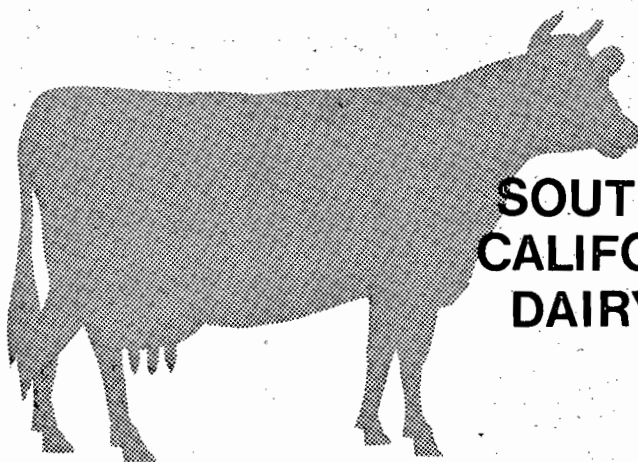
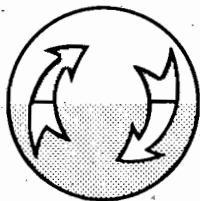


AN ANALYSIS OF

**DAIRY WASTE
MANAGEMENT
ALTERNATIVES**



**FOR
SOUTHERN
CALIFORNIA
DAIRYMEN**



**AGRICULTURAL EXTENSION
UNIVERSITY OF CALIFORNIA, RIVERSIDE**

UC Cooperative Extension

PREFACE

Implementation of the Porter - Cologne Water Quality Act is a matter of great concern to dairymen, suppliers of goods and services, county governments and to the regulatory agencies charged with the protection of water quality.

The burning question is *Can dairies remain in Southern California?*

Favorable climate, nearness to market, readily available labor, supplies and services, and an already - committed investment of many millions of dollars comprise compelling reasons for retaining a highly developed dairy community.

This publication analyzes the impact of the new law, and suggests the conditions under which the Southern California dairy industry can remain and be competitive with other dairy regions capable of supplying the market.

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AN ANALYSIS OF DAIRY WASTE MANAGEMENT ALTERNATIVES

For Southern California Dairymen

Regulations designed to prevent pollution of surface and underground waters will require new management decisions for most Southern California dairymen. These regulations stipulate that every dairyman must contain and dispose of polluted water on land that he owns or controls.

Further, there is a limit on the amount of manure which can be applied to cropland. The allowable manure application rates are, or will be, set by regional water quality control boards, depending on cropping patterns and other factors.

It is expected that the limit for each acre of cropland will be the wastes produced by as few as 1.5 cows under certain circumstances, to as many as 5 or more cows under other circumstances. This is the equivalent of 3 to 10 tons of manure (dry weight) per acre. The requirements and alternate means of compliance are shown in broad outline below:

Requirements

1. Contain and dispose of all polluted water on land owned or controlled by dairyman.

Alternatives

- a) *If space and grade permit, provide retention structures to impound polluted water, and provide facilities to distribute it on land owned or controlled by the dairyman.*
- b) *If space and grade do not permit the above action, prevent pollution of storm water by providing cover for cows and manure.*
- c) *Relocate.*

2. Limit the application of dairy wastes to each acre of cropland to that produced by 1.5 to 5 cows.

a) Own, rent, or otherwise control cropland for the disposal of all wastes at the allowable application rate.

b) Own, rent, or otherwise control cropland for the disposal of a portion of the wastes, and export the excess.

c) Reduce the cost of waste disposal on cropland by relocating to an area where lower land values prevail.

FACTORS WHICH BEAR ON THE SELECTION OF ALTERNATIVES

No fewer than eight factors influence the choice of alternatives:

1. Land Values (investment costs).
2. Taxes on land (cash holding costs).
3. Cow density (or manure application) limitations imposed by water quality control agencies.
4. Cow density limitations imposed by local governmental planning authorities.
5. Production responses attributable to geographical region.
6. Production responses attributable to the side effects of waste management facilities (heat, cold, mud, rain, injury, insects, disease).
7. Operating costs attributable to various waste management systems.
8. Net revenue realized from cropland used for waste disposal.

