recommended field application rates. The two lines on the right give the responses of two colonies of *T. urticae*. These lines lie nearly completely outside the rates contained within the dashed lines, which means that the spider mite is nearly unaffected by recommended application rates of permethrin. In contrast, the three colonies of predator have LC_{50} values near the lower end of the recommended application rates. Therefore, permethrin is approximately 40 times more toxic to the predator than to the spider mite under laboratory conditions. Again, extension of laboratory data into the field situation needs to be done carefully, but the general conclusions are supported by the results of field trials with permethrin in which spider mite buildups have been observed frequently. The spider mite buildups may be due to predator mortality, or, perhaps, to physiological stimulation of spider mite reproduction, or both. Use of a synthetic pyrethroid for control of the pear psylla, *Psylla pyricola* Foerster, will provide a difficult problem for the pear pest manager since spider mites may become more serious.

A genetic selection program is in progress using these colonies to obtain a strain of *M. occidentalis* that is resistant to the synthetic pyrethroids as well as to organophosphate insecticides. If such a strain can be selected, its release and establishment in pear orchards might allow the use of synthetic pyrethroids without concomitant spider mite outbreaks.

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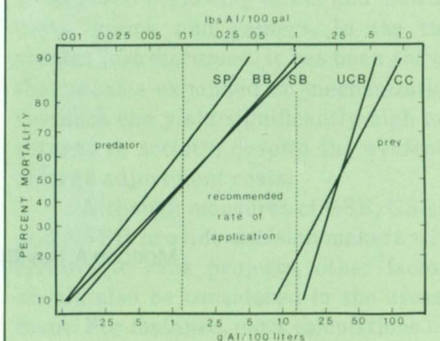
LC_{50s} of ***Metaseiulus occidentalis*** **Collected from California Pear Orchards, 1977**

Predator Source		LC_{50}* (95% confidence interval)	
County	Orchard	Guthion	Diazinon
El Dorado	Marchini	1.7 (1.1 - 2.4)	10.4 (6.7 - 16.2)
Lake	Ivicvich	1.6 (1.2 - 2.2)	3.8 (2.7 - 5.3)
	Jones, Home	3.7 (2.3 - 5.8)	5.9 (2.6 - 6.0)
Sacramento	Randall Island	1.8 (1.4 - 2.4)	5.0 (3.8 - 6.7)
	Sacramento River	4.3 (3.0 - 6.2)	-
Solano	Ames & Allbright	1.8 (1.5 - 2.3)	6.4 (4.8 - 8.6)
	Neitzel	0.8 (0.2 - 3.0)	3.0 (1.7 - 5.3)
Yuba	Campbell	2.0 (1.7 - 2.5)	8.6 (6.5 - 11.6)
	Di Giorgio, New England	1.1 (0.7 - 1.7)	10.1 (6.7 - 15.2)
	Levake	3.6 (2.7 - 5.0)	8.2 (5.5 - 12.5)

*Expressed as lbs A.I./100 gallons



The relative toxicity of permethrin to three predator colonies, *Metaseiulus occidentalis*, and to two colonies of the twospotted spider mite, *Tetranychus urticae*.

Tomato pomace scores well as sheep feed

Norman H. Hinman ■ William N. Garrett ■ John R. Dunbar ■ Arthur K. Swenerton ■ Nancy E. East

In 1977, approximately 5.5 million tons of California tomatoes were processed to make tomato paste and similar products. The skins and seeds, plus a small quantity of clinging pulp, collectively referred to as pomace, amounted to roughly 500,000 tons of material containing about 100,000 tons of dry matter. The study reported here was conducted to determine the feed value of this material.

The study consisted of two trials in which sheep were fed tomato pomace alone or mixed with alfalfa. In the first trial, fresh pomace was mixed with varying proportions of alfalfa hay to form rations of 0, 26, 48 and 77.5 percent pomace on a dry-matter basis. As a guide for mixing, a dry-matter sample was taken from each batch of pomace as it was received. Daily dry-matter samples of pomace were also taken at mixing time to permit accurate calculation of the resulting diets. All dried samples were composited and retained for use in the second trial in which sheep were fed a preweighed allowance of dried pomace only. Feces and urine for analyses were collected in each trial.

The pomace used was the by-product from commercial processing of tomatoes for tomato paste. It was received in batches at approximately weekly intervals and stored under refrigeration until used. At first the sheep were hesitant to eat the pomace, but after a few days they consumed it quickly.

Table 1 shows the chemical composition of the alfalfa-tomato pomace diets. The crude protein level of all diets was approximately 20 percent. The crude fat (ether extract) and gross energy content increased proportionately as the level of pomace was increased from 0 to 100 percent. Ash, nitrogen-free extract, and cellulose followed a reverse pattern, decreasing with higher pomace levels. The relatively high lignin value shown for dried pomace alone is apparently due to the presence of cutin, a wax-like substance found on the skins and in the seeds of some fruits.

Table 2 gives digestion coefficients of the diets. In general, the diet containing 48 percent pomace had more readily digestible components than did the diets containing pomace at other levels or alfalfa alone. Whether or not this increased digestibility resulted from particular ratios of pomace to alfalfa is not known: it may simply have been caused by variation in quality of the pomace. The pomace had slightly lower digestion coefficients for dry matter, organic matter, and crude fiber than did the alfalfa, but digestion coefficients for cellulose, nitrogen-free extract and ether extract were generally higher in diets containing larger amounts of pomace. Protein digestibility was relatively constant in the mixed diets, but was lower in dried pomace alone. This low digestibility may have been caused by damage to protein during the drying process, because digestibility of protein from pomace in the other diets as determined by difference (table 2) remained high.

