



Diversification of Pear Usage*

H. W. Schultz
Food Technology Department, Oregon State College

For many years the conversion of cull pears and pear canning wastes to useful and profitable products has been a subject of much discussion and research. It is no wonder that this has taken place when the canners of pears see about 45 per cent of their raw material going out the back door as waste, or the growers and the packers of fresh pears see thousands of tons of cull pears going unused each year.

Over and over again we hear the questions, "What can we do about it?" "Can't we make this or that out of the pears?" or "Why doesn't someone do something about it?" These questions have not been ignored, and satisfactory answers have been provided for most, if not all, questions except "Can we make a profit by converting culls or wastes." This is the key question of all. This is the question the people in the front office want answered before much money is invested in a new plant operation. There isn't an incentive if there isn't much likelihood of a profit.

A review of the long history of the problem and the large amount of research which has been conducted leaves one with no other conclusion than that there is no simple answer to the problem. Furthermore, anyone (the author included), who attempts to present a simple answer or anyone who expects to receive a simple answer must be considered inadequately informed on the subject.

The purpose of this paper is not to attempt to present a simple solution to the problem, but rather to apply a principle in evaluating the suggestions which have already been made, with the desire that hope may be revived that there may still be uncovered a way by which at least part of the unused pears may be salvaged. The principle is simple and is based on the thesis that the conversion of unused pears to any single product or by-product may not solve the problem or be profitable, but the conversion of the unused pears to several products or by-products may solve the problem and be profitable. This is not a new principle for it has long been used successfully in certain parts of the food industry and in other industries. It has proved to be profitable and has as much as anything else been responsible for the great diversification of food products during the past 15 years.

It is proposed that we first examine the composition of pears to determine what useful chemical substances are present. Then we will review the edible and non-edible products which have been made from pears. Finally, we will suggest a combination of manufacture which appears feasible.

* Miscellaneous Paper No. 36, Oregon Agricultural Experiment Station.

The Composition of Pears

Although there is some variability in composition between varieties and pears of different maturities, one reference¹ gives the following proximate analysis:

Water	82.7	%
Protein	0.7	
Fat	0.4	
Ash	0.39	
Carbohydrate	15.8	
Crude fiber	1.4	

There appears to be nothing spectacular in the composition as shown. But let us look a bit closer to see what some of the so-called minor chemical components are. These are as follows:

Asparagine	0.1 to 0.5%	(in immature pears)
Catalase		
Peroxidase		
Fat	14 to 25	% of the seed
Glucose	2.9	%
Fructose (levulose)	6.8	%
Sucrose	1.5	%
Pectin	0.3 to 0.6	%
Sorbitol	2.4	%
Malic acid		

The quantities of some of these materials are very small. However, some of them are known to have unusual and valuable properties. Asparagine is essential to the growth of lactobacilli which are used in analytical procedures for determining the amounts of vitamins and amino acids in many chemical laboratories. It is also used in the mass production of tuberculin. Asparagine now sells for \$18.00 per pound. From a ton of green pears one might expect to recover anywhere from \$36.00 to \$180.00 worth of asparagine.

The fat contained in the pear seed is chemically constituted to be classified as a drying oil such as is used in paint manufacture. Its monetary value is unknown and the yield from pears would be small, but it could prove to be a profitable recoverable material.

The sugars would not be profitable items to recover, it is believed. However, pears are rather unusual in containing relatively large amounts of fructose (levulose).

Pectins are recovered commercially from a number of fruits for use in making gels. Pears are not a poor source of pectin which should not be overlooked as a possible profitable item.

The high percentage of sorbitol makes this component interesting. Sorbitol is now highly advertised for use in various foods where retention of moistness is desirable. Sorbitol is a humectant which is applicable

1. Watt, Bernice K., and Annabel L. Merrill. Composition of Foods—
Raw, Processed, Prepared. Agriculture Handbook No. 8,
U. S. Department of Agriculture. (1950)

to a number of foods such as candies. It now sells for 35 cents per pound. One ton of pears should yield up to \$16.80 worth of this substance.

Malic acid has some uses as a fruit acid, but pears are a relatively poor source compared to other fruits.

The two enzymes, catalase and peroxidase, are present in only small quantities, but they are very reactive materials used now only in laboratories. Suppliers of laboratory chemicals sell catalase and peroxidase for the phenomenal prices of \$22,500.00 and \$34,000.00 per pound respectively. Needless to say, they are not ordered by the pound.

Products from Pears

No less than twenty-four products contain all or a large part of the edible portion of pears. Some are produced regularly and in large volumes while others are produced only occasionally to meet certain special trade demands or are produced in small quantities. Following is a list of these products:

Canned	
Whole	Juice, cider, nectar
Halves	Syrup
Quarters	Candied, glacéed
Slices	In candies
Diced	Dried, creamed, jellied
Irreg. pieces	Spiced
Baked	Dried
Fruit Cocktail	Halves, unpeeled
Baby food	Peeled & cored
Jelly, jam, butter	Peeled & sliced

It cannot truthfully be said that pears are limited as to the numbers and diversity of products which can be made from them. It is true, however, that the consumer demands or the sales of some of the products listed are very limited. To meet these small demands would not justify the establishment of separate plant or additional operations in existing plants for the production of such items singly, but there might be an incentive in manufacturing several of these items in one plant so that the combined sales would net an attractive profit. An important consideration is that several of these items undoubtedly experience limited sales because consumers are not acquainted with them, not because they have poor consumer appeal.