This publication presents a method of assessing the effects of these many variables. It is recognized that no two dairies have identical revenues and costs. Also, it is realized that feed costs, interest rates, and milk prices are continually changing, thus making it difficult to establish typical current costs and returns.

However, this is relatively unimportant because it soon becomes apparent that land values and pollution prevention requirements combine to become the single most important issue affecting the profitability of dairying in Southern California.

In order to focus on the waste management issue in the analysis which follows, waste management costs are superimposed on all other costs. By this technique, the influence of land values and cow density limitations on profit margins stands out vividly. In addition, the following concepts apply.

REVENUE

The basic annual revenue from a Chino Valley cow maintained in an earth corral is assumed to be \$855. A comparable cow in the San Joaquin Valley is assumed to gross \$825. The \$30 differential represents about 500 pounds less milk produced due to stresses associated with weather and climate.

A yearly increase of 1,000 pounds of milk, worth \$60, is assumed for the "Chino" cow if she is provided a clean, dry, comfortable environment, sheltered from rain, but with free-choice sun or shade for parts of most days.

This is the essence of a waste management system designated as the Recycled Aerated Manure (RAM) system. Cows are maintained in roofed, open-sided structures, with air-dried manure used as an absorbent bedding. While the increased

revenue is largely offset by increased costs, the RAM system's principal virtue is its extremely low - pollution and low - nuisance potential.

Cropland used for waste disposal is credited with a net revenue of \$100 per acre. For example if cropland is available at the rate of 3 cows per acre, each cow is credited with a "net cropland revenue" of \$33.33. Likewise, at 20 cows per acre, each cow is credited with \$5 above her basic revenue.

EXPENSES

As mentioned earlier, waste management costs are separated from all other costs, because waste management is the item under scrutiny. "All other costs" include everything not related to waste management, such as feed, milking labor, supplies, services, etc.

For the basic Chino cow in an earth corral, "all other costs" total \$775 per year. The same amount is charged against the San Joaquin Valley cow. The reasoning is that the costs of hauling milk and hay from the San Joaquin Valley are approximately offsetting, as are certain other items of lesser importance.

A RAM system cow in Chino is charged with \$760 per year for "all other costs." The \$15 differential from the corral-cow represents the expected savings accruing from several items, including:

1. Cleaner cows, less washing required, less polluted waste water to contend with.
2. More compact layout, less distance to drive cows to and from the milking barn resulting in time saved and less stress on cows.

3. More convenient checking site for cows in heat, breeding, treating, and for pregnancy checking.
4. Better udder health resulting from mud-free resting area.
5. Fewer foot and leg injuries because of soft, dry, non-skid surface in feeding and resting areas.
6. Greatly reduced fly control costs because of low fly production.

Waste Management Costs

Land for Waste Management — An annual charge of 8½ percent of the selling price is made for land used for waste disposal. This charge comprises 6 percent for interest and 2½ percent for property taxes.

EXAMPLE: With land at \$6,000 per acre and with a limit of 3 cows per acre, the annual cost is:

$$\frac{\$6,000}{3} \times .085 = \$170 \text{ per cow}$$

If 85 percent of the wastes are removed, the limit becomes 20 cows per acre. Thus:

$$\frac{\$6,000}{20} \times .085 = \$25.50 \text{ per cow}$$

Facilities for Waste Management — For earth corral dairies an estimated \$38.50 per cow is invested in waste management (including pollution prevention) facilities and equipment. An annual charge of \$5 per cow is made to cover interest and amortization.

The RAM system requires an estimated investment of \$167 per cow. The annual charge for interest and amortization is \$22 per cow.

Supplies and Labor for Waste Management — An annual charge of \$8 per cow for supplies and labor is made for cows maintained in earth corrals.

