TABLE 1. BRUSHLAND IMPROVEMENT COSTS BY YEAR AND CATEGORY.

Year	Labor	Machinery and equipment	Materials	Total
1961-62	$ 489.15	—	$ 163.20	$ 652.35
1962-63	396.15	$ 130.50	178.60	705.25
1963-64	411.75	421.07	439.28	1,272.10
1964-65	697.20	609.14	465.30	1771.64
1965-66	857.55	599.59	612.35	2,069.49
TOTAL COST	$ 2,851.80	$ 1,760.30	$ 1,858.73	$ 6,470.83
PER ACRE COST	7.37	4.55	4.80	16.72
PERCENTAGE	44.	27.2	28.7	

TABLE 2. BRUSHLAND IMPROVEMENT COSTS BY CATEGORY AND PRACTICE.

	Labor		Machinery		
	Hrs.	Cost	and equipment	Materials	Total
Tree treatment	607	$ 1,075.80	—	$ 289.00	$ 1,364.80
Crush brush	112	243.00	$ 507.50	—	750.50
Brush spraying	229	450.00	253.31	260.15	963.46
Brush burning	119	211.20	—	—	211.20
Reseeding and fertilizing	456	871.80	999.49	1,309.58	3,180.87

TABLE 3. BRUSHLAND IMPROVEMENT COSTS AND INCOME PER ACRE FOR NINE YEARS DISCOUNTED AT 6% RATE*

Period	Year	Return no improvement	Improvement costs	Return	Net	Cumulative net income
1961-62	1	$ .88	$ 1.58	$ .76	$ - .82	$ - .82
	2	.83	1.72	.89	- .83	- 1.65
	3	.78	3.10	.97	- 2.13	- 3.78
	4	.74	4.32	2.92	- 1.40	- 5.18
1965-66	5	.70	5.05	.47	- 4.58	- 9.76
	6	.66	—	4.25	4.25	- 5.51
	7	.62	—	4.04	4.04	- 1.47
	8	.59	—	4.31	4.31	+ 2.84
1970-71	9	.56	—	4.50	4.50	+ 7.34
TOTAL		$ 6.36	$ 15.77	$ 23.11	$ 7.34	

Difference in costs from Table 1 is the result of figuring 6% discount.

*6% rate equal to what money would have earned in alternate investments.

seeding time on the area planted with the rangeland drill.

Different grazing values were used for sheep and cattle. The return for sheep grazing was determined by assigning a value of 3 cents per sheep day; for cattle the measure was pounds of gain at 25 cents per pound. The sheep were grazing during the summer, fall and early winter with maintenance feeding the aim rather than an increase in poundage. The cattle were young heifers which were in the area during late winter, spring and early summer, however, and increased weight was the important factor.

In the first 3 years, before the improvement practices were effective, the average annual value of animal products was about $360 (graph 2). By the fourth year an upward trend in values was apparent although in the fifth year a very poor, early spring feed condition produced a sharp dip. Cattle values contributed most of the increase because their numbers were augmented when more feed became available during the spring portion of the grazing season. Sheep, on the other hand, grazed on the residual feed in the fall when it was dry thus their numbers were more constant. Some of the decrease in sheep values, in the last 3 years, was due to sheep killing by coyotes, which reduced the yield of sheep products.

A comparison of improvement costs with net income discounted at 6% (a cost equal to what money would earn in various alternative investments) over the 9 years of the study is shown in table 3. At the end of the fifth year when all improvements had been made, the total net returns amounted to $9.76 less than the improvement costs. During the eighth year, however, net returns were greater than the improvement costs by $2.87; by the end of the ninth year they had exceeded them by $7.34. From the eighth year onward with minimal maintenance or improvement costs, the net returns may be expected to increase at a substantial rate.

Other values

Removal or reduction of brush and substitution of grasses and clover achieves other advantages not measured by livestock. For example, the possibility of large wildfires is much reduced when big areas of brush are broken into small units separated by grassy openings less subject to fires. Feed values lost by fires are estimated at about $2 per acre per year, thus the reduced probability of feed loss from fire could be added to the benefits achieved.

