50	9.00
Cauliflower	California	Ctn. film wrpd., 12's	11.00	7.50	11.00	9.00	9.00	15.00
Celery pascal	California	Crt. 2-3 doz.	12.00	14.00	11.00	19.00	14.00	11.00
Lettuce, iceberg	California	Ctn. 2 doz.	8.00	9.50	12.00	9.00	12.50	9.00
Onions								
jumbo	Texas	Sack 50-lb.	16.00	12.00	—	6.00	—	—
jumbo	California	Sack 50-lb.	17.00	11.00	14.00	5.50	—	6.75
Spinach, Savoy	New Jersey	Bkt. bu.	—	—	—	—	—	—
Tomatoes	Florida	Ctn. 25-lb.	11.00	14.00	13.00	9.50	8.50	9.00
Watermelon	Florida	Per lb.	—	—	—	—	—	—
CHICAGO								
Broccoli	California	Ctn. 14 bn.	7.75	9.25	8.75	7.25	8.00	9.00
Cabbage, domestic round type	Texas	Crt. 1-3/4 bu.	8.25	—	—	8.25	—	—
Cantaloups	California	1/2 ctn. 18's	—	—	8.00	—	—	10.00
Carrots, topped, washed	California	Ctn. 48-1 lb. film bag	10.50	10.00	9.75	9.75	11.00	10.75
Cauliflower	California	Ctn. film wrpd. 12's	11.25	9.75	—	10.25	9.25	12.50
Celery pascal	California	Crt. 2-3 doz.	17.50	13.50	12.00	17.75	11.00	11.00
Cucumbers	Florida	Ctn. 1-1/9 bu.	20.00	17.00	—	14.00	20.50	—
Honeydews	Texas	Crt. 2/3-flat 6-8's	—	10.50	6.00	9.50	8.00	9.00
Lettuce, iceberg	California	Ctn. 2 doz, head	8.50	10.00	10.75	8.25	11.00	8.00
Onions								
jumbo	Texas	Sack 50 lb.	16.50	—	—	7.50	6.50	7.00
jumbo	California	Sack 50 lb.	16.25	10.25	13.50	6.50	6.50	10.50
Tomatoes	Florida	Ctn. 25 lb.	12.00	14.50	—	9.50	8.00	8.00
Watermelon	Texas	Per lb.	—	—	.12	—	—	.19

SOURCE: Weekly summary of terminal market prices, AMS, USDA.

Table 12. --Fresh vegetables: Retail price, marketing spreads, and grower-packer return per unit, sold in Northeast and North Central, indicated months, 1987-88

1/ Area commodity, month, and retail unit	Retail price	Marketing spreads		Grower-packer return (F.o.b. shipping point price)	
		Absolute	Percent of retail price	Absolute 2/	Percent of retail price
	Cents		Percent	Cents	Percent
Northeast					
Cabbage (lb.)					
May 1987	39.1	28.2	72	10.9	28
May 1988	39.8	29.1	73	10.7	27
April 1988	38.4	28.1	73	10.3	27
Carrots (lb.)					
July 1987	39.6	31.0	78	8.6	22
July 1988	40.2	29.7	74	10.5	26
June 1988	41.5	30.8	74	10.7	26
Celery (lb.)					
July 1987	52.1	43.7	84	8.4	16
July 1988	51.6	42.7	83	8.9	17
June 1988	55.7	45.0	81	10.7	19
Cucumbers (lb.)					
May 1987	69.9	36.0	52	33.9	48
May 1988	50.6	32.8	65	17.8	35
April 1988	85.3	49.3	58	36.0	42
Lettuce (head)					
July 1987	53.3	19.9	37	33.4	63
July 1988	50.2	35.6	71	14.6	29
June 1988	50.8	22.3	44	28.5	56
Onions, dry yellow (lb.)					
July 1987	58.7	40.1	68	18.6	32
July 1988	39.8	—	—	—	—
June 1988	38.6	29.9	77	8.7	23
Peppers, green (lb.)					
June 1987	152.7	56.6	37	96.1	63
June 1988	66.1	44.5	67	21.6	33
May 1988	76.7	47.9	62	28.8	38
Tomatoes, mature green (lb.)					
May 1987	84.5	56.9	67	27.6	33
May 1988	88.6	61.5	69	27.1	31
April 1988	92.7	51.3	55	41.4	45
North Central					
Cabbage (lb.)					
May 1987	33.6	22.7	68	10.9	32
May 1988	34.6	23.9	69	10.7	31
April 1988	32.2	21.9	68	10.3	32
Carrots (lb.)					
July 1987	38.5	29.9	78	8.6	22
July 1988	41.2	30.7	75	10.5	25
June 1988	41.0	30.3	74	10.7	26
Celery (lb.)					
July 1987	44.2	35.8	81	8.4	19
July 1988	49.8	40.9	82	8.9	18
June 1988	50.7	40.0	79	10.7	21