The RAM system requires frequent (approximately twice a week) removal and replacement of bedding. The cost of supplies and labor to accomplish this is estimated at \$62 per cow per year. Dry manure is used as bedding.

COW DENSITY AND MANURE REMOVAL RELATIONSHIPS

As a starter, it is helpful to get a clear picture of the effect of exporting various amounts of the manure produced on a dairy, as related to cow density (or manure application) limitations imposed by government for either water quality control or land-use planning purposes.

% of Wastes Removed from Dairy	Basic Limitation on Cow Density (per regional water quality control board)		
	1.5	3	5
	Allowable Cow Density After Adjustment for Waste Removal		
0	1.5	3	5
50	3	6	10
75	6	12	<u>20</u>
80	7.5	15	25
85	10	<u>20</u>	33.3
90	15	30	50
92.5	<u>20</u>	40	
95	30		

(The underlined figure of 20 cows per acre is the maximum cow density per gross acre allowed by the San Bernardino County Zoning Code.)

DISCUSSION

The accompanying figures (1 - 4) indicate geometrically the effects that land values, cow density limitations, waste management systems, and environmental considerations have on revenue and expense, based on the assumptions previously outlined. Any or all of the assumptions can be modified when warranted, and certain conclusions may thereby be altered. The following conclusions are based on the assumptions described:

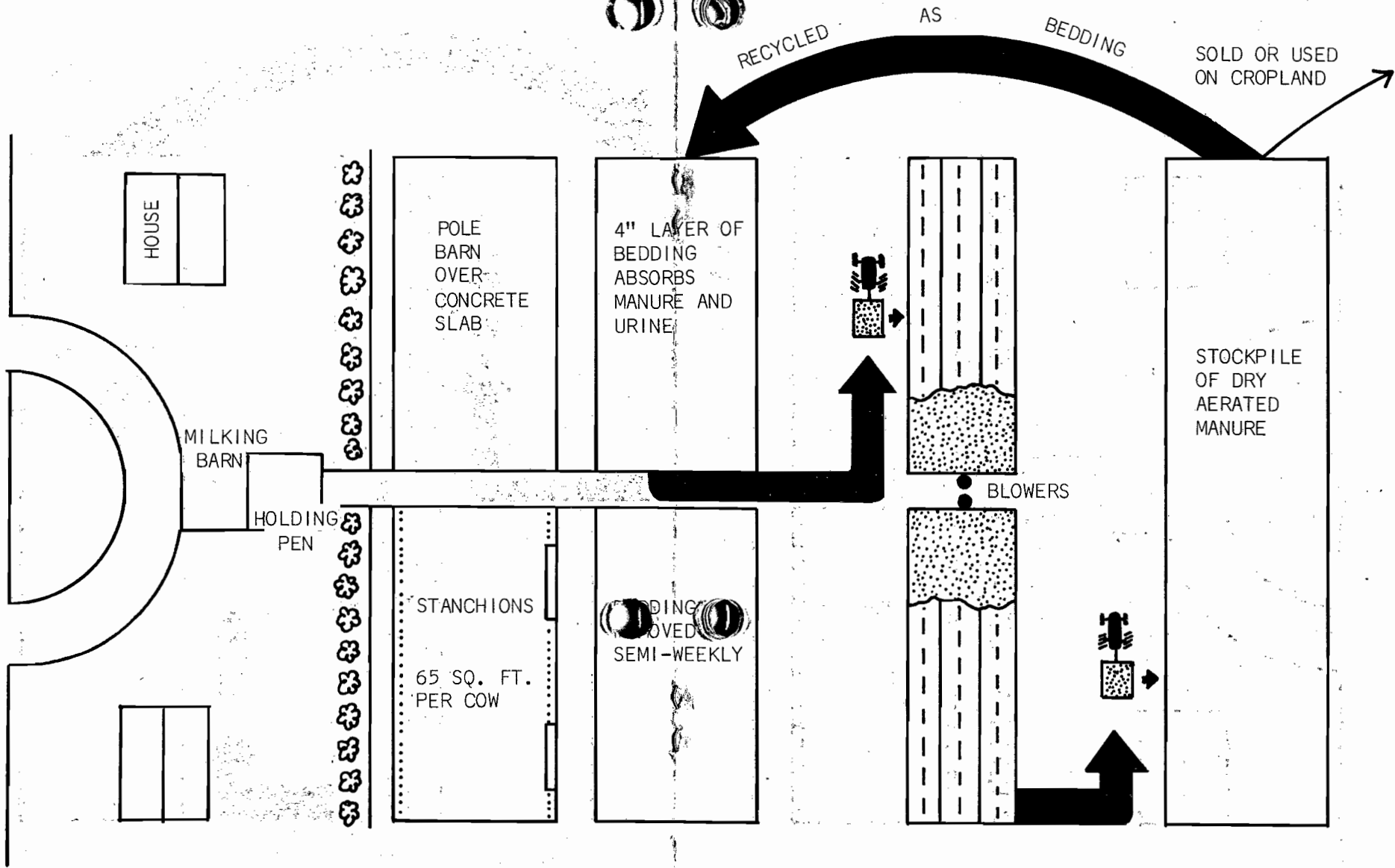
High land values are a powerful incentive to operate at the zoning code's maximum cow density of 20 cows per gross acre.

