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# Avocado Varieties for California

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The following listing groups varieties according to 1976 California Avocado Society recommendation (1 to 5), private introductions (6 to 8), and University of California patents (9 and 10). Within each group, they are listed in order of palatable maturity. Other new experimental varieties are being tested, both private and UC. A third UC patent, Esther, has mediocre flavor which degenerated to "unacceptable" flavor at the end of the more tropical California summers of 1982 and 1983.

*A. Suggested by the Variety Committee of the California Avocado Society, 1976*

1. BACON: Good fruit size and quality, tree very cold hardy; short season, tall tree, yield variable to light.
2. FUERTE: The early-season quality standard, long season, hardy; yield just too erratic in most areas.
3. ZUTANO: Heavy yield, good fruit size, cold hardy; short season, end russet, large seed, less flavor, tall tree.
4. HASS: Heavy yield, small seed, nutty flavor, long season; tree large and sensitive to adversities, alternating production.
5. REED: Heavy consistent yield, attractive, late maturity; fruits large and round, tall tree, limb wind breakage.

*B. Experimental Varieties*

6. JIM: Re Bacon: longer season, spreading tree, heavier yield; long neck, late bronzing, market problems.
7. SANTANA: Re Zutano: higher-quality fruit, spreading tree; seldom yields enough.
8. PINKERTON: Heavy yield, tiny seed, good season, high quality; some fruits too necked, or too large.
9. GWEN: Very heavy yield, nutty flavor, long season, small tree; may discolor when ripening, seed averages larger than Hass.
10. WHITSELL: Heavy yield, small seed, 'B' flower, small tree; russets, set alternates, tree may be slow to take off.

*Order of maturity* as listed above is different from the long-established California order based on achieving the legally required 8% oil level. That rather arbitrary 8% level, chosen decades ago, was designed—in part—to ensure greater consumer satisfaction with our product. It indeed did much to prevent the harvesting of hopelessly immature fruit. An arbitrary level for all varieties, whether of an oil % or the comparable dry weight % that has now replaced it, has obvious advantages for legal enforcement. And our experience this past autumn in trying to increase consumer satisfaction by raising the legal dry weight % revealed several problems:

1. Marketing confusion and jockeying for market advantage.

2. The delay in harvesting our fall varieties encouraged an influx of out-of-state (Florida) fruit.

3. Certain varieties, specifically Jim among those fairly commonly grown, begin to drop their fruit before reaching the new higher dry matter level considered appropriate for their type-group.

We need better fall varieties. In the meantime, we may need to fine-tune our maturity standards. Perhaps, a superior method for determining true, physiological fruit maturity can eventually be developed.

Nevertheless, with the technology now available, surely we are wise to improve consumer enjoyment of our product by acting to further reduce the harvest and sale of immature fruit. (Even this past autumn, I have been dismayed by the immaturity of Zutano and Bacon fruits for sale in the local supermarket. They usually looked attractive, but repeatedly had a bland or raw taste—or both—far below the potential of even these two varieties. This is no way to encourage an early repeat sale to our good customers. Or any repeat sale to someone trying avocados for the first time. However, Fuerte quality has been good, as offered locally.)

In terms of our heretofore-established 8% oil level standard, Zutano has usually been the first variety to be legally mature. Using instead the preferred criterion of palatable maturity, I have placed it in the above listing after both Bacon and Fuerte. This agrees with my own subjective taste impression; more significantly, it is based on the published data of Lee *et al.* (1983). Their Table 3 gives the earliest date of "acceptable taste" for both Bacon and Zutano at four different locations from Santa Barbara to Valley Center. At every location, Bacon was rated acceptable by the taste panel earlier than Zutano, the difference averaging two weeks. Their Table 2 compares Zutano at Fallbrook with Fuerte at Irvine for five consecutive years. Every year, Fuerte was rated acceptable sooner. The difference in location makes the comparison questionable, but Table 3 gives the average date of Zutano acceptability at Irvine for three years; that date is six days later than the 5-year average of Fuerte acceptability at the same location. Bacon flavor was rated acceptable at an average of 8.7% oil, whereas Zutano did not gain acceptability until 10.4%.

These differences in first date of satisfactory flavor are small. And there e significant differences in taste preferences among consumers: one's aluation of maturity acceptability will be influenced by one's personal preference for sweeter (Bacon), richer

(Fuerte) or milder (Zutano) fruit. We can only say that a large, otherwise unbiased taste panel placed them in the above average order. The significant point is that there is no evidence to support our earlier thinking that Zutano should be picked earlier in the season than Bacon or Fuerte.

The variety listed 4th above, Hass, is clearly later-maturing than the first three. However, with the very much larger Hass acreage, there are a few off-blooms and enough early-blooms from inland San Diego County to provide a fair quantity of good quality late-fall fruit. Indeed, these new crop Hass have sometimes tasted much better than some of the supposedly "mature" Bacons and Zutanos.

Reed, (5), may be four months later-maturing than Hass. Since the Eastern Seaboard is accustomed to the usually large, green, smooth, sweeter, and blander West Indian types from Florida, it is inviting to think that we can sell them much of our Reed fruit in May and June, before Florida begins picking its fruit. This seems to be a dubious approach. Reed is a variety that needs to be well above the equivalent of 8% oil for reasonably good flavor, but it eventually becomes very good eating. Let us rather educate the Eastern Seaboard also, to what a superior California avocado can taste like!

