

Lemon Industry in California

long-term projection of market potential for lemon juice products based on variable determinants of summer demand

Sidney Hoos

The following article is the third of a series on the economic situation and marketing problems of the California lemon industry.

Analyses of short-term economic and price relationships between fresh lemons and lemon juice products were reported on in the second article of this series. For examination of the current situation and for projection over short periods into the future, such analyses are helpful, but for long-term projections, a different method is used. Future uncertainties—of varying magnitudes—exist in the long-run determinants of demand.

Making long-term projections in the economic sphere is a highly treacherous activity and definitely more dangerous for those who follow them than for those who make them. Yet, without long-term projections the investigation and report would be incomplete.

When considering the comparative trends in consumption disappearance of frozen concentrated lemonade some doubt exists as to what prepared cold-drink beverages are in fact competitive in demand. An even more difficult question concerns the varying degrees of competition. Lemonade is more of a specialty item than a staple or necessity. Further, its seasonality of consumption and its demand sensitivity of higher ranges of summer temperature may well be greater than for other cold drink products. For comparative purposes, the consumption-disappearance trend of frozen concentrated lemonade may be contrasted with carbonated beverages, fermented malt liquor, frozen concentrated orange juice, and frozen concentrated grape juice.

Each of these drink products has a different background and history and has in large part been influenced by differential impact of economic and demand development. Carbonated beverages, for example, have a statistical record back to 1849. Fermented malt liquor, generally referred to as beer and ale, has a longer record, but its long-term consumption development was interrupted by prohibition legislation. Frozen concentrated lemonade, orange juice, and grape juice, reflect postwar developments.

In its first five or six years, frozen concentrated lemonade surpassed the corresponding historical performance of the other beverages—excepting frozen concentrated orange juice—and since 1950–51, when it was introduced in any substantial amount for which household consumption data are available, frozen concentrated lemonade has grown at a faster rate than the other juice products listed. In substantial part, that growth reflects the behavior of a new product which has been favorably accepted by the public. Yet, frozen concentrated grape juice has been on the market about the same length of time as frozen lemonade but has not grown so rapidly. So far, the rate of market penetration and consumer acceptance of frozen concentrated lemonade has been near historic for that type of a specialty product.

For long-term projections in trends in production-disappearance of various beverage products, the basic determinants and the premises involved must be considered. Those determinants include the future trend in population and its

structure, the course of gross national product and its related disposable personal income, and the changeable and changing pattern of consumer preferences.

The projection of the national population numbers can not be made with confidence. In the 1920's and 1930's, birth rates were falling as they had been for two centuries and it was widely thought that by 1975–1980 the national population would have reached its peak. But, shortly after 1940, a marked upward turn in births set in and has been sustained in recent years. Many observers have come to the view that a new and radically different population prospect is emerging.

Barring catastrophic events, certain developments in the national population can be anticipated between 1955 and, say, 1975. Most of the men and women who will become parents during the next 20 years have been born. In fact, until around 1965, most children will be born to parents whose birth occurred in the depression years. Because those were years of low birth rates, the limited child-bearing population between 1955 and 1965 will impose limits on the number of births, even if family size does rise and remain high. The number of women in the 20–39 age group will remain about constant until after 1965, when the many

Concluded on page 14

Projections of Market Potentials for Frozen Concentrated Lemonade and Lemon-Juice Products

Factor	1955 base	Range of projections up to 1975			
		High	Medium	Low	
Population (eating out of civilian supplies)	millions	164.4	230	220	210
	per cent	100	140	134	128
Disposable personal income, per capita (in 1955 constant dollars)	dollars	1,630	2,700	2,280	1,860
	per cent	100	166	140	114
Disappearance-consumption rate, per capita, of frozen concentrated lemonade (household use)	gallons	0.065	0.120	0.100	0.08
	per cent	100	185	154	123
Total disappearance-consumption of frozen concentrated lemonade (household use)	thousand gallons	10,686	27,600	22,000	16,800
	per cent	100	258	206	157
Disappearance-consumption rate, per capita, of lemon-juice products, including imports (in pounds fresh equivalent)	pounds	2.2	4.0	3.3	2.6
	per cent	100	180	150	120
Total disappearance-consumption of lemon-juice products, including imports (in pounds fresh equivalent)	million pounds	361.68	920	726	546
	per cent	100	254	200	150