The basic cow density limitations established to protect ground - water quality simply dictate the amount of manure which must be removed in order to achieve the maximum cow density allowed by the zoning code (see figure 4). The following table further illustrates this point:

Basic Cow Density	Waste Removal Required to Achieve 20 Cows/Acre	
	Percent Removal	Pounds Removed per Cow
1.5	92.5	3,700
3.0	85.0	3,400
5.0	75.0	3,000

The upper limit of waste removal from an earth corral is probably near 85 percent, due to the liquification which takes place in winter. The RAM system would probably allow the removal of as much as 92.5 percent of all wastes produced.

RECYCLED AERATED MANURE SYSTEM



Since it is not economically feasible to haul highly liquified wastes, the liquid flush-out systems are not compatible with high land values.

With lower land values (figures 3 and 4), a dairyman's options are greatly widened in the matter of owning cropland for waste disposal. The San Joaquin Valley dairyman can follow the Southern California pattern of exporting manure from a limited acreage, or he is justified in owning sufficient land for the disposal of all waste produced because the cost of owning land is approximately offset by the revenue it generates.

A more pertinent issue is the penalty of environmental stresses associated with muddy corrals during extended periods in the winter, and hot weather in the summer. Some of these shortcomings are eliminated or reduced with free-stall housing. This, of course, adds a new dimension in cost — which may well be justified.

Locations of some dairies in the Chino Valley make it extremely difficult or impossible to control, impound, and distribute polluted storm water. The RAM system offers a solution which appears to be competitive with dairies using conventional earth corrals. If county government is willing to issue a variance to permit in excess of 20 cows per gross acre, the economics of the RAM system are further improved. Requesting such a variance would not be unreasonable because of the greatly reduced pollution and nuisance potential of the RAM system dairy.

**IT COSTS TO HAUL MANURE AWAY . . .
(BUT SOMETIMES IT COSTS MORE TO KEEP IT)**

With land valued at \$6,000 per acre
and with an annual charge of x .085 percent
The annual cost of owning land is . . . \$ 510 per acre

Subtract net revenue from cropland
used for waste disposal -100 per acre

Adjusted annual cost of owning
land for waste disposal \$ 410 per acre

\$410 = \$136.67 per ton (dry weight)
3 tons manure applied to owned land

\$410 = \$68.34 per ton (dry weight)
6 tons manure applied to owned land

\$410 = \$41.00 per ton (dry weight)
10 tons manure applied to owned land

(Three, six and ten tons manure per acre correspond
to 1.5, 3, and 5 cows per acre.)

Within the range of allowable limits of manure application, the costs of owning \$6,000 - per - acre land for waste disposal is far greater than the cost of hauling manure off the dairy. One would have to apply 82 tons per acre to lower the cost of using land to \$5 per ton of manure applied.

