

# Pear Pulp and Pear Molasses

## nutritional value for cattle and palatability to sheep tested in feeding trials with commercial products

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**Pear molasses and pear pulp** are two by-product feeds—highly palatable to sheep and cattle—which recently became available to the livestock industry.

A feeding experiment—with cattle, to establish the nutritional value of the molasses and the pomace or pulp residue and with sheep, to obtain data on the palatability of the products—was initiated after processing procedures were advanced so commercial production was feasible.

Co-operating agencies supplied pear molasses and pear pulp and—for comparison—sufficient molasses dried beet pulp and cane molasses.

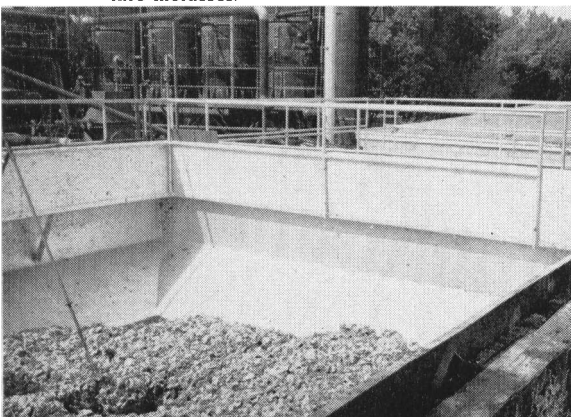
From the data obtained during the trial it was computed that pear pulp had a value approximately 70% to 75% of molasses dried beet pulp. The production-trial estimate and the chemical analysis indicate a value similar to a high-grade, low-protein hay.

Pear molasses—from analyses and replacement value data—had a value of 115% to 120% that of cane molasses containing 54% total digestible nutrients. The organic matter of pear molasses can be considered equal or slightly superior in feeding value to that of cane molasses.

### Cattle Trials

Twenty-two head of Hereford and Hereford-Angus crossbred steers—about 20 months of age—were obtained from the San Joaquin Experimental Range herd and separated into two Lots of five head and two Lots of six head. They were selected on the bases of groups making equal gain under comparable conditions on the range over a period of several

Receiving hopper filled with pear waste. In background evaporator battery where clear juice extracted from the waste is concentrated into molasses.



Composition of Feed Used in the Cattle Feeding Trials

	Pear pulp %	Pear molasses %	Molasses* dried beet pulp %	Cane* molasses
Dry matter . . . . .	92.4	76.4	91.9	74.0
Ash . . . . .	5.4	5.3	5.1	9.0
Protein (N X 6.25) . . . . .	5.4	1.2	10.7	2.9
Ether extract . . . . .	2.9	0.0	0.7	0.0
Crude fiber . . . . .	31.5	0.0	16.0	0.0
Nitrogen free extract . . . . .	47.2	69.9	59.4	62.1
Lignin . . . . .	25.0	0.0	6.0	0.0
Cellulose . . . . .	23.9	0.0	..	0.0
Calcium . . . . .	2.2	..	0.62	0.74
Phosphorus . . . . .	0.11	..	0.09	0.08

\* Average composition according to Morrison, F. B., Feeds and Feeding.

months, and of having about equal initial weight at the beginning of the trial.

All Lots were fed during a preliminary period of 26 days so they were well started on feed before the actual trial period began.

Each Lot was fed two pounds of oat hay and one pound of cottonseed meal per steer daily along with as much alfalfa hay as they would consume. Concentrate mixtures consisting of 50% ground barley, 25% beet or pear pulp, and 25% pear or cane molasses were fed in increasing amounts until the total concentrate consumption including cottonseed meal was a little over 60% of the total daily feed.

Steers were topped-out of the various Lots when it was judged that the individual steers would produce a Good Grade carcass—Choice Grade, under the grade designation established in January 1951.

The animals were slaughtered at a nearby plant and the right side brought to the laboratory for butchering into wholesale cuts, the calculation of cut-out value, and dissection of the 11th and 12th rib cuts for determination of percentage of lean, fat, and bone.

There was no significant difference in the carcass cut-out value of the animals from the various Lots.

Although there was no significant difference in the percentage of fat in the rib cuts, dressing percentage and carcass grade indicated that the cattle fed beet pulp attained slightly more finish in less time than those receiving pear pulp. For

this reason, and because of the high lignin content, the relative value of pear pulp—78% of beet pulp—calculated from replacement value for live weight gains probably should be discounted. A value between 70% and 75% of beet pulp would appear to be a reasonable estimate. These estimates from the production trial and the chemical analysis lead to the conclusion that pear pulp should be considered more as a roughage than as a concentrate feed, the feeding value approximating that of high-quality low-protein hay. The pear pulp was palatable and readily taken by the cattle in the mixture.