In the experimental group of varieties above, Jim is listed first, (6); and it reaches acceptable flavor probably at least as early as Bacon. Santana is usually a little later than Zutano. Pinkerton is like Fuerte in blooming over a very long period, often beginning in late fall; its earliest-maturing fruits come off in December, or even late November, with good flavor.

Gwen and Whitsell are too new for their average maturity dates to be known with assurance in the different regions. Our tests have given variable results in different years. It now appears that Gwen will reach palatable maturity about with Hass, and that Whitsell will be a little later.

*Cold hardiness,* like earliness of maturity, is positively correlated with germplasm of the Mexican instead of the Guatemalan horticultural race. So the above two lists are roughly in order of decreasing hardiness. Hass, Reed, Pinkerton, Gwen, and Whitsell are all about equally cold tender, and will be injured at about 30°F (-1°C). This is more tender than one would expect for Pinkerton, since its early bloom (and fruit maturity) indicates substantial Mexican heritage. And it is more hardy than one might expect for Reed, the only one of the 10 listed varieties that is apparently pure Guatemalan.

Of the five hardier varieties, Jim and Bacon will take the most cold, Zutano and probably Santana are next, then Fuerte. Temperature limits vary with several factors: length of time at that temperature, degree of tree dormancy, nutritional status, size of crop, etc. For comparative purposes, Fuerte might tolerate 27°, Zutano and Santana 26°, Bacon and Jim 24 °F. This compares with some pure Mexicans, such as Mexicola or Duke, that under similar circumstances might tolerate even 18°F.

**Fall Greens**

Increased Florida production, and especially booming Hass production causing a great increase in both its carryover into the new crop year ("carry out" past November 1) and

early marketing of its new-crop fruit, have closed off the historical autumn supply-hollow price advantage— apparently permanently. Moreover, Hass has come to so dominate the California avocado picture that other varieties sell at a discount regardless of quality. Worse for these predominantly Mexican fall-maturers, they have lower quality in terms of flavor richness, seed size, and handling and shipping ability, making them more vulnerable in the market place.

But what has really caused their present desperate plight is that the California avocado supply has (temporarily) outrun adequate demand, producing a "buyers" market in which the fall lower-quality "orphans" are sometimes devaluated to returns less than even their costs of picking and handling.

The future of Bacon, Zutano, Jim, and Santana looks grim. Still, as a group, they have certain pluses:

1. They are the only varieties on my above list with much *cold-tolerance*. Anyone who chooses to grow Hass or another variety of comparable tenderness in an area where a few degrees of frost can be expected in occasional winters, is riding for a fall. He may get lucky and have enough mild winters to justify his investment. Or, he may not. There are surely enough unavoidable gambles in farming—including avocado farming—to make one leery of deliberately tempting fate.

2. All are "B"-flowering type, and so provide effective *cross-pollination* benefits for Hass, Pinkerton, Reed, Gwen, and any other "A"s. There is evidence that the greater the cold-tolerance of a pollinator, the more it can increase fruit set of the "pollinator," so their hardiness makes them especially favorable. More of this under Bacon, below.

3. To varying degrees, they do have *acceptable quality*, if properly managed. Such management involves two chief factors:

   a. That they not be picked before they are good to eat. This sounds so simple, but is not that easy in the real world of market timing advantages and varieties with individual differences being forced into the Procrustean bed of maturity indices. Still, the chief reason for the bad flavor reputation of these early varieties is that they have been picked too long before their eating prime.

   b. That they be handled as befits their thinner skin protection, all the way from initial picking to displaying in the retail market. We used to do this reasonably well, even for the considerably more delicate pure-Mexican "thinskins." Now, the dominating Hass variety has spoiled us; its thick skin takes much rougher handling—and any skin bruises that might discolor as the fruit ripens are covered up by the black color. Worse, a vicious circle has developed: very low prices inhibit the more careful handling needed to prevent superficial or deeper injury, which in turn lowers prices still more. Consistently better handling of the autumn fruits probably awaits better prices.

4. *Adequate grower prices* will return. A buyer's market is intolerable permanently. Several measures already begun in our industry will eventually redress the current supply/demand imbalance. (My own reckless guess is that—if present acreage-reduction and other corrective measures continue, and barring climatic or other disruption—the 1987-88 crop season will be the first crop small enough to permit reasonably good grower returns—although the succeeding crop may again be

uncomfortably large.) There needs to be a sharp reduction in bearing acreage, and the production of fall varieties has to be reduced proportionately much more than does total production.

Fall varieties will once more be profitable when their total production has decreased to a small fraction (one-quarter?) of present levels. This will be combined with market standards that better prevent the present selling of fruit that is immature in terms of palatability. Concomitantly, they will need to receive a little better handling. Even with these improvements, present fall varieties will be practically limited to the two special situations of colder locations and cross-pollination.

A larger future for varieties that mature in the fall probably would require the development of new varieties that better combine higher fruit quality with greater productivity. And it would certainly help if the new fruits looked more like Hass.