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APRICOT

Concluded from page 5

formed—emerged from cotyledon proliferations—tumors—as well as from those of the hypocotyls. Shoot growth was drastically retarded or completely inhibited, and when leaves developed at all they tended to be small, extremely narrow and distorted.

None of the abnormal growth found after treatment with the phenoxy compounds appeared in seedlings from NAA-treated trees. Although NAA inhibited germination to a considerable degree and reduced the percentage of viable plants, its only unfavorable effect on seedling growth was slowed development. Otherwise the seedlings from NAA-sprayed trees were like those from unsprayed trees.

Seeds from sprayed trees were as normal in appearance as those from unsprayed ones, aside from a somewhat greater tendency toward splitting of the seed coats caused by slight stimulation of cotyledon growth. Furthermore, in microscopic studies of seed development from the time of application of 2,4,5-T to fruit maturity, not a single deviation from the normal developmental pattern was found. These observations lead to the conclusion that the growth regulators as applied here with respect to concentration and time of application do not interfere with normal seed development but do stimulate abnormalities during germination.

To determine whether inhibited germination as well as the same types of seedling abnormalities could be induced in apricot seeds treated directly with 2,4,5-T—as those occurring in offspring of sprayed trees—unsprayed Royal seeds were stratified in moist sand at 32° F for three weeks beginning in February 1956.

Pits and integuments were then removed and different lots of seeds were soaked in 1, 2, 4, and 8 ppm solutions of 2,4,5-T with three durations of treatment for each concentration, 12, 24, and 36 hours. Seeds were also soaked in distilled water for the same periods of time. After treatment the seeds were planted in vermiculite in the greenhouse and germination data were recorded during the following seven weeks.

The smaller table in column 2 shows that consistent decreases in the percentages of germination and viable plants accompanied either increasing concentration of 2,4, 5-T or increasing duration of treatment. For the seeds soaked 24 and 36 hours, however, part of the reduced germination must be attributed to exposure to liquid for those periods of time, since germination of seeds soaked in water alone was decreased with lengthened time of treatment.

The seedlings from seeds soaked in

2,4,5-T solutions showed the same general types of external abnormality as those from sprayed parent trees. Primary root growth was inhibited to greater or lesser extent according to dosage. Swellings appeared on the hypocotyls and cotyledon bases and roots emerged from them. Seedlings from seeds given the higher dosages showed slight epinasty of the first few leaves. Of the seedlings classified as viable, in all but those from the lightest treatments, average shoot growth was retarded, with the slowed growth approximately in proportion to the severity of the treatment.

In view of the greatly reduced percentages of seed germination and viable seed-

The Effect of Soaking Stratified Royal Apricot Seeds in Water and in Various Concentrations of 2,4,5-T Upon Subsequent Germination and Viable Plant Production

Treatment	Germination %	Viable plants %
12 hours		
Water	100	100
2,4,5-T, 1 ppm	100	100
2,4,5-T, 2 ppm	83	83
2,4,5-T, 4 ppm	58	42
2,4,5-T, 8 ppm	25	8
24 hours		
Water	90	90
2,4,5-T, 1 ppm	82	64
2,4,5-T, 2 ppm	60	40
2,4,5-T, 4 ppm	45	9
2,4,5-T, 8 ppm	45	0
36 hours		
Water	69	69
2,4,5-T, 1 ppm	64	27
2,4,5-T, 2 ppm	36	7
2,4,5-T, 4 ppm	31	0
2,4,5-T, 8 ppm	15	0

The Effect of Plant Growth Regulator Application to Apricot Trees at the Beginning of Pit Hardening on Subsequent Germination and Seedling Viability