Pear molasses apparently was superior to cane molasses in palatability. The ash and nitrogenous compounds of pear molasses are somewhat lower than those of cane molasses, factors which contribute to the higher total digestible nutrient—TDN—value of the pear molasses. The organic matter of pear molasses can be considered equal or slightly superior to cane molasses.

Three weeks prior to the slaughter of the last steers from the various Lots, one steer in each Lot was given an intravenous injection of a broth culture of *Spherophorus necrophorus* organism—commonly considered to be the cause of bovine liver abscesses.

One steer in Lot Four apparently suffered an anaphylactic reaction which resulted in labored respiration. The animal went off feed, lost weight, and was removed from the test. Since his gains had been near the average for the group, only small error was probably introduced by deducting average feed consumption from the Lot total.

The rates of gain for the various Lots—shown in the upper table on page 12 are not significantly different. The feed per hundred pounds gain, however, was higher for the pear pulp Lots. Comparing Lots One and Three—which were fed beet pulp but with different molasses sources—the advantage in feed economy was with Lot Three which was fed pear molasses. To a less extent the reverse was true when comparison is made between Lots Two and Four.

Generally, in the past most cattle fat enough to yield 58% to 60% have graded, Good. Recently grade require-

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ments have been raised which in part accounts for failure to select correctly all animals out of the feed Lot that would make the grade. The Lots fed beet pulp, however, had more finish, with more animals grading good than the pear pulp Lots. Because of small numbers, more reliable data on comparative feed value can be derived from combining the data as shown in the lower table on this page.

The main features of the feeding trial

data are summarized in the tables on this page. The experimental design permitted combining the data from Lots One and Three to compare with larger numbers, beet pulp against pear pulp—Lots Two and Four. Similarly, the data from Lots One and Four that received cane molasses were combined to compare with those from Lots Two and Three, fed pear molasses.

## Sheep Trials

Twenty-four crossbred yearling ewes were selected for the test on the palatability of the pear molasses and the pear pulp with 20% pear molasses added.

The sheep had never tasted molasses and they refused to eat either the cane or the pear molasses which were placed in tubs and offered to the sheep for the first five days of the trial.

From the sixth day to the twelfth day of the trial the molasses was poured over the hay. On the twelfth day, the straight molasses in tubs was again offered to the ewes.

In the Lot where the ewes had free access to both kinds of molasses, the pear molasses was eaten in preference to the cane molasses—the supply of pear molasses was always exhausted first.

The cane molasses Lot continued on feed without any digestive disturbance. The Lot receiving the pear molasses ate well for 10 days when they went off-feed. During the remaining eight days of the trial these ewes failed to eat their allowance of pear molasses. The effect of this upset is reflected in the average weight of this Lot which decreased from 106 pounds on April 19 to 101 pounds on May 1.

Apparently pear molasses is so palatable to sheep that it should not be fed free choice.

Lot Four was started by feeding one third of a pound of the pulp on the first day and gradually increasing the amount until the tenth day after which time one pound daily was fed. Although these ewes had never been fed grain, they ate the pulp readily preferring it to alfalfa hay. As shown in the table in column 1 of page 12 very satisfactory gains were made on this feed.

In view of the results cited above with the pear molasses fed free choice, a second trial was conducted to compare cane and pear molasses when added to alfalfa hay. Thirty-two crossbred ewes were separated into two comparable Lots and fed 3.6 pounds of alfalfa hay with either 0.9 pounds of cane or pear molasses. The results of this trial together with a second trial on self-feeding are shown in the table in column 3 of page 12.

The ewes were shorn on the 29th day of the experiment so the wool weight is figured as a part of the gain for the period. As shown in the table in column 3 of page 12 the ewes on both cane and pear molasses made satisfactory gains when the molasses was fed in the hay.

To determine if sheep which were accustomed to the pear molasses could be safely offered molasses free choice, on the 59th day of the experiment both Lots were offered the molasses separate from the hay. Neither Lot consumed all of the molasses offered. The ewes on the cane molasses continued to gain, but the ewes

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**Summary of Data for Each Lot**  
All figures are in pounds unless otherwise indicated

	Lot 1	Lot 2	Lot 3	Lot 4
	Beet pulp and cane molasses	Pear pulp and pear molasses	Beet pulp and pear molasses	Pear pulp and cane molasses
Number in lot . . . . .	6	6	5	4*
Average days per steer . . . . .	94.5	99.2	92.2	90.8
Average initial wt. . . . .	822	811	829	811
Average final wt. . . . .	1056	1051	1062	1045
Average daily gain . . . . .	2.48	2.42	2.53	2.58
Total daily ration . . . . .	26.2	25.8	25.3	28.0
Total feed for 100 lbs. gain . . . . .	1057	1066	1000	1085
<b>Carcass grades</b>				
Good . . . . .	4	2	4	2
Commercial . . . . .	2	4	1	2
Average dressing . . . . .	60.7%	59.4%	59.9%	59.1%

\* One steer in Lot 4 was removed from the test. See text for explanation.