Cucumbers (lb.)					
May 1987	70.1	36.2	52	33.9	48
May 1988	58.8	41.0	70	17.8	30
April 1988	79.9	43.9	55	36.0	45
Lettuce (head)					
July 1987	54.0	20.6	38	33.4	62
July 1988	49.2	34.6	70	14.6	30
June 1988	49.1	20.6	42	28.5	58
Onions, dry yellow (lb.)					
July 1987	53.9	35.4	66	18.6	34
July 1988	37.1	—	—	—	—
June 1988	37.4	28.7	77	8.7	23
Peppers, green (lb.)					
June 1987	182.0	85.9	47	96.1	53
June 1988	93.4	71.8	77	21.6	23
May 1988	102.3	73.5	72	28.8	28
Tomatoes, mature green (lb.)					
May 1987	83.4	55.8	67	27.6	33
May 1988	96.5	69.4	72	27.1	28
April 1988	101.1	59.7	59	41.4	41

1/ Production areas: Cabbage (Northeast), cucumbers, peppers, and tomatoes-Florida; carrots, celery, and lettuce-California; Cabbage (North Central) and onions-Texas. 2/ Adjusted to account for waste and spoilage incurred during marketing. — = Not available

SOURCES: Bureau of Labor Statistics, Department of Labor and Weekly Summary of F.O.B. Prices, AMS, USDA.

Table 13. —Fresh vegetables: Representative truck rates for selected vegetables, January-June, 1987-88 1/

Commodity, area, and city	1987						1988					
	Jan.	Feb.	Mar.	Apr.	May	June	Jan.	Feb.	Mar.	Apr.	May	June
	Dollars per shipping container											
Cabbage (50 lb. wirebound crate)												
Southern Florida to:												
Atlanta	.63	.63	.63	.70	.88	—	—	—	—	—	—	—
Chicago	1.95	1.95	1.95	—	—	—	—	—	—	—	—	—
New York City	1.95	1.95	1.95	1.90	2.33	—	—	—	—	—	—	—
Rio Grande Valley, Texas to:												
Chicago	2.06	1.84	1.94	1.97	—	—	—	—	—	—	—	—
New York City	2.94	3.06	2.81	3.13	—	—	—	—	—	—	—	—
Carrots (48-1 lb. film bags)												
Imperial Valley, California to:												
Atlanta	2.73	2.80	2.80	2.53	—	4.40	2.33	2.27	2.27	—	—	3.60
Chicago	2.67	2.58	2.47	2.60	—	4.53	2.47	2.33	2.47	—	—	3.53
New York City.	3.87	3.93	3.67	3.67	—	5.93	3.40	3.47	3.40	—	—	5.07
Rio Grande Valley, Texas to:												
Chicago	2.06	1.84	1.94	1.97	—	—	2.06	1.84	2.09	1.94	2.08	—
Dallas	.97	.97	.97	.97	—	—	.94	.94	.94	.94	.98	—
New York City	2.94	3.06	2.81	3.13	—	—	3.19	2.75	2.94	3.13	3.25	—
Celery (60 lb. wirebound crate)												
Southern California to:												
Atlanta	2.93	2.67	2.47	2.47	2.93	4.13	2.53	2.60	2.60	2.87	2.73	3.27
Chicago	2.73	2.47	2.47	2.47	2.87	4.00	2.27	2.27	2.27	2.47	2.47	3.27
New York City	3.93	3.67	3.53	3.67	4.27	5.67	3.47	3.60	3.80	3.87	3.93	5.07
Southern Florida to:												
Atlanta	—	—	—	—	—	—	—	—	—	—	—	—
Chicago	—	—	—	—	—	—	—	—	—	—	—	—
New York	—	—	—	—	—	—	—	—	—	—	—	—
Corn (4-3/4 doz. wirebound crate)												
Southern Florida to:												
Chicago	1.95	1.90	1.93	1.95	1.98	2.05	1.98	1.98	1.98	1.98	1.98	1.98
New York City	1.95	1.93	1.93	1.98	2.00	2.05	1.98	1.98	1.98	1.98	2.03	2.00
Lettuce (24 head carton)												
Imperial Valley, California to:												
Atlanta	2.38	2.44	2.44	2.21	—	3.84	2.03	1.98	1.98	—	—	3.14
Chicago	2.33	2.21	2.15	2.27	—	3.95	2.15	2.03	2.15	—	—	3.08
Dallas	1.80	1.69	1.74	1.69	—	2.27	1.45	1.51	1.51	—	—	2.33
New York City	3.37	3.43	3.20	3.20	—	5.17	2.97	3.02	2.91	—	—	4.42
Potatoes (100 lb. sack)												
Idaho Falls, Idaho to:												
Atlanta	4.88	5.00	5.00	4.63	4.75	6.38	4.88	4.88	4.75	4.75	4.88	4.63
Chicago	3.50	3.50	3.50	3.50	3.50	3.75	3.63	3.50	3.50	3.50	3.50	3.50
Presque Isle, Maine to:												
Atlanta	2.84	2.93	2.93	—	—	—	2.28	—	2.93	2.93	2.88	—
New York City	1.89	1.89	1.89	1.89	1.89	—	1.96	1.94	1.94	1.94	1.89	—
Western and Central New York to:												
New York City	1.65	1.65	1.65	1.65	—	—	1.63	1.63	1.63	1.63	—	—
Tomatoes, vine ripe (25 lb. carton)												
Southern Florida to:												
Atlanta	.53	.53	.53	.59	.64	—	.56	.53	.53	.53	.69	.69
Chicago	1.17	1.17	1.17	1.17	1.17	—	.96	.96	.96	.96	1.28	1.41
New York City	1.31	1.31	1.31	1.31	1.33	—	1.36	1.36	1.36	1.25	1.28	1.41