SUMMARY

The foregoing analysis suggests that:

1. The control of polluted surface runoff is the primary issue facing Southern California dairymen concerned with compliance with new water quality control regulations.
2. It is not economically feasible to own high-priced cropland for manure disposal at any of the proposed maximum application rates. Therefore, most of the manure must be exported.
3. In San Bernardino County, there is a strong incentive to maintain 20 producing cows per gross acre and export the amount of manure which exceeds the maximum allowable application rate. Basic limitations of 1.5, 3, and 5 cows per disposal acre would require the exporting of 3,700, 3,400, and 3,000 pounds of manure per cow per year respectively.
4. If space and grade are adequate for control, impoundment, and distribution of corral runoff, a dairy in Southern California can be competitive with dairies in the San Joaquin Valley.
5. If space and grade for managing corral runoff are lacking, a waste management system with a low - nuisance and low - pollution potential is available. Costs are higher, but returns are also higher — making the system competitive with other alternatives.
6. While it is economically sound to own cropland for waste disposal in the San Joaquin Valley, this condition merely broadens the range of profitable operations. A San Joaquin Valley dairy farm is not necessarily more profitable, according to the assumptions set forth in this analysis.
7. Although the Porter - Cologne Water Quality Act has a tremendous impact on the dairy industry in Southern California because of high land values in the area, it is important to remember that the law applies statewide. Equivalent regulations will apply in other states. All things considered, as yet there is no economic incentive to abandon a huge investment in a highly developed and highly specialized dairy community for a more dispersed and diversified agricultural area.