Some of the above products must be made from all or a major portion of the edible portions of the fruit while others can be made from parts not used for other products. Some require the use of the finest quality fruit while others can utilize less perfect fruit. As an example, size, shape and freedom from defects are essential in pears used in certain canned and dried products, but such is not the case if the pears are to be made into jelly, jam, butter, juices, or syrup. By suitable procedures, the latter products could be made from cull pears or from canning wastes.

By-Products from Pears

Cull pears and cannery wastes can be or are being used in the manufacture of a substantial number of by-products which are as follows:

Sweet canning juice	Livestock feed:
Flavoring	Silage
Fermented products:	Whole pear
Brandy, vodka,	Trimming
alcohol, vinegar,	Dried pears
methane, yeast	Pomace
Insect, rodent bait	Molasses
Fertilizer	

It appears that very large proportion of research on utilization of cull pears and cannery waste has been devoted to by-product manufacture. Perhaps this is because the manufacture of many of these by-products could potentially dispose of large quantities of the unused pears whereas manufacture of some of the specialty edible products does not look so attractive from a volume standpoint.

The manufacturing feasibility or the utility of the above by-products has been established through research. The economic picture is not so clear, however. Certain manufacturing operations have been conducted on both a pilot and commercial scale to demonstrate feasibility of procedures and the utility of the by-products, but when the commercial operations are discontinued one must usually assume that they were found to unattractive economically.

The production of a sweet juice from cannery waste which is suitable for use, after further addition of sugar, has been applied commercially in the Apple Growers Association cannery at Hood River, Oregon².

The processing of pear canning waste to produce molasses and pomace suitable for feeding to livestock was conducted commercially for a few years at San Jose, California as a result of research conducted by the Western Utilization Research Branch of the USDA in cooperation with The Canners League of California³.

It is not uncommon, particularly in the Medford, Oregon area, to use undried or sun-dried unripened pears as cattle feed. Sometimes the pears are used in silage, sometimes dried for separate feeding. Expanding the use of dried cull pears is limited by the cost of fuel for artificial drying.

Perhaps the most successful disposition of cull pears and cannery waste has been through fermentation. An example is to be found in the Hood River Distillery which converts a large portion of the unused pears in the Hood River, Oregon area into alcohol and vodka. It is possible that the same or similar operation could be carried on in other areas where large volumes of pears are available. In appraising this method of disposal it must be remembered that only the sugar of the pears is utilized. The remaining solids must be disposed in some manner.

2. Neubert, A. M., D. W. Graham, O. E. Olson and C. L. Beardsley.
Refine Pear-Canning Waste for Use as Syrup Base.
Food Industries, Vol. 22, p. 1545 (1950)

3. Brown, A. H., W. D. Ramage and H. S. Owens. Progress in Processing Pear
Canning Waste. Food Packer, Vol. 31, No. 7, p. 30 (1950)

Pear vinegar can also be produced through fermentation. Some pickle manufacturers prefer this type of vinegar to apple vinegar. Pear brandy also is a feasible by-product.

Methane for use as a fuel can also be made by fermenting pear waste^{4, 5}.

As in the case of products from pears, it appears that no single by-product can solve the cull pear and cannery waste problem by itself. Again it seems that more than one kind of production is necessary, and there is the possibility of combining product and by-product operations to be most effective.

Diversification May Be the Answer

In view of the large number of products and by-products which have already been made from pears, it does not seem reasonable that further effort should be spent in looking for additional uses. If this is accepted, then what are the possible courses of action?

There are probably three courses which can be taken. First, accept the situation as it is and live with it as well as possible. Second, choose a few products or by-products which will utilize the largest volume of unused pears and make the operations as efficient as possible. If it is necessary to do this with little or no profit then accept it as an unavoidable operating cost just as the water and power bills are accepted. Third, diversify the usage of pears to make more of the products and by-products which it is known can be made from the unused pears. Make good, acceptable items and promote their distribution and sale until they are consumed in volume and at a profit.

One example will serve to illustrate how this diversification might be carried out to utilize unripened cull pears, which will be presumed to be wholesome and essentially sound fruit. Let us presume that all or most of the foods on the product list above, except the canned and dried items, were to be manufactured. First, it will probably be necessary to refrigerate the pears to permit their use for manufacture over a period of time beyond harvest. After ripening certain pears or parts of pears would be selected for candying, glacéing and spicing. A portion of the remaining pears or pear parts would then be converted to puree, jam, and pear butter. Finally, the other parts could be converted to juice which in part could be made into jelly, nectar, syrup, cider, and vinegar. Pulp remaining should be suitable livestock feed.

In conclusion it should be reiterated that there is no single answer to the unused pear problem. Therefore, the suggestion given here is not intended to be simple or perfect. The first two courses of action are easy to follow. The third would take careful planning, capital, and hard work.

4 Harnik, G. W. A Preliminary Investigation on Methane Gas Production from Pear Waste. Thesis for M. S. degree in Food Technology, Oregon State College (1948).

5. Wilder, C. J. Bacterial Fermentation of Pear Waste. Proceedings, Fourth Annual Pacific Northwest Industrial Waste Conference, Washington State College (1952)