1/ First week of the month.
— = not available.

SOURCE: Fruit and Vegetable Truck Rate Report, AMS, USDA.

Table 14. —Canned vegetables: Carryover, pack, seasonal supply, and disappearance, 1984/85-1987/88

Commodity and season	Carry-over	Pack	Seasonal supply	Total seasonal shipments
	Million cases, 24/303's			
Lima beans				
1984/85	.4	2.3	2.7	2.2
1985/86	.5	2.0	2.5	1.8
1986/87	.7	1.7	2.4	1.7
1987/88	.7	1.3	2.0	
Snap beans				
1984/85	4.1	52.1	56.2	48.1
1985/86	8.1	55.5	63.6	51.8
1986/87	11.8	48.5	60.3	50.5
1987/88	9.8	56.0	65.8	
Beets				
1984/85	2.8	9.3	12.1	9.8
1985/86	2.3	9.4	11.7	8.5
1986/87	3.2	9.0	12.2	9.9
1987/88	2.3			
Sweet corn				
1984/85	8.4	56.9	65.3	54.2
1985/86	11.1	55.7	66.8	57.6
1986/87	9.2	55.1	64.3	57.8
1987/88	6.5	59.2	65.7	
Green peas				
1984/85	1.7	23.3	25.0	21.7
1985/86	3.3	29.3	32.6	24.9
1986/87	7.7	20.9	28.6	24.1
1987/88	4.5	23.1	27.6	
Tomatoes 1/				
1984/85	8.7	43.2	51.9	40.9
1985/86	11.0	37.5	48.5	38.7
1986/87	9.8	39.0	48.8	42.9
1987/88	5.9	44.6	50.5	
Total				
1984/85	26.1	180.9	207.0	178.2
1985/86	36.3	189.4	225.7	183.7
1986/87	42.4	174.2	216.6	186.9
1987/88	29.7	184.2	213.9	

1/ The pack data does not include concentrated crushed tomatoes.

SOURCE: National Food Processors Association.

Table 15. —Frozen vegetables: Carryover, pack, seasonal supply, and disappearance, 1984/85-1988/89