How responsible is the over-supply of fruit from fall varieties for our present situation of inadequate returns for avocados generally? I think that responsibility has been overstated. The chief cause of the precipitous fall in our average year-round price is the precipitous rise in our average year-round production. Most of that increase has been in Hass (thank goodness!). Fall varieties also increased sharply, but off a far smaller base. Fall varieties did create much consumer dissatisfaction—due in good part to pre-mature harvesting as noted above. There is no way of knowing what effect our very low fall variety prices have on subsequent Hass prices. But letters and interviews in the *Avocado Grower* have sometimes seemed to imply that if we could just topwork all of our Bacons, Zutanos, Jims, Santanas, etc. to Hass, our overall problems of inadequate prices would largely be solved. The April 1984 *Avocado Grower* quotes an industry leader as saying: "Perhaps our main villain is fall greens... This is, perhaps, the root cause of all the problems in our industry."

What would happen if we grafted over to Hass all of our fall greens, or even just the half or more of them in warmer areas? Two things seem certain:

1. an inpouring of additional Florida fruit, and

2. pressure to hold our Hass fruit later and to market its new crop sooner—i.e., pressure for reducing Hass consumer satisfaction by both over-maturity and under-maturity.

The effect on our overall prices is unclear. We can only hypothesize that getting rid of fall greens with their low prices would directly benefit average Hass prices. And switching to a higher-selling variety should up the overall average. *But*, the added Hass production would put more pressure on its prices year-round. And, after an initial topworking decline, total production should eventually increase, because Hass usually outbears Bacon especially, putting still more pressure on prices. The analyses get more complicated yet. But it is conceivable that merely switching from fall greens to more Hass could actually lower our overall grower returns. (This hypothetical situation is very different from that analyzed in *The Market Report* for December 12, 1984, where it is assumed that the fall green trees are just eliminated with their 90 million pounds of fruit—this large a reduction in production would of course be expected to considerably increase total grower earnings.)

We have a number of different kinds of problems in the California avocado industry at this time. One of them is excess fruit of inferior fall varieties. But, the basic problem is simply that our total production has outstripped present market development. We do need to make some varietal adjustments; but recovery will be delayed if we put emphasis elsewhere than on the primary supply/demand imbalance.

A letter in the March 1983 *Avocado Grower* suggests that "The avocado fiasco really starts with overzealous real estate agents pushing marginal avocado land as prime to greedy land developers, gullible retired people, and those nearing retirement who also want to make a fast buck. (I place myself in the latter category.)" That is commendably self-blaming, but is a bit harsh on all concerned. Another *Avocado Grower* letter (February 1982) states that "Little emphasis has been put on the basic reason for the market failure. There are just far, far too many avocados for the country to absorb at prices acceptable to growers." And another: "(Our industry handlers and leaders) all worked hard to give us farmers 'top dollar' for our avocados... They developed new markets. They returned higher and higher prices for our fruit. And what did they get—*more avocados*... We farmers planted more trees (until finally) the volume of fruit to market exceeded the limits of elasticity of the marketplace."

To be sure, there were contributing factors, like disorganized selling, also unnerving fear of the future in both growers and handlers. But at the heart of our problem is industry expansion faster than markets could be developed.

**Varieties Evaluated**

**1. Bacon.** It is listed first, as the earliest-maturing of the varieties that were recommended (1976) by the authoritative California Avocado Society's Variety Committee. In addition to this advantage, it has both of the justifications suggested above for keeping a fall variety: it is also the most cold-hardy variety on this C.A.S. list, and it can be a valuable cross-pollinator.

Evidence for the latter has been reported from grower observations in different Hass groves. (Hass is "A"-flower type, Bacon "B".) This past year saw statistically significant support for actual fruit counts by Dr. Norm Ellstrand of UC's Department of Botany and Plant Sciences. In Irvine Company (Orange County) groves, he compared set on Hass trees that were isolated (about 600 yards or meters from the nearest cross-pollinator) with other trees that were inter-planted with Bacons. Overall counts showed 48% more fruit on the trees exposed to cross-pollination, obviously a highly consequential increase. This is not to claim that benefits will average this high or even be present everywhere. The studies needed over many years and in many locations have not been possible because of budgetary limitations.

However, I am concerned for growers anywhere who are now topworking Bacons in (or adjacent to) their Hass groves. One can imagine a situation where 20% of the trees in a Hass grove are Bacons; the latter have only fair production and are returning disastrously low prices per pound; the grower reasonably concludes that he can help his cash flow by topworking the Bacon "drones" to his better bearing, much better paying

Hass; but instead of getting more Hass fruit thereby, he may actually average less total on his now more numerous Hass trees because he has lost his cross-pollination. Again, we do not know that this will happen—it is a possibility. Indeed, cross-pollination may help Hass stave off the dawning onslaught of the heavier-bearing new UC varieties.

To be weighed against the three Bacon advantages of earliness, cold-hardiness, and cross-pollination benefits, are its usually lesser productivity, tree height, and recently the fruit price. Also, although its seed averages smaller than that of Zutano, and its flesh is better-flavored to most people, its fruit quality is not outstanding. One's judgment on this will depend largely on whether or not one prefers the sweeter (to most people) taste of Bacon. My own opinion is that a mature Bacon fruit has quite acceptable flavor, granted that it does not have the nutty "true California avocado" taste of Hass or Gwen.

