TABLE 2. HYGROTHERMOGRAPH TEMPERATURE AND HUMIDITY DATA RECORDED DURING THIS STUDY

Week ending	Temperature over 65°F	Humidity over 50% R.H.
	hours	hours
March 22, 1970	35	135
March 29, 1970	51	98
April 5, 1970	71.5	98.5
April 12, 1970	19	131
April 19, 1970	30.5	110
April 26, 1970	31	109
May 3, 1970	33	133
May 10, 1970	62.5	85.5
May 17, 1970	85	87.5

on each of these trees. Second, ten trees were selected at random from the center of each plot and professional blight cutters cut all infected shoots out of each tree, dropping the cuttings on the ground below each tree. The investigators then counted the blight cuts made. Table 1 gives the number of blight strikes counted visually, as well as actual cuts made by blight cutters.

Tree selection

The trees selected for visual counts and those selected for actual blight cuts were not necessarily the same; thus, there were differences in numbers (as noted in table 1). In addition, the blight cutters used ladders to gain access to blight in the tops of the trees that the investigators may not have been able to observe from the ground. Table 2 gives temperature and humidity data recorded during the course of this study.

Even without statistical analyses of the visual blight strike counts, or actual blight cut, it can be said that streptomycin provided very good fireblight control. However, the cost of the 24-oz-rate of streptomycin would be considered carefully by the average pear grower.

The Kocide 101 copper treatments provided marginal control, while the copper 20–80 dust, based on visual counts only, provided poor control.

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COMFREY

as a feed for swine

HUBERT HEITMAN, JR.

SERGIO E. OYARZUN

Under the conditions of these experiments, dehydrated comfrey was not a suitable ingredient for a laboratory rat ration at the 20% level, where it supplied half of the protein, and it was completely unsatisfactory at the 40% level. The swine digestion trial indicated that the comfrey used had a dry matter content of 12.1% digestible crude protein, and 52.7% TDN content. The ratings for crude protein, total digestible nutrient content and nitrogen-free extract were all lower for comfrey than for the control ration.

THE RELATIVELY HIGH PROTEIN content and yield of comfrey (*Symphytum peregrinum*) make it of interest as a possible protein source in the rations of such monogastric animals as swine. The dietary study reported here was conducted to yield preliminary information.

An analysis of comfrey dry matter (table 1), shows the level of crude protein is about 25 per cent. The crude fiber level appears moderate (about 12½%), but ash is high (over 23%). An initial crude palatability test using two 150-lb hogs indicated that they would consume reasonable quantities of a ration containing up to 40% dehydrated comfrey. Higher levels were not fed.

Rat rations

Purified rat rations were designed containing about 10% crude protein and levels of 0, 20 and 40% dehydrated comfrey. Nitrogen and crude fiber contents of the three rations were equalized using casein, comfrey and cellulose (see table 2).

Thirty, 21-day old Sprague Dawley male rats were divided at random between the three groups and fed individually *ad libitum* for a 21-day trial. The results are summarized in table 3. Analysis of variance statistics indicated highly significant differences ($P < 0.01$) in both gain and feed consumption. It is notable that all ten rats lost weight continuously through the trial on the 40%-comfrey ration, but about 56% of the weight loss occurred in the first week. One rat in the 20%-comfrey group lost weight continuously and succumbed on the sixth day. The differences between all rations for gain and feed consumption were highly significant ($P < 0.01$), except that the difference between feed consumption of the two comfrey groups was significant ($P < 0.05$). While the 40% comfrey group lost weight, the difference between the feed-per-unit-of-gain in the rats fed the control, and 20% comfrey rations was highly significant. Adjustment of gains to equal food consumption (170.1 gm) by covariance indicated that the differences between adjusted gains (58.3, 26.1 and –2.1 gm, respectively) were still highly significant. Analysis of variance of the relation of gain to comfrey level indicated the reduc-

tion due to regression was highly significant.

It appears obvious that even when half of the casein protein (20% comfrey ration) was replaced with comfrey protein that there were drastic reductions in feed consumption (about 24%), feed conversion (about 50%) and gain (about 62%).

TABLE 1. PROXIMATE ANALYSES OF COMFREY AND CONTROL RATIONS (DRY MATTER BASIS)

	Comfrey		Control rations	
	Rat trial	Swine trial	Rat trial	Swine trial
	%	%	%	%
Crude protein	26.0	24.4	10.3	17.6
Ether extract	2.4	3.4	3.9	1.2
Crude fiber	12.3	12.6	4.9	8.4
Nitrogen-free extract	35.7	35.9	77.4	67.1
Ash	23.6	23.7	3.5	5.7

TABLE 2. RATIONS, RAT TRIAL

	Control	Comfrey	
		20%	40%
		Percenatge	
Casein	11.0	5.5	—
Comfrey, dehydrated	—	20.1	40.3
Corn oil	5.0	5.0	5.0
Sucrose	71.4	60.1	48.7
Cellulose*	6.6	3.3	—
Salt mixture†	4.0	4.0	4.0
Vitamin mixture‡	2.0	2.0	2.0

* Solka-floc.