EARTH CORRALS - CHINO

LAND COST: \$6000/ACRE
 SPREADING LIMIT: 3 COWS/ACRE
 AREA OF PROFITABILITY IS SHADED

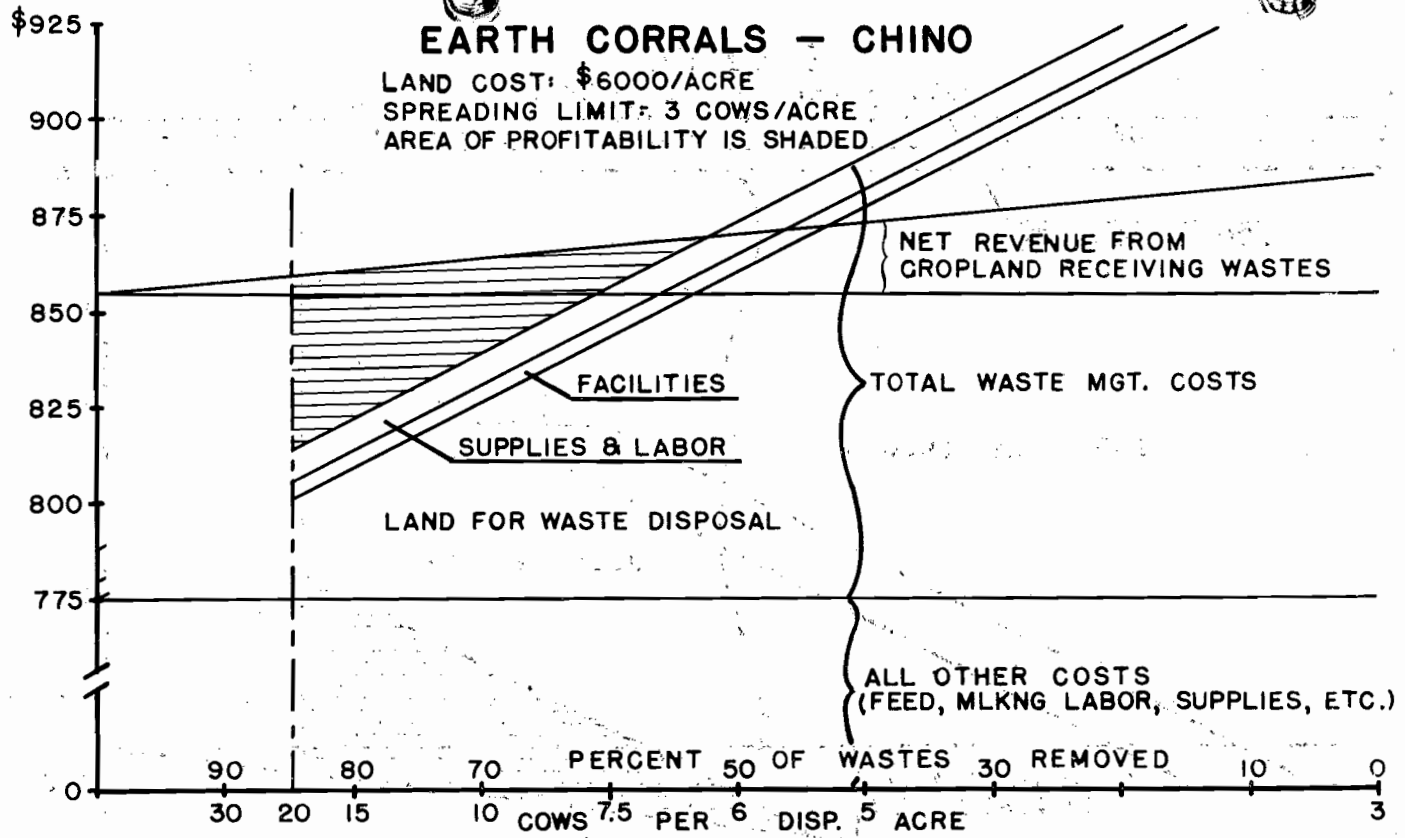


FIGURE 1

RAM SYSTEM - CHINO

LAND COST: \$6000/ACRE

SPREADING LIMIT: 3 COWS/ACRE

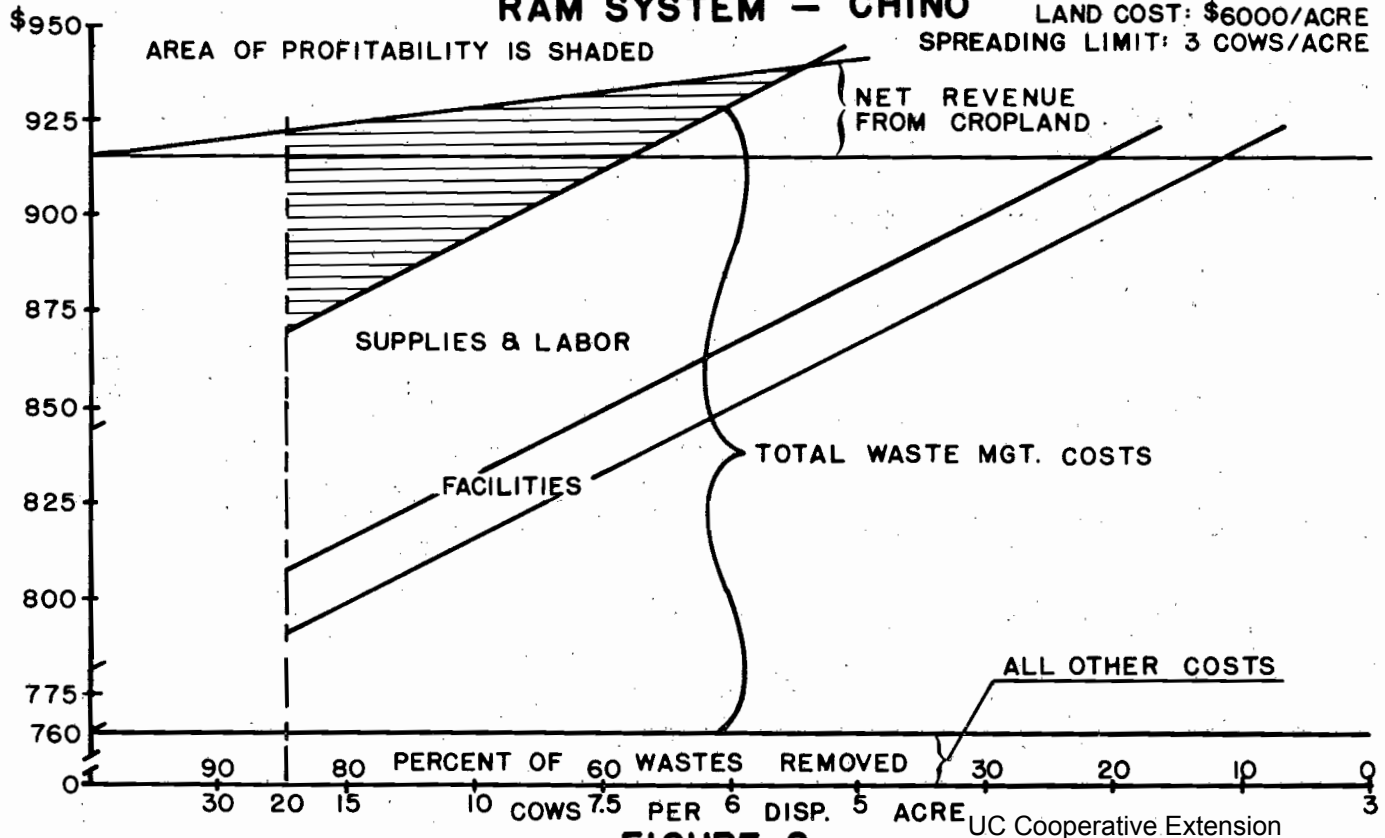


FIGURE 2