***Conclusion:*** If your Bacons are in a cross-pollination situation, for Hass or other "A"-flowering types like Heed or Pinkerton, or even for some benefit to a "B"-type like Fuerte, you perhaps should leave them in. Similarly, if they are in a cold area and you really want to grow avocados, and your production is reasonably good, you might want to keep them— until a clearly better variety for you comes along. Extensive topworking or abandonment of other Bacon trees, also Zutanos and less desirable varieties like Jalna and Mayo (Covocado), will eventually help to improve avocado prices in general and fall prices especially.

**2. Fuerte.** Once the backbone of the California avocado industry, it has been increasingly surpassed by Hass because of its erratic and low average production in most areas. But its acreage continued to edge upward, until its recent calamitous price decline. It is now being squeezed between rapidly increased production of Bacon and Zutano plus late-held Hass early in its season, and rapidly increased supplies of early Hass late in its season, with a little added pressure from increasing Pinkerton production.

A further blow has been the indirect effect on relative Fuerte price of the reversal to Hass dominance. The several-fold expansion of the California industry based chiefly on rapidly increasing Hass acreage means that to more and more consumers and to much of the trade generally, Hass is the known and trusted standard and all the rest are more or less dubious unknowns. Including even Fuerte. The once-King has become just another Pretender. Especially in a buyer's market, dominance tends to be self-aggrandizing: "For to him who has will more be given and he will have abundance; but from him who has not, even what he has will be taken away."

Fuerte has superb quality and a remarkably long harvesting season. The Calavo advertisement well describes it as "Avocado nonpareil...The *Fuerte avocado* has never been surpassed in mellow smoothness, in delicate nut-like flavor, in eye-appealing shape and color. At Calavo, the *Fuerte avocado* is a fruit to be marketed with pride, its superior qualities meriting maximum possible returns..."

Alas! Behold how the mighty are fallen! Well, the fanner, and especially the struggling California avocado farmer of 1985, cannot afford to have crucial market decisions swayed by sentiment.

The Fuerte has tended to be lumped by consumers and retailers with Bacon and Zutano, which are superficially similar but with distinctly lower quality as usually sold in its early season. To connoisseurs, Fuerte and Zutano are as distinctly different in appearance as they are in flavor. But the average consumer of California avocados eats far too few to be aware of such niceties. It has been suggested that even the average grocery store check-out attendant would have trouble distinguishing between Fuerte and Zutano from appearance. In an industry without varietal labeling, the Fuerte has become probably our most under-priced variety in terms of fruit quality.

Years ago, when it was becoming clear that Hass would replace Fuerte as our own major variety, I saw a bright future for Fuerte. I believed that the very ascendancy of a rough, black fruit in a greatly expanded industry would leave a strong nucleus of devotees preferring the very different Fuerte appearance and somewhat different flavor, augmented by some of the new consumers with similar personal preferences, so that the relatively fewer Fuertes could even sell at a perpetual premium over Hass and so compensate for their lighter bearing. I was grievously wrong.

Fuerte set is benefited by cross-pollination, probably to a greater degree than Hass on the average. It also needs more careful physical handling than does Hass.

***Conclusion:*** Fuerte is being smothered between an excess of lower quality early season green fruit with which it is confused and a still-increasing flood of Hass fruits that need to be picked both earlier and later than the original Hass season in order to reduce summer gluts.

To survive as a significant variety, it needs two things. First, a correction of our present industry overproduction in terms of market availability, especially of fall-maturing fruit. Second, special promotion that brings its excellent quality to the attention of buyers at both wholesale and retail levels. The former level would be much helped by a program analogous to the recently begun but very promising campaign by Pinkerton growers. The latter, retail level, may need an advertising tie-in with individual fruit labels; Fuerte seems to me to be our only variety where such varietal labeling is likely to be cost-effective.

We need a variety with the Fuerte tree cold-hardiness, tree fruit storage, and fruit quality, that averages at least twice as much fruit per acre. In the meantime, what should Fuerte growers do? Where production averages low (say under 6,000 pounds per acre), you might keep your best tree or two for personal eating, and topwork (or abandon) the rest.

If your production is good, you might hang in there. You will continue to have the personal satisfaction of knowing that your avocados give the industry a distinct market advantage by their longer picking season, and build a stronger industry by their superior quality. And your relative returns should improve before long.

**3. Zutano.** For southern California, I am afraid that it is doomed; I do not think that it can long maintain an important position. Its heavy production nearly everywhere is not enough to compensate for its bad market reputation. It has probably overall done the industry more harm than good, and the painful financial consequences are now being

inflicted on its growers.

How inferior is Zutano fruit quality? Flavor is of course highly subjective and controversial. Many years ago, when Zutano was still bringing a very good price, at a meeting of growers I raised the suggestion that it did not have high enough quality to make a good basis for our industry. But the unanimous opinion of the growers who responded was that its quality was perfectly acceptable. And a subsequent California Avocado Commission survey, quite limited, indicated consumer acceptance of the Zutano.