Commodity and season	Carry over	Pack	Seasonal supply	Total shipments
	Million pounds			
Broccoli				
1984/85	62.1	365.8	427.9	336.8
1985/86	91.1	356.8	447.9	369.6
1986/87	78.3	324.5	402.8	307.7
1987/88	95.1	312.5	407.6	300.2
1988/89	107.4			
Lima beans				
1984/85	32.7	122.5	155.2	123.0
1985/86	32.0	117.1	149.1	108.0
1986/87	41.1	100.9	142.0	120.9
1987/88	21.1	102.4	123.5	
1988/89				
Snap beans				
1984/85	81.5	248.3	329.8	254.1
1985/86	75.1	271.9	347.0	275.9
1986/87	71.1	294.0	365.1	290.9
1987/88	74.2	230.7	304.9	244.4
1988/89	60.5			
Cauliflower				
1984/85	31.1	102.1	133.2	91.8
1985/86	41.4	94.6	136.0	96.3
1986/87	39.7	89.1	128.8	89.7
1987/88	39.1	77.8	116.9	72.7
1988/89	44.2			
Carrots				
1984/85	96.7	255.6	352.3	258.9
1985/86	93.5	254.6	348.1	255.4
1986/87	92.7	270.4	363.1	250.5
1987/88	112.6	294.6	407.2	
1988/89				
Sweet corn				
1984/85	124.5	673.6	798.1	677.6
1985/86	120.5	783.6	904.1	767.1
1986/87	137.0	756.8	893.8	758.9
1987/88	134.9	840.0	974.9	
1988/89				
Green peas				
1984/85	82.5	423.7	506.2	385.9
1985/86	120.3	486.0	606.3	442.3
1986/87	164.0	373.6	537.6	405.8
1987/88	131.8	400.2	532.0	434.8
1988/89	97.2			
Spinach				
1984/85	25.2	171.2	196.4	169.5
1985/86	26.9	174.8	201.7	168.1
1986/87	33.6	157.1	190.7	162.3
1987/88	28.4	171.2	199.6	162.3
1988/89	37.3			
Total				
1984/85	536.3	2,362.8	2,899.1	2,298.3
1985/86	600.8	2,539.4	3,140.2	2,482.7
1986/87	657.5	2,366.4	3,023.9	2,386.7
1987/88	637.2	2,429.4	3,066.6	2,720.0
1988/89	346.6			

SOURCES: Carryover, Cold Storage, NASS, USDA; Pack, American Frozen Food Institute.

Table 16. --Frozen vegetables: Cold storage holdings, 1986-88

Crop	July 1			1988 as a percent of 1987
	1986	1987	1988 1/	
	Million pounds			Percent
Asparagus	17	19	23	42
Lima beans	48	28	17	61
Snap beans	71	74	61	82
Broccoli	106	137	120	88
Brussels sprouts	22	13	18	138
Carrots	103	117	116	99
Cauliflower	40	39	44	113
Sweet corn	163	140	186	133
Mixed vegetables	57	51	45	88
Okra	28	20	39	195
Onions	34	24	30	125
Blackeyed peas	13	6	7	116
Green peas	228	233	159	68
Peas and carrots	8	7	6	86
Spinach	84	103	82	80
Squash	41	44	59	134
Southern greens	30	17	32	188
Other vegetables	208	188	206	110
Total vegetables	1,301	1,260	1,350	107
Potatoes	1,097	1,003	995	99
Grand total	2,398	2,263	2,245	99

1/ Preliminary.

SOURCE: Cold Storage, NASS, USDA.

Table 17. --Processing vegetables: Planted and prospective acreage, 1986-88

Crop	1986	Planted acreage 1987		Prospective 1988 contract	1988 as percent of contract 1987
		Total	Contract		
	1,000 Acres				Percent
Beans, snap					
Freezing	59.8	66.9	64.9	64.8	100
Canning	146.5	162.9	143.1	148.6	104
Total	206.3	229.8	208.0	213.4	103
Sweet corn					
Freezing	165.6	176.6	176.3	178.7	101
Canning	266.5	286.7	286.4	282.7	99
Total	432.1	463.3	462.7	460.4	99
Green peas					
Freezing	132.1	138.6	138.6	137.6	99
Canning	157.2	163.7	161.9	155.2	96
Total	289.3	302.2	300.4	292.7	97
All three crops					
Freezing	357.5	382.1	379.8	381.1	100
Canning	570.3	613.3	591.4	586.5	99
Total	927.8	995.4	971.2	967.6	100
Tomatoes	260.6	262.6	258.1	274.8	106
Total four crops	1,188.4	1,258.0	1,229.3	1,242.4	101

SOURCE: Vegetables, NASS, USDA.

Table 18. --Vegetables: Monthly index of wholesale and retail prices, 1985-88

Item	Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						1982-84=100							
Canned	1985	103.6	101.1	103.8	102.4	101.7	104.4	103.1	104.2	100.7	100.6	99.0	99.1
	1986	99.5	100.6	101.2	100.5	101.0	103.4	101.2	100.9	102.5	100.6	101.7	102.1
	1987	102.1	102.8	104.8	104.6	103.4	105.9	103.6	105.0	102.8	102.9	102.3	102.6
	1988	103.2	103.5	103.6	103.2	103.2	103.7	107.9					
Frozen	1985	105.5	106.1	106.2	106.7	106.6	106.8	106.9	106.8	106.8	106.9	106.7	106.7
	1986	106.8	106.8	106.9	106.3	106.7	107.0	106.5	106.6	106.6	106.4	106.5	106.7
	1987	107.2	107.6	107.4	107.8	107.5	107.4	107.4	107.5	107.7	107.2	106.6	106.7
	1988	107.0	106.6	107.2	106.7	106.4	106.6	107.1					
Processed 1/	1985	104.0	104.3	104.0	104.0	104.7	104.9	105.0	105.3	104.8	104.3	104.0	104.0
	1986	104.3	104.3	104.0	104.3	104.2	104.6	104.9	105.0	103.8	103.3	103.6	104.2
	1987	106.2	105.0	107.5	106.4	106.9	107.3	107.7	107.9	107.6	107.5	107.3	107.3
	1988	107.2	107.6	107.9	108.4	108.6	110.0	111.3					

1/ At the retail level.