EARTH CORRALS — SAN JOAQUIN VALLEY

LAND COST: \$1000/ACRE

SPREADING LIMIT: 3 COWS/ACRE

AREA OF PROFITABILITY IS SHADED

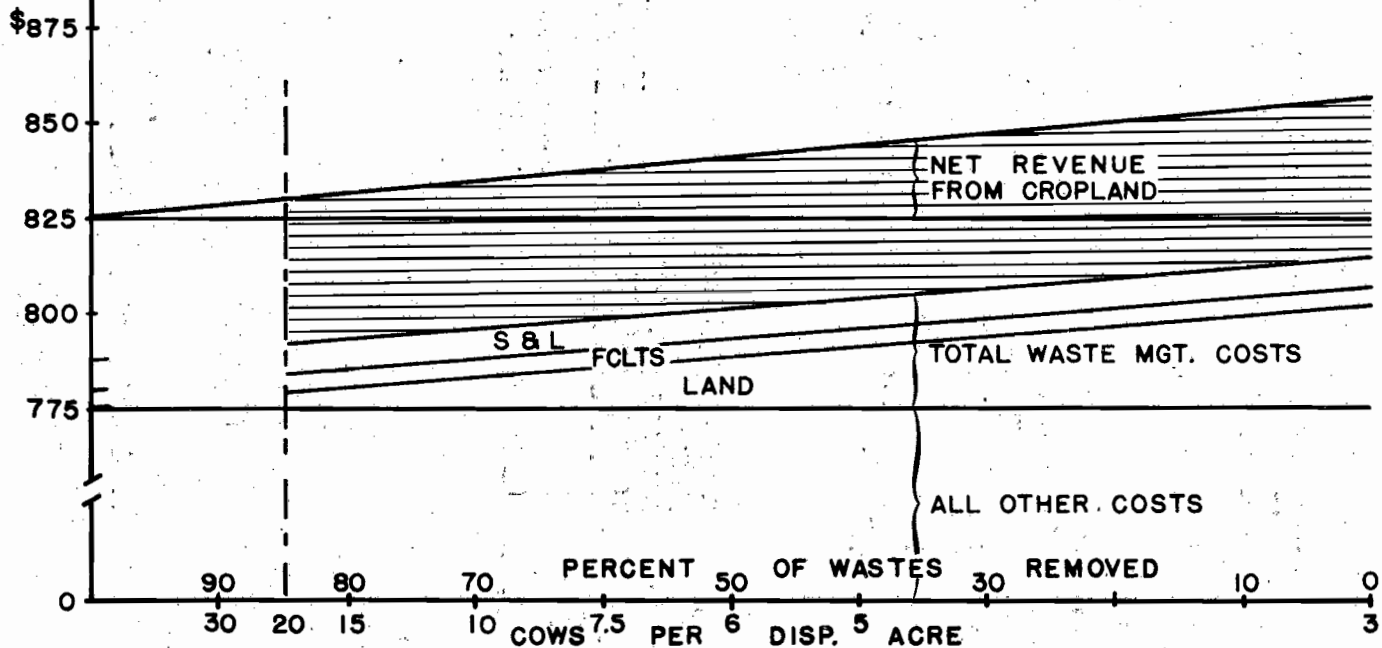


FIGURE 3

RECAPITULATION

LAND FOR WASTE DISPOSAL @ \$6,000/A IN CHINO, \$1,000/A IN S. J. VALLEY



REPRESENTS AREA OF PROFITABILITY