Variety and locality	Treatment	Germination %	Viable plants %
Royal San Jose	Control	100	100
	2,4,5-T, 15 ppm	100	100
	2,4,5-T, 25 ppm	84	41
	2,4,5-T, 50 ppm	50	22
	Control	94	67
Tilton Hollister	2,4,5-T, 25 ppm	56	45
	2,4,5-TP, 25 ppm	59	14
	2,4-D, 25 ppm	0	0
	NAA, 25 ppm	54	32
	Control	67	40
Royal Green Valley	2,4,5-T, 50 ppm	47	17
	2,4,5-TP, 50 ppm	28	0
	2,4-D, 50 ppm	0	0
	Control	50	27
	2,4,5-T, 100 ppm	23	6
Stewart Winters	2,4,5-TP, 100 ppm	30	2
	2,4-D, 100 ppm	0	0
	NAA, 100 ppm	15	6

lings as a result of growth regulator application to parent apricot trees, nurserymen should avoid using seeds from sprayed trees for propagation even though they appear normal.

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LEMON INDUSTRY

Continued from page 2

women born in 1945-55 will commence to enter the 20-39 age category. There will be the potential for a really explosive population upward surge after 1965 should early marriage and large families be popular at that time.

The projections of the national population may be at different degrees of high, depending on whether the projector assumes the continuance of recent birth rates or a gradual return to the prewar level, or—an even more extreme assumption—that births might drop low enough to fit the long-time prewar trend line. National population projections to 1975 may be set at a high of 230 millions; a medium of 220 millions; and a low of 210 millions.

Along with the growing numbers of consumers, the capacity for gross consumption has risen, and prospects are favorable to a continuation of this expansion in the next 20 years.

The President's Materials Policy Commission has forecast a 100% rise in production of all goods and services from 1950 to 1975. With the prospect of more than 200 million persons in the United States by 1975, this forecast implies a gross national product of about \$2,650 per capita, which is 52% higher than the 1950 figure.

During the past 30 years, per-capita disposable income has averaged about 75% of per-capita gross national product. However, this figure is affected by the relatively lower tax rates of the 1930's. During the last five years, the per-capita disposable income has averaged only 71% due to higher taxes. Assuming no tax increases but only a maintenance of the present structure in 1975, per-capita disposable income then should be about 48% higher than it was in 1950.

When people in low-income categories obtain an increase in income, they may spend as much as one half of their additional income on food. But in the higher income categories, an increase in income has much less effect on food demand—perhaps no more than 10% of the increase is spent for food. It is generally

accepted in the United States that the additional outlays for food are in the vicinity of 20% to 25% of an income increase.

With the population growth and income rise that are in prospect, the demand for food by 1975 may be 50% higher than in 1950. This expectation results from an estimated population growth of 36% between 1950 and 1975, accompanied by a 10% increase in per-capita food demand, which is based on the expectation of higher incomes.

In the spring of 1948, the Department of Agriculture made a nationwide survey of the food consumption of urban families. It was found that fruit took 8¢ of the consumer's food dollar and 5¢ of the 8¢ were spent on noncitrus fruits. Of the total expenditure for fruits other than citrus, about 62% was spent on fresh fruit, 26% on canned fruit, 5% on canned juices, and the remainder on frozen and dried products. Urban families with annual incomes between \$1,000 and \$2,000 spent \$17 a week for food compared with \$31 by the group with incomes between \$5,000 and \$7,500.

Among the food commodities to which consumers respond most readily—if they have adequate incomes—are frozen and fresh fruits. The 1948 survey indicated that the quantity of these items consumed in the home can increase as much as 3% with 10% higher incomes.

American families do not have rigid and fixed consumption habits and patterns, which—perhaps—is one of the most outstanding and significant features of the national economy. The great changes that have occurred in the American manner of living within recent decades have had their impact on every phase of economic life. The changes in food needs and preferences are certainly not the least important of these impacts. Formerly the American working force in many industries and occupations was engaged in energy-consuming physical labor now performed by machines. However, Americans continue to consume about the same total poundage of food-stuffs per capita as they did half a century ago. The adjustment has been to substitute foods that have appetite appeal and nutritional components other than carbohydrates for part of the previous energy-rich diets.