SOURCE: Bureau of Labor Statistics, Department of Labor.

Table 19. --Canned vegetables: Wholesale prices of selected items, July 1987-88

Item	July 1987	July 1988	1988 as a percent of 1987
	Dollars per case		Average percent
Snap beans			
24/303	7.00	7.62	109
6/10	9.12	10.35	113
Sweet corn			
24/303	7.12	7.86	110
6/10	12.00	13.00	108
Green peas			
24/303	8.00	8.50	106
6/10	10.00	12.62	126
Whole tomatoes			
24/303	7.75	8.26	107
6/10	9.25	11.50	124
Tomato paste			
6/10	17.00	17.00	100
55-gallon drums (¢ per pound)	.38	.40	105

SOURCES: Food Production Management and American Institute of Food Distribution, Inc.

Table 20. --Frozen vegetables: July wholesale prices of selected items, 1987-88 1/

Item	Retail size	Foodservice 2/
	Dollars	
Snap beans		
1987	8.75	.47
1988	8.96-9.02	.51
Sweet corn, cut		
1987	8.20	.46
1988	9.10	.49
Sweet corn, cob 3/		
1986	9.98	.44-.46
1987	10.99-11.02	9.38
Green peas		
1986	8.20	.46
1987	9.10	.46
Broccoli, spears		
1986	10.25-10.50	.52-.57
1987	10.80	.58

1/ Retail sizes are 24/10-ounce or 9-ounce packages. 2/ Foodservice sizes are 12/2-1/2 pound packages. 3/ Retail size is 12/4's and foodservice is 48/1's.

SOURCE: American Institute of Food Distribution.

Table 21. --Potatoes: Acreage, yield per acre, and production, selected seasons, 1986, 1987 and indicated 1988

Season	Harvested acreage			Yield per acre			Production		
	1986	1987	1988 1/	1986	1987	1988 1/	1986	1987	1988 1/
	1,000 acres			Cwt			Million cwt		
Winter	12.3	11.7	12.3	243	214	230	2.99	2.50	2.82
Spring	75.9	80.7	79.0	261	220	251	19.82	17.72	19.83
Summer	95.2	100.0	92.1	220	228	214	20.93	22.80	19.72
Total	183.4	192.4	183.4	238	224	230	43.74	43.02	42.37

1/ Indicated 1988.

Source: Crop Production, NASS, USDA.

Table 22. --Potatoes: Acreage of fall crop, 1986/87 and indicated 1988

States	Planted area			Harvested area		
	1986	1987	1988 1/	1986	1987	1988 1/
	1,000 acres					
California	17.0	19.0	16.5	17.0	19.0	16.5
Colorado	57.0	61.0	60.0	57.0	60.0	59.5
Idaho	310.0	340.0	350.0	307.0	337.0	347.0
Maine	87.0	87.0	86.0	86.0	86.0	85.0
Michigan	42.0	34.0	32.0	35.0	33.0	30.0
Minnesota	72.0	72.0	70.0	70.0	71.0	64.0
New York	33.0	33.0	31.5	31.4	32.4	30.5
North Dakota	128.0	130.0	130.0	120.0	125.0	124.0
Oregon	53.0	56.0	47.0	52.0	55.0	46.0
Washington	119.0	124.0	115.0	118.0	124.0	115.0
Wisconsin	59.0	64.5	62.0	57.5	63.5	61.0
Other	88.1	87.5	83.5	85.3	84.4	80.1
Total	1,065.1	1,108.0	1,083.5	1,147.0	1,090.3	1,058.6

1/ Indicated 1988.

SOURCE: Crop Production, NASS, USDA.