**Data on Combined Lots for Comparison of Each Feed Investigated**  
All figures are in pounds unless otherwise indicated

	Lots 1 & 3		Lots 2 & 4		Lots 1 & 4		Lots 2 & 3	
	Beet pulp	Pear pulp	Beet pulp	Pear pulp	Cane molasses	Pear molasses	Cane molasses	Pear molasses
Number in lot . . . . .	11	10	11	10	10	11	10	11
Average days per steer . . . . .	93.5	95.7	93.5	95.7	92.9	96.0	92.9	96.0
Average initial wt. . . . .	825	811	825	811	818	819	818	819
Average final wt. . . . .	1059	1048	1059	1048	1052	1056	1052	1056
Average daily gain . . . . .	2.50	2.48	2.50	2.48	2.52	2.48	2.52	2.48
<b>Average daily ration</b>								
Alfalfa hay . . . . .	8.9	9.5	8.9	9.5	9.8	8.7	9.8	8.7
Oat hay . . . . .	1.8	1.9	1.8	1.9	1.9	1.8	1.9	1.8
Barley . . . . .	7.1	7.1	7.1	7.1	7.1	7.1	7.1	7.1
Beet pulp . . . . .	3.5	..	3.5	..	3.5	3.5	3.5	3.5
Pear pulp . . . . .	..	3.6	..	3.6	..	..	..	..
Cane molasses . . . . .	3.5	3.5	3.5	3.5	3.6	..	..	..
Pear molasses . . . . .	..	..	..	..	..	3.5	3.5	3.5
Cottonseed meal . . . . .	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Total daily ration . . . . .	25.8	26.6	25.8	26.6	26.9	25.6	26.9	25.6
<b>Feed for 100 lbs. gain</b>								
Alfalfa hay . . . . .	356	383	356	383	389	351	389	351
Oat hay . . . . .	72	77	72	77	77	73	77	73
Barley . . . . .	282	287	282	287	282	287	282	287
Beet pulp . . . . .	141	..	141	..	141	144	141	144
Pear pulp . . . . .	..	143	..	143	..	..	..	..
Cane molasses . . . . .	141	143	141	143	141	..	141	..
Pear molasses . . . . .	..	..	..	..	..	142	..	142
Cottonseed meal . . . . .	39	40	39	40	39	40	39	40
Total feed for 100 lbs. gain . . . . .	1031	1073	1031	1073	1068	1036	1068	1036
<b>Carcass grades</b>								
Good . . . . .	8	4	8	4	6	6	6	6
Commercial . . . . .	3	6	3	6	4	5	4	5
Average dressing . . . . .	60.3%	59.3%	60.3%	59.3%	59.9%	59.7%	59.9%	59.7%

## STINK BUG

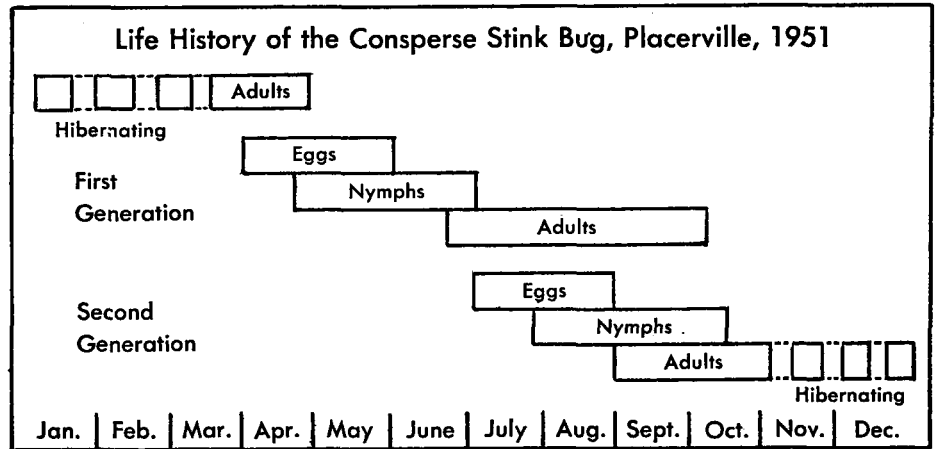
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Some nymphs from these eggs matured to adults early in September but the majority of the bugs of this generation was still in the nymphal stage by mid-September. Very few adults or nymphs were found on the few plants which were still succulent outside the orchards. Probably some late injury to the fruit was caused by adults of this second generation. No egg masses were found in September.

Some adults of the first generation may blend with adults of the second generation to go into hibernation as fall approaches.