Yet now it is almost universally condemned, with descriptions like "terrible," "a dog," "dragging down our other varieties." Partly, this is a consequence of harvesting immature fruit. Because it used to be considered our earnest variety, at a time when the earliest fruit brought the best price of the year, there was economic pressure to harvest it under 8% oil. Even at 8% oil, it is usually unfit for sale, in my opinion. And even when it approaches maturity at 10-plus %, the flavor may be barely acceptable to most people who know what avocados should taste like. (The only Zutano fruits that I would rate good tasting have been so mature that there was objectionable surface corking, end-spot, and sometimes breakdown.)

The real test is what the markets report back. In the *Avocado Grower* for August 1982, the head of A&P's Western Buying Division is quoted, "We don't handle Zutanos if we can help it...our shoppers just don't like them." And this is for a region including the Eastern Seaboard, where smooth, shiny-green, more bland avocados are supposed to be preferred. In the November 1982 *Avocado Grower*, an interview with the manager of Von's produce division quoted him as giving the Zutano a qualified endorsement: "Zutanos are not the most desirable variety around, but their availability at the fall of the year keeps our momentum going." But a follow-up interview in the July 1984 issue of *Avocado Grower* reports in its lead paragraph that now "he makes it clear he wasn't shopping for Zutanos, which he called 'hard to sell.'" (Of course, at a low enough price, almost anything will move.)

The overwhelming message on Zutano quality is loud and clear. How about other uses? It is both less early and less cold-hardy than Bacon. It has reportedly had cross-pollination benefits for Fuerte, even though both are "B"-type; for both "A"s and "B"s, Bacon could well be more effective.

I see only one exception to this dreary recital of Zutano shortcomings. It could have a place for some time in the San Joaquin Valley, for several reasons:

1. Lower production costs there mean that growers can turn a profit at a significantly lower fruit price than in the Southland; Zutano is likely to play out its career selling at a discount.

2. Maturity is earlier in the Valley, so that by the time Hass picking in the major producing areas has declined enough to open a bit of a window, Valley "Zuts" should have a respectable oil (dry matter) content.

3. Skin surface is more attractive in the Valley, permitting longer development on the tree and so again more flavor.

4. "Zuts" that are allowed to mature properly before picking are of reasonably good

flavor—as the Valley can permit. If that fruit is not as good as Southland growers wanted to believe when it was bringing them a lot of money, it is also not as bad as people have thought recently.

5. The industry has started moving toward higher dry matter standards. While this can cause unforeseen problems as noted earlier, the principle would seem to merit the support of California growers generally, and certainly of Valley growers who can thereby make their major variety more "respectable."

6. About 70% of the Valley total, "Zuts" are the only reasonably successful variety there. The paucity of present alternatives is shown by the fact that in second place come Susans! (Bacons usually bear poorly in Valley heat.)

For these reasons, Zutano may survive, in greatly reduced numbers, in the small San Joaquin Valley avocado industry. A new adapted variety, with higher quality and greater cold-hardiness, is certainly needed.

***Conclusion:*** Nearly all Zutano trees are probably best topworked or abandoned as soon as possible.

**4. Hass.** The Emperor of the industry, and deservedly so. About 70% of our total production and its proportion is still rising. Concern that we are putting "too many eggs in one basket" is tempered by rejoicing that our dominant variety has such high fruit quality. With 1984-85 probably going to be by far our largest crop ever, it is likely that a considerable number of people will be tasting California avocados for the first time; how reassuring for future purchases that 7 of 10 such new people will have Hass as their initial experience!

The Hass is preferred by different segments of the population for different, interrelated reasons. Growers like it because it bears so well—and returns more per pound. Marketing people like it because it hangs so long on the tree after reaching good quality, and because it travels so well in its sturdy thick skin—and because it is now much easier to sell than any other variety. Consumers like it because it "tastes great."

One is tempted to end the discussion on this note of euphoria and self-congratulation. But realism reminds us that no agricultural variety is faultless. The Hass is excellent, but far from perfect.

1. It is *cold tender.* Unfortunately, this is true of the Guatemalan race, which gives us the better horticultural traits of thick skin, small tight seed, nutty flavor, and longer harvest season. Hass is perhaps 80% Guatemalan; the Mexican remainder beneficially advances its maturity season by several months, and makes it a little more cold-hardy than most pure Guatemalans. But, especially with topworking now sometimes moving it into intrinsically colder areas, the next southern California freeze will devastate many Hass groves —Fuerte, and especially the fall predominantly Mexican types, will show their superiority.

2. Its *productivity is inferior.* This may sound surprising, since it was its heavy yields that propelled Hass to its present preeminent place in our industry. But that was in competition with the usually low-producing Fuerte. We now apparently have

considerably better producers yet.

The latest UC Cooperative Extension survey of our industry economics (Takele, 1984), gives data showing that for the past 19 years of available data through 1982, the Fuerte average yield per acre has been 4,842 pounds, and Hass 7,249 pounds or nearly 50% more. Unfortunately, comparative data for other varieties are not given and are difficult to obtain. The March 1984 *Avocado Grower* lists yield data provided by Gentry Karr from the 300-acre Dorel Groves near Escondido. The average figures for Fuerte and Hass are strikingly close to the long-range industry averages, 4,820 and 7,360 pounds respectively. Three other varieties were also listed: Jim. Zutano, and Reed, and all had averaged more than Hass — Reed by 47%.