Table 23. —Potatoes, pulses, dry edible peas, and lentils: U.S. monthly and season average grower prices, 1986-88 1/

Crop	Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
							Dollars per cwt						
Potatoes	1986	3.12	3.35	3.50	3.99	4.39	4.79	6.91	5.68	4.28	4.20	4.64	4.74
	1987	5.01	4.93	5.05	5.66	7.23	6.98	6.96	4.95	3.95	3.73	3.68	3.57
	1988	3.75	3.73	4.00	4.09	4.66	4.23	5.70	6.30				
Dry edible beans	1986	17.30	17.10	17.00	17.10	16.90	17.30	17.30	17.00	15.90	19.30	20.20	22.00
	1987	21.50	21.40	18.60	18.90	19.00	18.60	19.40	17.00	15.40	14.60	14.00	13.10
	1988	13.40	14.40	16.30	16.90	18.40	21.00	27.50	26.00				
Green peas	1986	10.00	10.25	10.95	11.00	11.45	11.50	10.00	9.25	8.70	9.05	8.80	8.55
	1987	8.35	8.60	8.30	8.50	8.50	8.35	8.00	7.25	7.10	7.00	7.00	6.95
	1988	7.15	7.50	7.55	7.60	7.50	8.00						
Yellow peas	1986	10.00	10.00	10.40	10.70	10.75	10.00	8.85	8.50	8.20	8.20	8.00	7.70
	1987	7.55	7.75	7.95	8.00	7.90	7.60	7.50	7.00	6.75	6.60	6.70	7.05
	1988	7.70	9.00	9.30	—	—	—						
Lentils	1986	46.00	42.25	40.00	NQ	NQ	NQ	21.00	19.38	16.70	21.00	20.65	19.00
	1987	17.75	17.50	14.10	14.90	14.50	13.40	12.40	10.25	10.00	9.20	8.25	8.00
	1988	7.70	8.00	8.00	8.50	10.00	15.50						

1/ 1988 prices are preliminary. NQ = No quotas

SOURCES: Agricultural Prices, NASS, USDA and American Dry Pea and Lentil Association.

Table 24. —Potatoes: Monthly and annual average retail price index, 1982-88

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual average
							1982-84=100						
1982	90.3	93.0	94.2	95.8	100.2	107.9	116.0	102.7	85.2	76.3	75.3	75.5	92.7
1983	73.9	75.3	75.4	80.9	88.3	95.3	100.3	107.1	105.2	99.1	95.4	99.4	91.3
1984	107.1	112.5	113.7	114.9	116.4	122.5	142.5	149.6	110.8	101.5	98.0	102.4	116.0
1985	103.7	105.0	105.8	107.3	115.6	125.0	120.4	103.8	88.6	81.3	80.6	81.4	101.1
1986	83.8	82.2	81.9	83.7	87.5	99.3	111.4	112.0	104.9	101.2	103.9	103.9	96.1
1987	106.4	111.7	111.2	116.2	127.1	136.4	139.1	127.6	110.5	101.9	100.6	103.8	116.0
1988	104.6	106.2	108.5	111.2	114.7	122.2	125.7						

SOURCE: Bureau of Labor Statistics, Department of Labor.

Table 25. —Frozen french fries: Monthly and annual average Producer Price Index, 1982-88

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual average
							1982-84=100						
1982	99.1	98.6	99.0	98.4	99.0	98.6	98.4	101.1	101.4	102.4	102.0	102.1	100.0
1983	103.3	102.5	102.1	102.5	101.1	101.3	101.2	101.2	100.5	100.7	102.9	102.9	101.9
1984	103.1	102.5	108.3	107.4	107.2	109.8	110.2	110.3	109.9	110.1	110.1	110.0	108.2
1985	110.8	111.6	111.9	112.9	113.0	113.1	113.4	113.2	113.8	114.3	113.8	113.9	113.0
1986	114.0	114.0	114.1	113.4	113.5	113.5	112.8	113.3	112.8	112.8	113.9	113.5	113.5
1987	115.3	116.3	115.5	115.9	115.4	115.5	115.2	114.8	116.2	114.5	113.4	113.8	115.2
1988	114.4	113.6	113.6	114.1	113.0	113.4							

SOURCE: Bureau of Labor Statistics, Department of Labor.

Table 26. --Agaricus and exotic mushrooms combined: Number of growers, volume of sales value of sales, July 1 - June 30

Year	Growers 1/	All sales		
		Volume of sales	Price per pound	Value of sales
	Number	1,000 pounds	Dollar	1,000 dollars
1985-86	514	587,956	.839	493,093
1986-87	468	614,393	.865	531,658
1987-88	411	636,515	.890	566,394

1/ Number of growers counted once if growing both agaricus and exotics.
SOURCE: Mushrooms, NASS, USDA.