Table 3 compares the estimated digestible compostion of tomato pomace with that of alfalfa. Even though digestibility of energy was lower in the pomace than in the alfalfa, the energy content of the pomace was sufficiently greater (5.6 kcal/g versus 4.5 kcal/g) to result in higher values for total digestible nutrients, digestible energy, metabolizable energy and the estimated net energy. The higher energy value of pomace is largely due to its greater content of ether extract. Some plant materials contain ether-soluble substances (essential oils, for example) which may be digested and absorbed, giving higher digestible ether extract and digestible energy values, only to be excreted in the urine. Apparently, this did not occur here, as energy excreted in the urine varied linearly from 5.9 percent of the gross energy in the alfalfa to 2.9 percent in the pomace alone.

Evidence obtained in this study indicates that tomato pomace shares a common and unfortunate trait with many by-products: it is a variable commodity. For example, dry-matter content of pomace varied from 27.5 percent near the beginning of feeding to 11.9 percent (see fig.). Composition and quality of pomace probably depends upon the processing procedures, and also upon the source and kind of tomatoes used.

This investigation indicates that tomato pomace provides about 10 to 12 percent more energy than does good quality alfalfa (dry basis). Digestibility of the protein in pomace, however, appears to be about 10 percent less than the protein in alfalfa; the 13 percent digestible protein content of pomace is well above the dietary requirement for weaned calves (8 ± 1 percent).

A steer weighing 600 pounds could be expected to gain 1.5 pounds per day if it consumed 12.5 pounds of pomace dry matter. At this rate (8.3 pounds of pomace per pound of gain), pomace from the 1977 tomato crop would have produced 12,000 tons of gain or fed 120,000 steers from 500 pounds up to 700 pounds.

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TABLE 1. Chemical Composition of Alfalfa-Tomato Pomace Diets*

Item	Alfalfa 100% Pomace 0%	Alfalfa 74% Pomace 26%	Alfalfa 52% Pomace 48%	Alfalfa 22.5% Pomace 77.5%	Dried pomace 100% (trial 2)
Organic matter	91.3	92.0	93.3	94.7	94.8
Ash	8.7	8.0	6.7	5.3	5.2
Crude protein	20.3	20.2	19.9	20.1	19.8
Crude fat	2.3	5.1	8.5	9.1	11.5
Crude fiber	28.3	28.6	31.1	34.6	31.4
Nitrogen-free extract	40.4	38.1	33.7	30.8	32.1
Cellulose	26.8	25.2	24.1	21.2	15.1
Lignin	4.9	5.6	6.4	6.8	19.9†
Cutin	2.6	4.5	6.8	14.1	
Energy, kcal/g	4.54	4.71	4.99	5.50	5.62

*Dry-matter basis. Proximate analysis (Weende) used to determine crude protein, crude fat and crude fiber. Cellulose, lignin and cutin determined by the method of Van Soest.
†No correction for cutin.

TABLE 3. Digestible Matter Composition and Energy Evaluations of Alfalfa and Tomato Pomace

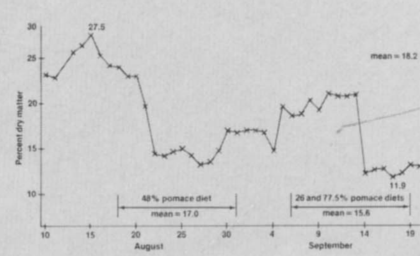
Item	Alfalfa	Tomato pomace*
Protein	15.4	13.2
Fat	0.6	9.6
Crude fiber	13.2	10.6
Nitrogen-free extract	30.5	25.8
Total digestible nutrients	60.5	70.7
DE, kcal/g	2.83	3.02
ME, kcal/g	2.32	2.62
NE_m, kcal/g	1.42	1.65
NE_g, kcal/g	0.79	1.04

*Values were calculated using the means of the digestion coefficients shown in table 2.

TABLE 2. Digestion Coefficients of Alfalfa-Tomato Pomace Diets

Item	Alfalfa 100% Pomace 0%	Alfalfa 74% Pomace 26%	Alfalfa 52% Pomace 48%	Alfalfa 22.5% Pomace 77.5%	Pomace 100% by difference	Pomace 100% by extrapolation†	Dried pomace 100%
Dry matter	63.8	64.1	66.9	57.6	64.2	58.9	59.4
Organic matter	65.4	65.3	67.9	58.9	64.7	60.0	60.1
Crude protein	76.1	75.0	75.0	69.6	71.9	69.0	58.5
Crude fat	24.1	66.1	78.8	80.3	86.2	88.1	76.0
Crude fiber	46.7	42.2	47.7	32.5	36.6	32.7	31.6
Nitrogen-free extract	75.5	77.2	79.7	75.2	80.7	77.1	83.3
Cellulose	60.0	64.2	69.8	73.6	78.2	78.2	80.2
Energy	62.3	60.5	63.1	50.8	56.7	51.0	53.6

*Assumes digestibility of nutrients in alfalfa remains constant at all levels.
†Calculated from linear regression coefficients obtained by correlating digestibility with pomace level of 0, 26, 48 and 77.5 percent fresh pomace diets.



Dry-matter content of tomato pomace at time of feeding.