Such is reasonable from my observations, which indicate that Pinkerton also may significantly out-produce Hass. So may the new UC variety Whitsell, and Gwen appears to be the heaviest producer of all.

3. Its *tree production alternates*. This probably limits its average production capacity, and causes problems like burned branches and fruit, undersized fruit, and sometimes broken branches, in the "on" year. Varieties like Reed, Esther, and Gwen are less alternating.

4. Its *grove production varies from year-to-year.* This does not necessarily follow from point 3. The statement is sometimes made that "Fuerte alternates on a grove basis, Hass only on a tree basis," with the implication that Hass groves maintain a more constant yield level. There is some truth to this, but unfortunately not enough.

A previous (1978) edition of the UC economic survey listed yield records for high-producing groves of both Fuerte and Hass in four counties over five years or longer. The ratio of highest year to lowest year, for the seven Fuerte groves was 3, 6, 5, 2, 5, 3, and 3—certainly much variation. But for the eight Hass groves reported, the ratio was 2, 58, 6, 4, 3, 12, 2, and 5 — even worse variations. The 12:1 grove, for example, was of 10 acres and averaged 8,752 pounds for the five years, with individual year averages of 20,995; 4,057; 14,260; 1,813; and 2,635 pounds. Such sharp alternations not only cause the fruit and tree problems noted under point 3, they also cause serious cash flow and planning problems for the grower.

5. Its *industry production varies from year to year.* This in turn does not necessarily follow from point 4. Individual groves could vary sharply from year to year without any marked overall industry variation. Unfortunately, such is not the case. Takele's (1984) economic survey lists the annual yield per acre average for both Fuerte and Hass for the last 19 available years. For Fuerte the high was 9,236 pounds, the low 1,182. The Hass swings were less but harmful, with both extremes occurring in the last four reported years: 6,777, 3,396, 10,829, and 4,960 pounds respectively.

As this indicates, there tend to be annual alternations, which in recent years have been high in the crop year that begins with an even number (such as 1984-85), low in the intervening year. That alternation can be reversed by unusual spring weather (favorable or unfavorable). The present pattern of "high-even" goes all the way back to the 1965-66 season, which was "high" (following a 1964-65 "low"), but which was followed by a 1966-67 still higher for all varieties combined, then a 1967-68 sharply lower; and a

consistent alternation to the present was begun.

Severe annual alternation causes severe marketing problems, with markets entered into the "on" year that cannot be adequately serviced in the following "off" year. And it is impossible to predict the size of the next crop—how wide the swing will be. Reed and Gwen should prove superior to Hass in terms also of overall industry crop alternation.

6. Its *black color is not universally preferred*. Single-handedly, Hass has largely reversed the bias against dark avocados that was prevalent when it broke on the scene. But regions like our Eastern Seaboard retain such biases. And there are individuals elsewhere that also prefer a green color. This ties in with the desirability of two-color displays in all stores where such would be feasible.

7. Its *tree is large*, adding to picking costs and hazards, making any necessary spraying more difficult and expensive, and increasing tree susceptibility to wind damage.

8. It needs up to *twice as much nitrogen fertilizer,* according to observations by Don Gustafson.

9. It is *more subject to injury from various stresses,* such as drought and salinity (Don Gustafson and others), insect damage (Atkins, 1979, 1980, 1981), Blackstreak apparently, and unexpected decline.

10. *Fruit size averages too small,* in the on-crop years, and especially as the tree matures.

11. It increasingly risks becoming *a victim of its own success.* Hass is so dominant that there are growing pressures to hold old-crop fruit past its optimum, and to pick new-crop fruit before it is really good. Instances of both have occurred. They will probably increase with the rapid decrease in numbers of the fall-maturing trees that has already begun. One estimate is that non-Hass California avocados will decline from their present 30% of the total to little more than half that, in the next decade or so. Superficially, this seems highly desirable: we're moving toward an ever-higher proportion of the superior, consumer-pleasing variety. But I am afraid that it is going to prove a mixed blessing.

We can always adopt maturity standards to legally inhibit the selling of fruit below whatever dry weight % we care to adopt—although the greater the economic incentives to do so, the more such a standard may be circumvented. But the correlation between dry weight (or oil) and over-maturity is apparently weaker and more diffuse—a rancidity standard may be hard to come by.

Already we have problems, as reflected in the following sample of quotations: The November 1983 *Avocado Grower* quotes Steve White of Cal Flavor as expressing the fear that "A large quantity of Hass, rancid due to high oil content, may have found its way to market this autumn..." A letter in the March 1984 issue is concerned that "This costly major problem keeps being ignored... even the growers state, 'It's rancid and I wouldn't eat it myself, but it's what we have to do to get our price.' Personally, the majority of avocado complaints I have received from family and friends across the country regard 'very high-priced, over-mature fruit.'" And a January 1985 *Avocado Grower* interview with State Inspector George Meske states, "...many believe that a lack

of controls on overripe or rancid fruit is a key problem today particularly in marketing late Hass." As Calavo's Steve Layton noted back in the June 1982 *Avocado Grower,* "On the industry's varietal makeup,...Hass must be taste acceptable, not just available 365 days a year."