Table 27. --Canned mushrooms: Imports, selected countries, 1986/87 and 1987/88

Country	July/June 1986/1987	July/June 1987/1988	June 1987	June 1988
	Million pounds			
China, Mainland	66.1	57.5	5.0	6.1
Taiwan	63.7	39.2	5.6	2.6
Hong Kong	32.0	20.6	2.8	2.9
Total	161.8	117.3	13.4	11.6

SOURCE: Foreign Agricultural Service, USDA.

Table 28. --Dry edible beans: Harvested acreage, 1986-88

States	1986	1987	Indicated 1988 1/	1988 as percent of 1987
	1,000 acres			Percent
California	155.0	168.0	159.0	95
Colorado	185.0	180.0	195.0	108
Idaho	139.0	148.0	108.0	73
Michigan	340.0	440.0	250.0	57
Nebraska	205.0	197.0	200.0	102
North Dakota	280.0	359.0	380.0	106
Other 2/	191.0	216.4	200.0	93
Total	1,495.0	1,708.4	1,492.0	87

1/ As of August 1. 2/ Includes Kansas, Minnesota, Montana, New York, Utah, Washington, and Wyoming.

SOURCE: Crop Production, NASS, USDA.

Table 29. --Dry peas and lentils: Planted acreage, 1986-88

Class	1986	1987	1988	1988 as a percent of 1987
	Acres			Percent
Regular green	152,556	145,770	160,151	110
Sm. sieve green	9,999	10,409	6,032	58
Yellow	20,362	20,641	21,215	103
Lentils	161,220	152,115	73,225	46
Total	344,137	328,935	260,623	79

SOURCE: American Dry Pea and Lentil Association.

Table 30. --Commercial fresh vegetables and melons: per capita utilization, farm weight, 1976-87

Calendar years	Asparagus	Broccoli	Carrots	Cauliflower	Celery	Sweet corn	Lettuce	Onions 2/	Tomatoes	Honeydews	Total vegetables and melons
						Pounds					
1976	.4	1.1	6.4	1.0	7.4	8.0	24.2	13.1	12.6	1.1	75.3
1977	.3	1.2	5.1	1.1	7.0	7.6	25.8	13.5	12.4	1.1	75.2
1978	.3	1.1	5.6	.9	7.3	7.3	25.6	13.7	13.2	1.6	76.5
1979	.3	1.4	6.4	1.3	7.4	7.2	25.9	14.7	12.8	1.7	79.1
1980	.3	1.6	7.0	1.3	7.8	7.2	26.8	13.7	13.4	1.5	80.5
1981	.3	1.8	7.1	1.6	7.7	7.1	25.7	13.1	13.2	1.6	79.3
1982	N/A	2.2	7.3	1.6	7.8	7.1	25.6	15.2	13.4	2.0	82.3
1983	N/A	2.3	7.5	1.7	7.4	7.3	25.6	15.3	13.7	1.9	82.5
1984	.4	2.7	7.9	2.2	7.5	7.6	26.0	16.1	15.3	1.9	87.6
1985	.5	2.9	7.6	2.3	7.4	7.6	24.9	16.5	16.1	2.2	88.0
1986	.6	3.5	7.7	2.7	7.0	7.2	23.2	17.9	17.2	2.6	89.6
1987 3/	.6	3.6	8.5	2.7	7.1	7.3	22.7	16.3	16.8	2.4	88.0

N/A = not available. 2/ Includes production for the State of California, which is primarily for processing. 3/ Preliminary.

SOURCE: ERS, USDA.

Table 31. --Per capita utilization of selected commercially produced fresh and processing vegetables, calendar years 1975-87