† Salt mixture P-H manufactured by Nutritional Biochemical Corporation, Cleveland, Ohio.

‡ Vitamin Diet Fortification mixture manufactured by Nutritional Biochemical Corporation, Cleveland, Ohio.

TABLE 3. RESULTS, RAT TRIAL (21 DAYS, 10 RATS PER GROUP)

	Ration		
	Control	Comfrey	
		20%†	40%
Final weight, gm.	107.4	68.4	36.9
Initial weight, gm.	42.8	43.7	44.2
Gain, gm.	64.6[a],*	24.8[b]	−7.3[c]
Feed comsumption, gm.	212.6[x]	161.9[y]	135.1[z]
Feed per unit gain	3.36[a]	6.77[b]	—

* Values on same line differ significantly from those with different superscripts—a, b, c ($P < 0.01$); x, y, z ($P < 0.05$).

† One rat succumbed on day-6 of this ration. Data based on nine rats fed the 20% comfrey ration.

TABLE 4. RATIONS,* SWINE DIGESTION TRIAL

	Control	Comfrey	
		20%	40%
		Pounds	
Ground barley	83		
Cottonseed meal (41% CP)	11		
Meat and bone meal (50% CP)	6		
Salt	0.5		
Control, above		80	60
Ground, dehydrated Comfrey		20	40

* Plus 1675 I.U. Vitamin A and 90 I.U. Vitamin D_2 per pound of ration.

TABLE 5. RESULTS OF SWINE DIGESTION TRIAL (3 × 3 Latin square)

	Coefficients, apparent digestibility	
	Control ration	Comfrey*
	%	%
Crude protein	73.7	49.6
Ether extract	26.5	80.3
Crude fiber	14.9	84.5
Nitrogen-free extract	83.2	66.5
Calculated total digestible nutrients (TDN, %)	70.8	52.7

* Calculated by difference between the control ration and the 20% and 40% comfrey rations.

A 3 × 3 Latin square design digestion trial was run with rations also containing 0, 20 and 40% dehydrated comfrey (rations in table 4, analysis of comfrey and control ration, table 1) and three pigs weighing initially about 80 lb and finally about 140 lb. Collection periods were 10, 10 and 9 days and feed consumption 4, 5 and 6 lb in each of the three periods, respectively. The results are summarized in table 5. The digestion coefficients indicate a calculated TDN content of 52.7% for the comfrey used in this trial.

Swine rations

Analyses of variance were calculated for apparent coefficients of digestibility of the three swine rations for the organic components of the proximate analysis. In spite of the low magnitude of the degrees of freedom, the differences for the coefficients of digestibility between rations were statistically significant for crude protein ($P < 0.05$) and crude fiber ($P < 0.01$). The differences in coefficients for ether extract approached significance at the 5% level, but they lacked statistical significance for the nitrogen-free extract (NFE) because of variation caused by significant pig ($P < 0.05$) and period (replicate) ($P < 0.01$) effects. If the coefficients for NFE for pigs fed the control, and 20% comfrey, rations were combined and compared with those for pigs fed the 40% comfrey ration, analysis of variance indicated a highly significant difference. The coefficients of digestibility showed significant changes between comfrey levels due to regression for crude protein and crude fiber ($P < 0.01$) and ether extract ($P < 0.05$). Regression coefficients were positive for ether extract and crude fiber indicating that the digestibility of these components was higher in comfrey than the basal ration, but the reverse was true for crude protein and NFE where the regression coefficients were negative.

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Relationship of NAVEL ORANG to hard

THERE ARE SEVERAL severe bottlenecks in the search for agricultural chemicals (toxicants, sterilants or repellents) to control navel orangeworm infestations in almond orchards. One is that the use of experimental or unregistered pesticides jeopardizes the sale of crops from test plots. Another concerns the scarcity of knowledge about the flights of moths within or between orchards and within entire communities. The tools to do this kind of assessment work are still crude and the manpower requirement is high. Individuals and various small research teams working in California have accumulated a large amount of information about this tenacious pest, but an economic control method for orchard infestations has not yet been determined.

Bioassays

Bioassays of various pesticide effects against moths and larvae seem to show that the individual active stages of this pest are not particularly immune or resistant. However, repeated applications of potent and persistent pesticides applied to protect ripening crops fail to give the result desired. The supposition is that the true value of treatments in small plots is not evident because there is an inflow of moths from surrounding untreated areas. The moths flying into an area inflict additional damage before the pesticide residues begin to act, making it impossible to find out how a treatment affects the original inhabitants of a test plot. The result is a lack of knowledge on how large a treated area must