If hunting is a product of the land then a value could be assigned to the increase in deer resulting from more young browse available with better nutrition and palatability than old growth. Removal of dense brush would increase hunter success by making more area accessible. Finally, the mixture of brush with grass provides a greater range of food selection for deer than dense brush.

A. H. Murphy is Specialist, Dept. of Agronomy and Range Science and Superintendent of the Hopland Field Station and D. T. Torell is Livestock Specialist, Dept. of Animal Science, Hopland Field Station. Donald E. Carr, formerly with Dept. Agricultural Economics, Davis, carried out much of the background work on economic data analysis.

A San

The problem of diarrhea in dairy calves was studied using samples of dairy farms from two counties in California. Farmers were interviewed concerning (1) the nature and extent of the problem in calves on their farms, and (2) management practices. Survey findings showed differences between the two counties regarding causes of diarrhea; age at onset; and management practices—particularly with respect to vaccination, calving sites, and treatment.

DIARRHEA IN DAIRY CALVES in California is a major animal health problem. The major diarrhetic diseases of calves have been outlined as (1) hemorrhagic enterotoxemia, due to *Clostridium perfringens* type C, which occurs primarily in animals less than 2 weeks of age; (2) bovine virus diarrhea (mucosal disease†; and (3) calf scours, a disease of newborn calves, characterized by septicemia, toxemia, or diarrhea. Calf scours is caused most commonly by *Escherichia coli,* but can result from infections by other agents, including streptococcus, diplococcus, pasteurella, salmonella, and certain viruses.

Providentia stuarti, Proteus (several species), mycoplasmas, the chlamydia, and some fungi have also been incriminated as causes of calf scours. Calf scours is a major cause of losses in newborn calves, but adequate data relating animal morbidity and mortality to this symptom are unavailable. Therefore, a pilot survey was initiated in June, 1969, to obtain this information about diarrhea in calves for a limited area in the state of California.

Joaquin and Tulare County Study of DIARRHEA IN DAIRY CALVES

E. LOPEZ-NIETO • G. CRENSHAW • C. E. FRANTI • A. D. WIGGINS

Information on the number of dairy farms in San Joaquin and Tulare Counties, their addresses, and the approximate number of cows in each herd during the year 1967-1968, was obtained from the county farm advisors. The herds on these farms were divided into four classes according to the number of adult cows in the herd. The class limits were 1 to 100, 101 to 200, 201 to 400, and 401 or more animals per herd. A proportional sample of 50 farms was selected from each county as representative of the husbandry and management practices, and size of herds for that part of the state.

TABLE 1. REPORTED INCIDENCE AND PREVALENCE OF DIARRHEA IN DAIRY CALVES, BY SIZE OF HERD, SAN JOAQUIN AND TULARE COUNTIES, CALIFORNIA 1968 - 1969

	San Joaquin Co.			Tulare Co.		
Size of herd	Total farms	Incidence, July 1968-June, 1969	Prevalence, summer, 1969	Total farms	Incidence, July, 1968-June, 1969	
no.	no.	%	%		%,	
1-100	11	41	6	4	50	0
101-200	16	46	1	14	54	3
201-400	15	31	35	17	46	3
401-over	5	51	17	4	20	4
Total	47	40	19	39	36	3

TABLE 2. DISTRIBUTION OF CALVING SITES BY HERD SIZE, 1968

	San Joaquin Co.				Tulare Co.			
		Calving site				Calving site		
Size of herd	Total farms*	Field	Corral	Maternity stall	Total farmst	Field	Corral	
no.	no.	no.	no.	no.	no.	no.	no.	no.
1-100	11	6	6	2	4	2	2	1
101-200	16	7	10	0	14	3	9	0
201-400	15	11	8	1	17	4	13	1
401-up	5	3	3	0	4	0	3	0
TOTAL	47	27	27	3	39	9	27	2

* Three farmers in the first group, one in the second, four in the third, and one in the fourth used field and corral simultaneously; one farmer in the third group used field and maternity stall.

† One farmer in the first group used maternity stall in winter, but field during remainder of year; two farmers in the second used pens; one farmer in the third group used field in summer and corral in winter; one farmer in the fourth group used cow pens.