A partial solution could be more northerly Hass, from San Luis Obispo County or still farther north. Our problem is going to worsen as Hass dominance increases. It is ironic that the Hass quality superiority that has impelled it to industry leadership is now to a certain degree imperiled by that very leadership.

12. An *inhibition of other worthy varieties* is another consequence of the great Hass dominance. Especially in this buyers' market with depressed avocado economics, the dominance becomes strongly self-perpetuating. Handlers are struggling to survive in 1985, and of necessity primarily concerned with 1985 fruit prices—they cannot afford the luxury of encouraging what could prove in a few years to be California's best variety. With Hass bringing top prices, and even those prices not adequate, no wonder handlers prefer only Hass. The "very good" can sometimes be the enemy of the "still better."

***Conclusion:*** Let us be glad-heartedly thankful that-our renowned Hass is such a superior variety in so many ways. At the same time, let us be aware of its several weaknesses and drawbacks.

**5. Reed.** In light of our discussion under point 12 above, Reed well exemplifies that, in a buyers' market with one dominant variety, a fruit that is different has a real identity problem. In the reasonably good "sellers' market" prior to the 1980-81 season, its new name, round shape, and large size were hindrances, but it still brought reasonably good prices. But in the crunch that year (Atkins, 1981), the Reed suffered proportionately much more than did Hass. And it has not really recovered.

However, the present buyers' market will be corrected in time. And Reed has at least two unusual things going for it. First, its late maturity—when Hass from the same area are past their best. Now that Esther is not panning out, Reed has the field to itself. Second, its heavy production. In the Hass discussion, we noted that it has outborne that main variety by nearly 50% at Dorel Groves. (Two years after the topworking of a handful of trees at UC Riverside, it has averaged more than double the Hass fruit number—fruit weight would show a substantially larger difference yet).

Moreover, it is an attractive fruit both inside and out, with very good quality in its true season. It would seem to be a natural for restaurants that serve considerable avocado. There, its large size would be an advantage: peeling and preparing larger fruits is more time-efficient. But restaurants like to standardize, and Hass is both of proven quality and available much longer. Also, there is a certain inertia involved. Also, restaurants (like others) have been "burned" by lower quality, cheap, smooth, green fruits. Some quality markets prefer its large size; a small but significant fraction of our best customers do also.

The Reed does have weaknesses. The tree is tall and slim like Bacon and Zutano. And it aggravates this by having a tendency to develop long side branches that are prone to wind injury; this can be accentuated by the kind of nipping of upright growing tips that is

effective in developing better Bacon and Zutano tree shapes.

Reed needs three things:

1. The return of more balanced market conditions, with less bias against what looks "different" from the dominant standard.

2. Higher maturity standards; for this variety the equivalent of at least 10% oil, preferably 11 or 12%. This will somewhat compress its season, but that should be partly compensated by extension at the other end, later into the full season as the production of "earlies" declines.

3. An organized effort to introduce it to buyers, analogous to the Pinkerton promotion now underway. This would cost some money, but I think that Reed has a sufficiently promising future to justify it. Such a promotion would make "large, round, green" a mark of excellence— turning a difficulty into an opportunity!

***Conclusion:*** The present abnormal marketing situation has been especially disastrous for Reed, causing some to give up on it. But its quantity and quality of product make me consider it salvageable, for a quite limited but useful and profitable place in our total variety picture. Eventually, it will presumably be replaced by a new variety with comparable late season, yield, attractiveness, and flavor, but with a longer harvesting period and perhaps a more conforming size and shape.

**6. Jim.** I have regarded it as the best of the early varieties, combining the better quality of Bacon and Santana with the better productivity of Zutano, on a tree superior to any of them. It also appears to be at least the equal of Bacon in both earliness and cold hardiness. And it should be at least as good a cross-pollinator.

Its chief weakness is that many fruits have long and sometimes crooked necks. Less serious is a bronzing of the skin, especially later in its season. But its major problem probably is that, before it could really become an established variety in the industry, excess fruit year-round combined with lower fall fruit quality to ruin fall prices- and "the new kid on the block," Jim, fared worst.

***Conclusion:*** As with the preceding Reed, some have given up on it. And, as with Reed, I believe that better economic times are coming for the industry generally and the Jim specifically. In addition to the cold-spot and cross-pollination special considerations, I still think that Jim may prove to be our best early. When we are down to possibly a quarter of our present early production, Jim prices should become profitable again. Its relatively low dry matter % means that it would need a special dispensation to comply with present standards.

**7. Santana.** It was exciting when introduced: a Zutano seedling retaining that high productivity but adding good fruit quality and size. Alas! The productivity was lacking in most areas where it was tried.

***Conclusion.*** Unless your yields are exceptional, discard it.

**8. Pinkerton**. Beginning a number of years ago, in talks with growers I suggested that if I were planting a new commercial grove where frost was not a serious concern, I would probably plant mostly Pinkertons. My reasoning was that the Hass boom appeared headed for an excess of that variety. But, in the greatly expanded industry of the future, the most promising window seemed to be mid-winter-December through February—when a fruit of the Pinkerton size and quality should have a place before many Hass were mature, and as a much heavier-bearing complement to Fuerte.