The shifting in the average diet is a gradual process likely to continue for many years to come. In addition, a further influence is the growing proportion of people in the older age categories. In coming years, it is expected that the number of persons aged 65 and over will increase almost twice as rapidly as the total population. This is in consequence of improvements in medical science.

Decreased need of energy-rich diets by older people and by a population that

has less arduous physical work to do is a matter that should have far-reaching significance for the fruit industries. Fruits are a very satisfactory substitute for foods that are high in carbohydrate. The role which could be played by lemon-juice products, particularly frozen concentrated lemonade, in this changing pattern of food consumption depends in large part on the manner in which the lemon products industry takes advantage of the situation; the potential will exist.

Making projection of consumption rates for a new product—such as frozen concentrated lemonade—and particularly one which apparently caught public favor is a different problem from one of making projections for an old long-time established product. For the new product the early growth factor is significant. In relative terms, the new product can be expected to reflect a strong initial growth factor due to market penetration and extension during the early years. Then a leveling out often prevails as the product becomes established, which may be expected of frozen concentrated lemonade.

To some observers the projections set forth in the table on page 2 may seem unnecessarily conservative, and to others the rates may seem grossly overoptimistic. But the projections are not predictions; they are indicators of potential developments in light of historical experience and considered likelihood as to the future of the United States economy.

The market projections are based—in addition to the population and income levels shown in the tabulation—on the premises that national productivity and employment generally reflect current peacetime conditions and that no marked changes occur in consumers preference structure. Therefore, they may be suggestive of the longer term market potential for lemon juice products.

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The fourth article in this series will appear in the November issue.

TENDERIZERS

Continued from page 10

These studies give some insight into the mechanism of papain tenderization of beef. Probably the most important tenderization mechanism is the hydrolysis of muscle-fiber protein, which accounts for three-fourths of the edible portion of beef. Papain hydrolyzes the sarcolemma and the muscle cell nuclei before there is any apparent digestion of the muscle fibers themselves. As measured by the transformation of soluble protein to amino acids, papain hydrolysis reaches a maximum at temperatures of 140°F to 176°F. It is probable that the heat-labile muscle proteins denature be-

fore the relatively heat-stable papain and papain hydrolyzes these denatured proteins with maximum effect.

Tenderization by papain can not be ascribed to one specific reaction but rather to a general hydrolysis of all of the structural components of beef muscle.

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ALFALFA APHID

Continued from page 7

aphid skin. The *Trioxys*-produced mummy is smooth, rounded, and grayish-brown in appearance but the mummy produced by *Aphelinus* is oblong in shape and black in color.

Several days after the mummy is formed, the parasite pupa changes to the adult which chews a hole in the aphid skin and emerges through it to continue the attack on the aphid. The adults of all three parasites are very small wasps, those of the largest species, *Praon palitans*, being no longer than one-eighth inch. Except for their lethal attack on spotted alfalfa aphid, these wasps are completely harmless, probably gaining their food from nectars and honeydews.

At present it is impossible to speculate as to the role these wasps will play in the biological control of spotted alfalfa aphid. Even after becoming established they must demonstrate the ability to spread from the release plots into adjacent commercial alfalfa fields and there survive and multiply in the face of the disruptive conditions of the alfalfa growing cycle.

Some of the factors which may tend to inhibit maximum parasite activity are: widespread insecticide applications; the mowing and baling processes; winter pasturing or dormancy of alfalfa; and periodic scarcity of aphids resulting from ladybird beetle attack or adverse climatic conditions. However, if—despite these factors—the parasites can reach the status which they have attained in a number of areas in the Mediterranean region and Middle East, their collective role should be of considerable importance in the biological control of spotted alfalfa aphid in California.

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