Questionnaire

A questionnaire was designed to supply information about the number and breed of cattle currently on the farm, time of calving, number of calves with diarrhea during 1968 and at the time of the survey, number of calves that died because of (or with) diarrhea during the past year, age of calves at onset of symptoms, and season of the year at which major problems occurred. Other information obtained concerned nutrition, colostrum feeding practices, vaccination practices, and other factors related to management. Each dairyman was personally interviewed to obtain answers to the questionnaire.

For various reasons, including a lack of cooperation on the part of some dairymen, it was not possible to complete interviews on 3 farms in San Joaquin County and 11 farms in Tulare County. Findings from this retrospective study are presented in tabular form, using the four classes of herd size as a key tabulating variable. These findings do not contain diagnostic information, but refer to "diarrhea" as defined in the minds of farmers interviewed.

The reported incidence (1968) and point prevalence (at time of interview, summer 1969) of diarrhea are given in table 1. The prevalence was low in all classes in both counties, except in the 201 to 400 class on farms in San Joaquin County, where the prevalence rate was 35% . The reported incidence within the classes during the previous year in San Joaquin County ranged from 31 to 51% , and in Tulare from 20 to 54% .

In both counties, the Holstein breed was the most popular in each of the 4 classes of herd size. In San Joaquin, the percentage of Holsteins varied from 66% in herds of 201-400 animals to 89% in herds of 101-200 animals. In Tulare, the percentage varied from 81 to 100% .

The variation in the proportion of cows calving in any one season was small in both counties; dairymen interviewed had cows calving almost uniformly throughout the year.

In 1968 in San Joaquin County, the incidence of diarrhea in calves, by class of herd, was 31 to 51% ; the percentage of calves treated was 28 to 49% ; and, among all calves, the percentage of deaths attributable to diarrhea was 10 to 13% . The lowest percentage of calves treated for diarrhea was in herds of intermediate size, and the highest percentage treated was in the largest herds. There did not seem to be any direct relationship between treatment of calves and mortality, the rate being 11% in the class with lowest percentage of treatment, and 13% in the class with the highest percentage.

Mortality

Morbidity and mortality appeared to be related on farms studied in San Joaquin County. The lowest mortality was in the same class in which the reported morbidity was

TABLE 3. DISTRIBUTION OF VACCINATION PRACTICES ON TWO SAMPLES OF DAIRY FARMS, 1968

Size of herd	San Joaquin County					Tulare County				
	Total farms	Infect. bovine rhino-tracheitis	Bovine virus diarrhea	Lepto-spirosis	Mastitis	Total farms†	Infect. bovine rhino-tracheitis	Bovine virus diarrhea	Lepto-spirosis	Para-influenza
	no.	no.	no.	no.	no.	no.	no.	no.	no.	no.
1-100	11	5	5	8	5	4	2	2	1	1
101-200	16	7	5	12	3	14	10	10	11	9
201-400	15	8	8	14	7	17	11	8	11	6
401-up	5	3	2	4	2	4	3	3	4	3
TOTAL	47	23	20	38	17	39	26	23	27	19

*One farmer in the third group and one in the fourth used parainfluenza vaccine; one farmer in the first group, one in the second, and one in the third used salmonella bacteria; one farmer in the first group used Escherichia coli bacteria; two farmers in the first group, three in the second, and one in the fourth used blackleg vaccine. None used enterotoxemic antiserum or toxoid, nor scours antiserum. All vaccinate against brucellosis.

† One farmer in the second group and two in the fourth used mastitis vaccine; four farmers in the second group, two from the fourth used salmonella bacteria; one farmer from the first group, three from the second, one from the third, and two from the fourth used E. coli bacteria; one farmer from the second group, one from the third and two from the fourth used enterotoxemic antiserum; three farmers from the second group and five from the third used blackleg vaccine. All vaccinate against brucellosis.

lowest (31%), and the highest mortality occurred in the group in which morbidity was highest (51%).