The injury on maturing pears does not necessarily show on the skin of the fruit unless attacked severely, in which case a dimpling of the skin surface is observed.

By peeling back the skin of the fruit at the stem end of the pear the white corky injured tissues can be seen. These areas turn brown when exposed to the air, and the injured fruit is unfit for fresh market or canning. Most of the injury is usually found in the region of the neck of the pear but may extend more than



half way down from the stem end. The injured tissues from each puncture are usually about  $\frac{1}{2}$ " deep.

The feeding punctures on apple, apricot, plums, and peaches are generally more obvious than those on pears.

Few of the spray chemicals tested the past season show promise against the stink bug. The control of the pest may ultimately be a combination of chemical

control, clean culture in the orchards, and host plant eradication in adjoining areas. It is certain that the latter will play an important part in any control program.

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offered the pear molasses lost slightly during the 13-day period. These trials indicate that pear molasses is a satisfactory sheep feed when fed mixed with hay, but does not appear to be suitable for self-feeding at least when the remaining portion of the ration consists of hay only. The pear pulp with 20% pear molasses added appears to be a satisfactory sheep feed.

Palatability Test with Sheep

Ration	Lot I	Lot II	Lot III	Lot IV
	lbs.	lbs.	lbs.	lbs.
Alfalfa hay . . . . .	3	3	3	3
Cane molasses . . . . .	$\frac{1}{2}$	1	..	..
Pear molasses . . . . .	$\frac{1}{2}$	..	1	..
Pear pulp with 20% pear molasses . . . . .	..	..	..	1
<b>Average initial wt. (Apr. 1) . . . . .</b>	<b>105</b>	<b>102</b>	<b>101</b>	<b>104</b>
Wt. (Apr. 12) . . . . .	104	109	104	114
Wt. (Apr. 19) . . . . .	110	109	106	113
Wt. (May 1) . . . . .	111	108.5	101	114
<b>Average gain per sheep . . . . .</b>	<b>6</b>	<b>6.5</b>	<b>0.0</b>	<b>10</b>
<b>Average daily gain per sheep . . . . .</b>	<b>.20</b>	<b>.22</b>	<b>..</b>	<b>.34</b>
<b>Actual average feed per day</b>				
Alfalfa hay . . . . .	3.0	3.0	2.9	3.0
Cane molasses . . . . .	0.35	0.74	..	..
Pear molasses . . . . .	0.35	..	.49	..
Pear pulp with molasses . . . . .	..	..	..	.92

## Pear Pulp and Pear Molasses

From the data on feed required per 100 pounds gain—shown in the lower table on page 10—the replacement value of pear pulp and pear molasses were calculated by the following equations:

### Pear Pulp

- 143 pounds pear pulp equals 141 pounds of beet pulp minus 5 pounds barley, minus 5 pounds oat hay, minus 27 pounds alfalfa hay, minus 2 pounds molasses.
- Substituting the total digestible nutrient value of the known feeds the result is:  $101.5 - (3.95 + 2.5 + 14.0 + 1.1) = 80.0$
- $80.0 \div 143 = 56\%$  estimated TDN value of pear pulp, a value about 78% that of molasses dried beet pulp.

### Pear Molasses

- 142 pounds pear molasses = 141 pounds cane molasses minus 5 pounds barley, plus 4 pounds oat hay, plus 38 pounds alfalfa hay.
- Substituting TDN for the known feeds: 142 pounds pear molasses = 76.2 minus 3.9 plus 2.0 plus 19.75 = 94.0.
- $94.0 \div 142 = 66\%$  estimated TDN or about 120% of cane molasses have 54% TDN.

Using coefficients of digestibility from digestion experiments with cane molasses and applying these to the composition data, the calculated TDN value of pear molasses is about 62%. Thus the figures derived by two procedures are in essential agreement.

Pear pulp compared with beet pulp is high in lignin which is practically indigestible and usually depresses digestibility of the other nutrients. In this case the lignin probably comes largely from some pits of other fruits such as peaches which

**Comparison of Cane and Pear Molasses Added to Alfalfa Hay**

Molasses	Lot I	Lot II
	Cane molasses lbs.	Pear molasses lbs.
<b>Fed on hay</b>		
Average initial wt. . . . .	144.9	144.6
Average wool wt. (29th day) . . . . .	5.6	5.8
Average wt. (59th day) . . . . .	152.0	149.5
Average gain per head . . . . .	12.7	10.7
Average daily gain . . . . .	0.21	0.18
<b>Molasses</b>		
<b>Free choice, 13 days</b>		
Average gain or loss for period . . . . .	+4.9	-1.7
Average daily consumption of molasses . . . . .	0.67	0.60

were included in small quantity and from the pit cells of the pears. This lignin would act as a diluent of other more digestible material whereas in most feeds the lignin encrusted cells probably more or less protect the contents from digestive enzymes.

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