With the excellent special promotion now launched by Hank Brokaw, Warren Currier, and others, it seems that the Pinkerton is likely to achieve its promise. Recent issues of *The Market Report* (published by *Avocado Grower*s Association) show remarkably good relative prices for it: almost equal to Hass and about twice those of Fuerte. The latter difference would seem to be a gross injustice to Fuerte—but the consumer decides. Presumably the comparatively favorable Pinkerton prices are due to a combination of its thick, rough, excellent-peeling, Hass-like (except non-darkening) skin, its high quality including tiny seed, its season, and the effective promotion already underway. The promotion is described in the December 1984 *Avocado Grower.*

As Chairman of the California Avocado Society's Variety Committee, Oliver Atkins (1980) has predicted that "...it should prove itself as the best all around mid-winter fruit." Again, "It will help fill the void caused by the declining Fuerte acreage, and, as it (matures) and sizes ahead of the Hass, should tend to stop growers from picking Hass too early." (Atkins, 1981).

As with all varieties, there are weaknesses:

1. Shorter harvest season than Fuerte has. (But, will we ever find another fall-spring variety with the remarkably long season of Fuerte?)

2. Has been reported to sometimes have hard-spot ripening problems when left until March or later. (Fuerte also does sometimes, toward the end of its season.)

3. Considerably less cold-hardy than Fuerte.

4. Uncrowded fruits tend to become too large, especially on young trees. (But this large sizing early in the Hass season is on the whole a major advantage.)

5. Some fruits have too-pronounced neck development, especially inland.

6. Its slower ripening has been cited as a problem when it is handled like other varieties, and the consumer expects it to ripen in the standard time. Moreover, it sets over so long a period that when trees are stripped, some fruits may ripen notably slower than others. (But. the slower ripening can be a major advantage for distant shipping; it is no drawback for local markets when fruit is pre-ripened, a process that also tends to minimize maturity differences between fruits.)

7. As the tree approaches maturity, production tends to alternate, like Hass—at least on the trees that I have seen, but there have been reports to the contrary.

8. Trees are large, approaching Hass size.

9. Flavor, although very good, is not as good as Hass, in my opinion. (But the flavor of almost no variety is.)

10. If the present relatively good prices stimulate too much topworking to it, its relatively short season could result in excess fruit at that time— particularly since the still-increasing Hass production will have an increasing number of early-harvestable fruits.

***Conclusion:*** "This appears to be the best variety we have come up with for California since the Hass." (Atkins, 1978.) It seems to have a secure future niche for us, somewhat circumscribed in size because of its somewhat limited harvest season. As with Hass and Fuerte, this is a variety that by its quality is a real credit to our industry; it will help to build a stronger California avocado enterprise.

**9. and 10. Gwen and Whitsell.** These two are discussed in detail in a paper elsewhere in this Yearbook, which material will not be repeated here. According to *present* knowledge, one or both of them should eventually replace Hass as our major variety. *But:* (1) "There is many a slip 'twixt the cup and the lip"—they are not yet adequately tested. (2) Even if they fulfill their present promise, another still-better variety may emerge to overtake them long before they can overtake Hass.

## Choosing your Varieties

With the present troubled industry economics, the situation is one of transition and much uncertainty. Some prospects seem clear; in other aspects the crystal ball is very cloudy. We should emerge from this distressing period with an industry that is wiser, trimmer, stronger. Exactly what that will mean in varietal recommendation is not so obvious.

First and foremost, get your Farm Advisor's thinking; include retired Farm Advisor Don Gustafson if he is available. Ask other informed industry leaders like Bob Platt and Frank Koch and Jack Shepherd. Talk with your nurseryman—perhaps several nurserymen, people like Crawford Teague and Hank Brokaw. Talk with your handler—perhaps several handlers; recognizing that handler survival may dictate immediate concerns that could be different from your long-range interests, their insights on the firing line are invaluable. Try to corner Warren Currier. Talk with as many present growers as you know, perhaps making the acquaintance of a few for that purpose—there is a lot of unique and helpful experience out there.

The California Avocado Society, and specifically its Variety Committee. has the best overview available. The Committee Chairman for several years has been Oliver Atkins. He is as wise and forthright as he is gentle and kindly. And well-informed (he keeps warning growers not to go overboard yet on my new varieties!) He is so gracious and helpful that one hesitates to impose on him, but a phone call at a convenient time should not be too burdensome.

Ponder the varietal evaluations in his Variety Committee reports in each *California Avocado Society Yearbook.* For example, back in 1978, his report included this statement: "The last thing that the industry needs is an increase in Zutano, Bacon, and

other fall varieties..." If only we had collectively listened to that wisdom, how much industry and personal grief we would have been spared! The figures show (Takele, 1984) that nearly one-sixth of all Zutano trees, and over one-fifth of all Bacon trees, were planted as recently as the years 1980-82.

The C.A.S. Variety Committee brochure 'Avocado Varieties for Commercial Planting in California, 1976,' used for the framework of this article, is of course now obsolete. A revision has long been planned, but may itself quickly become obsolete if drawn up before the likely future trends are clarified. My personal guess at this point is that Bacon and Zutano will be removed from the generally-recommended list, and Pinkerton added, joining Hass, Fuerte, and Reed (?). The added Limitations and Comments concerning each recommended variety are as important as its inclusion.

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