In Tulare County, the percentage of calves with diarrhea ranged from 20 to 54% in the four classes, and of the calves affected, 14 to 44% were treated. From 3 to 19% of the deaths in calves were attributed to diarrhea. In contrast to data for San Joaquin County, the lowest proportion of calves treated for diarrhea was in the class of largest herds. The other three classes all had nearly the same proportion (43 to 44%) treated. The class containing the largest dairy farms included one herd with 2,500 calves, but the owner reported very little problem with diarrhea (10%) in calves.

Information on the average number of calves with diarrhea, by age, was recorded. In San Joaquin, the highest incidence (19.7%) was in the group of animals 0 through 3 days of age, whereas in Tulare, the highest incidence (20.5%) was in the group of animals 4 through 8 days of age. In general, the highest incidence in both counties was in herds containing 101 to 200 animals, and in calves 0 through 8 days of age.

Diarrhea in dairy calves reportedly occurred in all seasons, but the incidence was highest in both counties in winter. Eight of 39 Tulare County farmers, and 3 of 47 San Joaquin farmers reported additional troubles with diarrhea in summer.

Calving

In both counties, 40 to 50% of the calves were removed from cows within 12 to 24 hours after birth. Five of 46 farmers in San Joaquin allowed calves to remain with their mothers for more than 36 hours, but only one farmer in 39 interviewed in Tulare reported such a prolonged period of contact.

In San Joaquin, 47% of the dairymen reported that their cows usually calved in the field, while 57% reported the cattle calved in the corral (table 2). In Tulare, 23% of the cows calved in the field, and 69% in the corral. Only 3 of 47 farmers in San Joaquin, and 2 of 39 in Tulare, reported using maternity stalls for their dairy cattle.

In San Joaquin, the average age at which calves stopped drinking milk was 88 days, and the range was 30 to 135 days. The lowest mean (70 days) was in herds of 201 to 400 cattle, and the highest (100 days) was in the class of largest herds. In Tulare, the average age at which the calves stopped drinking milk was 84 days, the range being 7 to 200 days. The lowest mean (69 days) was in the group of smallest herds, and the highest mean (102 days) was in herds in the 201 to 400 class. In San Joaquin, the milkers fed the calves on 11% of the farms, the feeders fed on 43% , and the owners on 46% . In Tulare, the values were 54% , 26% , and 20% , respectively.

Control

To control calf diarrhea, 37 of the 47 dairymen interviewed in San Joaquin County reported cutting back on milk for scouring calves, and 9 withheld milk completely and fed their calves products such as eggs and rice. Oral medication was used on 42 farms and injectable medication on 32, a number of farms using both. On 44 farms, treatment was initiated immediately after signs of diarrhea were first noted.

In Tulare, 30 of the 39 dairymen reported cutting back on milk for scouring calves, and 6 withheld milk completely. Oral medication was used in 31 farms, and injectable medication in 29. In 34 farms treatment was initiated immediately after the signs of diarrhea were first noted.

Forty of 47 farmers in San Joaquin, and 22 of 38 in Tulare, reported using medication (treating) during feeding of calves. In San Joaquin, 23 farmers reported treating the umbilicus, compared to 13 in Tulare. About half the farmers interviewed in San Joaquin and two-thirds of those in Tulare reported using "preventive medications". About the same percentages stated that they never called upon a veterinarian to treat a scouring calf.

Vaccination practices varied greatly in the two counties (table 3). More San Joaquin farmers vaccinated their animals against leptospirosis, but Tulare farmers used infectious bovine rhinotracheitis (IBR), bovine virus diarrhea (BVD), and parainfluenza-3 (PI3) vaccines more commonly than did San Joaquin farmers. All farmers interviewed in both counties vaccinated against brucellosis.

Conclusions

The reported prevalence of diarrhea in calves was low on most of the farms because the survey was made in summer, when interviewers were available.

There are several possible explanations for the apparent lack of significant relationships between treatment for diarrhea in calves and mortality. These include: (1) the organisms responsible may be resistant to the medications being used, and (2) treatment may have been initiated too late when dehydration had already weakened the calves to the point where 10 to 15% would die anyway.