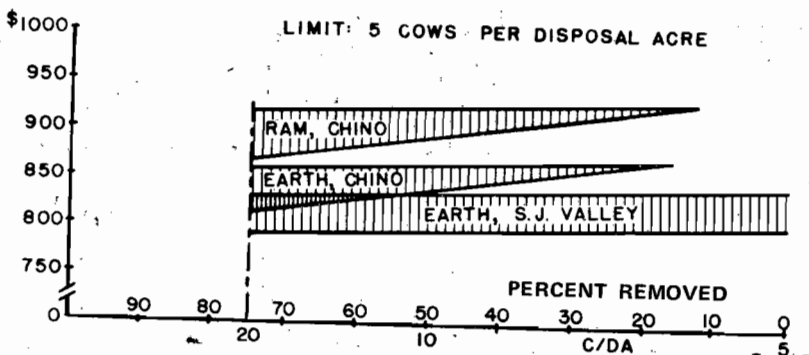
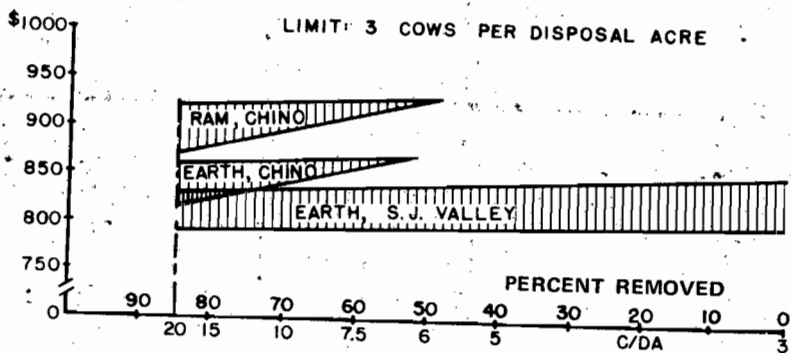
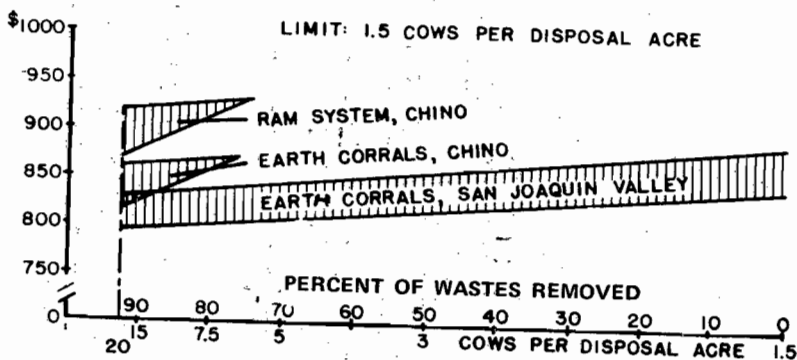


FIGURE 4

The University of California's Agricultural Extension Programs are available to all,
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