Crop	Farm weight basis												
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987 1/
	Pounds												
Asparagus													
Fresh	.4	.4	.3	.3	.3	.3	.3	N/A	N/A	.4	.5	.6	.6
Canning	.6	.5	.4	.4	.3	.4	.4	N/A	N/A	N/A	.3	.3	.3
Freezing	.2	.3	.2	.2	.2	.1	.1	N/A	N/A	.1	.1	.1	.1
Beans, green													
Canning	3.9	4.2	4.1	4.2	4.2	4.1	4.2	3.7	3.7	3.4	3.5	3.8	3.7
Freezing	1.4	1.3	1.2	1.4	1.5	1.6	1.5	1.5	1.7	1.7	1.7	1.5	2.0
Broccoli 2/													
Fresh	1.0	1.1	1.2	1.1	1.4	1.6	1.8	2.2	2.3	2.7	2.9	3.5	3.6
Freezing	1.0	1.1	1.2	1.4	1.4	1.4	1.5	1.5	1.5	1.8	1.9	1.7	2.2
Corn 3/													
Fresh	7.8	8.0	7.6	7.3	7.2	7.2	7.1	7.1	7.3	7.6	7.6	7.2	7.3
Canning	12.0	13.1	14.1	13.2	12.5	12.9	12.1	11.4	11.5	10.1	11.7	11.9	10.5
Freezing	6.3	5.9	7.4	6.3	6.8	6.4	6.2	5.7	6.6	7.9	7.8	7.5	7.9
Carrots 4/													
Fresh	6.4	6.4	5.1	5.6	6.4	7.0	7.1	7.3	7.5	7.9	7.6	7.7	8.5
Canning	.9	1.0	1.0	.9	1.0	.9	.9	.8	.8	1.1	.9	.8	.9
Freezing	2.6	2.6	2.7	2.5	2.7	2.5	2.5	2.2	2.2	2.9	2.4	2.2	2.4
Cauliflower 2/													
Fresh	.9	1.0	1.1	.9	1.3	1.3	1.6	1.6	1.7	2.2	2.3	2.7	2.7
Freezing	.6	.6	.7	.8	.7	.8	.9	.9	.8	.9	.9	.9	.9
Peas, green 5/													
Canning	2.8	2.9	3.0	2.9	2.6	2.7	2.7	2.5	2.4	2.0	2.0	2.2	2.0
Freezing	1.9	1.9	1.8	1.8	1.9	1.8	1.7	1.7	1.8	2.0	2.1	1.9	1.7
Tomatoes													
Fresh	12.0	12.6	12.4	13.2	12.8	13.4	13.2	13.4	13.7	15.3	16.1	17.2	16.8
Canning	61.9	65.6	62.8	58.8	64.3	63.6	59.3	60.1	60.8	68.4	63.1	63.4	64.6
Potatoes													
Fresh	52.6	49.4	50.1	46.1	46.6	51.0	45.7	46.6	49.9	48.8	46.6	49.6	~~44.0~~ 47.0
Canning	2.0	2.0	2.2	2.3	2.1	1.9	1.8	1.9	1.9	1.8	1.9	1.1	1.8
Freezing	35.0	39.7	42.3	41.4	41.6	36.1	38.4	40.3	38.3	41.6	44.30	44.30	~~44.3~~ 46.5
Other processing	30.1	32.1	27.6	28.5	27.6	26.1	27.4	27.3	27.6	28.1	28.8	~~28.6~~ 29.4	~~28.6~~ 28.1
Cucumbers for Pickles	6.2	6.1	5.9	6.0	5.9	5.6	N/A	N/A	N/A	N/A	5.7	5.3	5.1

N/A = not available. 1/ Preliminary. 2/ Production for processing of broccoli and cauliflower is all for freezing. 3/ "On-Cob" basis. 4/ Industry allocation suggests that 27 percent of carrot production is for canning and 73 percent is for freezing. 5/ Shelled basis.

SOURCE: ERS, USDA.

Table 32. —Commercially produced vegetables: Total per capita utilization, United States, 1973-87

	Farm weight basis					Percentage of annual total			
			Processing				Processing		
Fresh	Total fresh and processed	Fresh	Total	Canning	Freezing	Fresh	Total	Canning	Freezing
			Pounds				Percent		
1973	176.3	73.4	102.9	88.6	14.3	41.6	58.4	50.3	8.1
1974	178.3	74.2	104.0	89.8	14.2	41.6	58.4	50.4	8.0
1975	176.4	73.5	102.9	88.9	14.0	41.6	58.4	50.4	7.9
1976	183.0	75.3	107.8	94.1	13.7	41.1	58.9	51.4	7.5
1977	182.4	75.2	107.2	92.1	15.1	41.2	58.8	50.5	8.3
1978	177.8	76.5	101.3	87.0	14.3	43.0	57.0	48.9	8.0
1979	185.4	79.1	105.3	91.2	15.1	42.6	57.4	49.2	8.2
1980	185.7	80.5	105.2	90.6	14.6	43.4	56.6	48.8	7.9
1981	173.9	79.3	94.6	80.0	14.6	45.6	54.4	46.0	8.4
1982	174.6	82.3	92.4	78.9	13.5	47.1	52.9	45.2	7.7
1983	176.8	82.5	94.2	79.5	14.7	46.7	53.3	45.0	8.3
1984	190.2	87.6	102.6	85.2	17.4	46.1	53.9	44.8	9.1
1985	192.4	88.0	104.4	87.5	16.9	45.7	54.3	45.5	8.8
1986	193.0	89.6	103.4	87.6	15.8	46.4	53.6	45.4	8.2
1987	192.2	88.0	104.2	87.1	17.1	45.8	54.2	45.3	8.9

SOURCE: ERS, USDA.

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