The age at onset of diarrhea in calves differed in the two counties,

indicating the possibility that the major causative agents may differ between the two counties. Tissue or fecal samples for microbiologic study were not collected during the survey, but such a study should probably be made.

Calving site important

One of the most important factors related to diarrhea in calves in these counties appeared to be the site of calving. Farms on which calving usually occurred in a corral seemed to have higher losses than farms on which cattle dropped their calves in pastures or calving occurred in maternity stalls. The high risk of loss when calving occurs in a corral may reflect unsanitary conditions in the corral, such as dust in summer, mud in winter, concentration of cattle resulting in concentration of feces and urine in the corral, close proximity of other (possibly infected or carrier) animals, and contamination of soils by possibly infected birth fluids and waste.

A number of difficulties were encountered in conducting this small survey. A relatively poor response was obtained in Tulare County, at 11 randomly selected farms it was impossible to complete interviews. As in any retrospective study, the ability of the interviewee to recall events that occurred as long as a year ago is highly questionable. However, in this pilot study, in which we sought clues to additional factors which may be related to calf scours, we accepted the risk of memory errors. A prospective, follow-up study would have been more desirable, but was far too expensive to be considered seriously. The data collected have been subjected to factor analysis, however, and the results are being reported separately.

Elva Lopez-Nieto is Ancillar Professor, Programa Academico de Medicina Veterinaria, Lima, Peru. George Crenshaw is Extension Veterinarian; Charles E. Franti is Associate Professor of Biostatistics, and Alvin D. Wiggins is Assistant Professor of Biostatistics, Department of Epidemiology and Preventive Medicine, School of Veterinary Medicine, University of California, Davis.

Effects of Irrigation and Fertilizer on INIA 66 WHEAT

...yields, protein, and bushel weights

H. YAMADA • J. ST. ANDRE • R. M. HOOVER

Application of phosphorus and properly timed irrigation appreciably increased yields of late planted wheat. However, phosphorus applications reduced the bushel weights. Higher protein content was obtained by increasing nitrogen rates and by timely irrigation.

THE SOUTHERN SAN JOAQUIN valley has traditionally been a barley region. With the introduction of Mexican wheat varieties in the past few years, additional cultural information was needed so the full yield potential of these varieties and their competitive status could be determined. Fertilizers and irrigation variables appropriate to conditions in Fresno County's west side were selected to test a single promising variety which represented these genotypes.

Variety INIA 66 was planted on January 21, 1971 at a seed rate of 135 lbs per acre on a Panoche clay loam soil that had been preirrigated with 21 inches of water. Soil moisture samples indicated that moisture was available to the 6 ft depth. Fertilizer treatments were (in lbs per acre): (for the F-1 plot) 200N, 160P, 130K, 1.3Zn, 1.3Fe, 0.88Mg, and 0.08Mn; (F-2) 200N, 160P, and 130K; (F-3) 200N and 160P; (F-4) 200N and 130K; and (F-5) 100N. The stage of growth and the amount of water for plots at the time of irrigation was: (I-1) secondary root stage—5.4 inches; (I-2) secondary root—5.4 inches and late boot stages—5.9 inches; (I-3) early boot 6.9 inches and heading stages—5.1 inches; (I-4) secondary root—5.4 inches early boot—5.1 inches late boot—4.2 inches and milk stage—7.9 inches. Fertilizer and irrigation treatments were combined factorially for a 20-treatment total.

TABLE 1. INIA 66 WHEAT YIELD IN LBS. PER ACRE UNDER VARIOUS IRRIGATION AND FERTILIZER TREATMENTS

Irrigation treatments	Fertilizer treatments F1	F2	F3	F4	F5	Irrigation means	DMR* 1%
	Pounds per acre						
1	2841	2776	2936	2057	2013	2525	a
2	3172	3132	3175	2592	2316	2877	b
3	4029	3925	3894	2980	2798	3525	c
4	4035	3998	4037	3162	2961	3639	d
Fert. mean		3458	3511	2698	2522		
DMR 1%	c	c	c	b	a		

*Duncan Multiple Range Test. Coefficient of variation (C.V.) 3.9%