

Static Screening of Feedlot Dipping Vat Solution

J. M. Sweeten

MEMBER
ASAE

ABSTRACT

USE of a Hydrasieve screen for suspended solids removal doubles the "useful life" of coumaphos feedlot cattle dip solution and reduces pesticide disposal requirements by 50 percent. The system produced a 13.5 cent/head savings to feedlot management and paid for itself in 7 months. The optimum screening duration was 1 h per 1,000 head dipped, and the optimum screen slot size was 0.51 mm. Dry solids removal from the pesticide solution was 0.036 kg per head dipped.

INTRODUCTION

Cattle feedlots in the Southern Great Plains are required by State and Federal authorities to dip incoming cattle upon arrival to control spread of the Scabies Mite. Cattle dipping is an expensive, labor intensive process and has potential for surface and groundwater pollution from improper pesticide disposal.

Chemicals used in cattle dipping include toxaphene, coumaphos, and prolate. Dip solutions approved for Scabies control contain the following pesticide concentrations: (a) Toxaphene—0.5 percent to 0.6 percent concentration (8 to 10 L of commercial formulation per m³ water); (b) Coumaphos—0.3 percent concentration (12 kg of 25 percent wetttable powder per m³ water); (c) Prolate® —0.15 percent to 0.20 percent concentration (16.7 L commercial formulation per m³ water initial charge, or 14 L per m³ water replenishment rate); in addition, solution is acidified with 12 kg triple superphosphate per m³ water. Makeup water and chemicals must be added to the vat as needed to maintain proper volume and concentration.

Cattle dip solution in the vat must be replaced frequently. For example, an average of about 250 head can ordinarily be dipped per m³ of solution volume in a vat. The frequency of recharging a dipping vat is dictated in part by guidelines of the USDA's Animal and Plant Health Inspection Service (APHIS) that relate to useful life of active ingredients (120 days for coumaphos and toxaphene, vs. 60 days for prolate); maximum use rate of 530 head per m³ of vat solution; and maximum solids concentration of 10 percent by volume, which is usually

the limiting factor. Odors from anaerobic decomposition of vat solution often hamper working conditions and lead to premature vat recharging.

Discharged cattle dip must be disposed of in an environmentally-acceptable manner to prevent water pollution. For example, toxaphene has a lethal dose (LD₅₀) of 0.002 ppm for fish and 15 ppm for mammals and birds and a half-life of 11 yr. The most popular methods of disposal are evaporation (Sweeten and Price, 1974) and/or land spreading.

PREVIOUS RESEARCH

A sloping static screen (Bauer Hydrasieve*) was tested successfully in removal of settled and suspended organic matter from toxaphene solution at the APHIS-USDA cattle dipping station at Juarez, Mexico (Miller, 1975). The vat solution was screened for 14 h over a static screen with 0.51 mm aperature. Particulate concentration, measured volumetrically with 100 mL graduated cylinder, was reduced from 7.5 percent to 5.0 percent, while the toxaphene concentration was not measurably affected. The useful "life" of the cattle dip was doubled from 0.35 head/L to 1.06 head/L. Use of a Hydrasieve followed by a liquid cyclone separator reportedly doubled the useful life of toxaphene cattle dip solution at a Colorado feedlot (Utterback, 1976).

OBJECTIVES

Objectives of the experiments reported herein were as follows:

- 1 To determine the reduction in solids concentration achievable using a Hydrasieve to screen coumaphos cattle dip solution.
- 2 To determine whether the amount of coumaphos used in a cattle feedyard can be reduced by solids removal using the Hydrasieve.
- 3 To determine aeration capabilities of the Hydrasieve in screening cattle dip, as a possible step in odor control.
- 4 To determine whether the Hydrasieve is an economical management tool for cattle feedlot dipping vat management.

EXPERIMENTAL PROCEDURE

Experimental Site

Experiments were conducted at Olton Feedyards 30,000 head cattle capacity in the Texas Panhandle to determine whether a Hydrasieve used for cattle dip filtering can reduce pesticide consumption, disposal re-

Article was submitted for publication in November 1978; reviewed and approved for publication by the Structures and Environment Division of ASAE in May 1979.

The author is: J. M. SWEETEN, Extension Agricultural Engineer, Waste Management, Texas Agricultural Extension Service, Texas A&M University, College Station.

Acknowledgments: The authors acknowledge the invaluable financial support from the Texas Cattle Feeders Association, laboratory support from the Animal and Plant Health Inspection Service - USDA, and the cooperation of Olton Feedyards, Inc.

*Mention of commercial products does not imply endorsement by the Texas Agricultural Extension Service.



FIG. 1 Hydrasieve system used to screen solids from coumaphos cattle dip solution. Evaporation pond for waste cattle dip solution is in foreground.

quirements, and cost. The system was installed in June 1976, and screening experiments were conducted through July 1976. System evaluation continued until March 1978.

Records of dip vat management practices at Olton Feedyards from 1971 to 1976 were examined to obtain data on pesticide usage, pesticide cost, water requirements, frequency of vat recharging, and cattle dipped per vat charge. The records had a 19-mo gap (March 1972 - October 1973). In all, data from 22 vat cycles involving use of toxaphene and 20 cycles for coumaphos were available. This "historical" data provided the basis for determining the effectiveness of Hydrasieve treatment. Decisions regarding when to recharge the dipping vat were made by the feedlot manager and/or the vat manager based on animal appearance after dipping, volumetric solids testing, odor level, difficulty of agitation, and other factors.

Equipment

The cattle dip recycling system consisted of a Hydrasieve stationary sloping screen, trash handling pump, suction tube, pump intake hose, and discharge hose. The Hydrasieve was mounted alongside the dipping vat on a flat-bed trailer (Fig. 1). Screened effluent discharged directly into the dipping vat with 0.9 to 1.2 m free fall distance depending on water surface elevation in the vat. This provided turbulent mixing during the screening process. Solids were suctioned off the bottom of the 12.1 m³ concrete dipping vat using a 2.4 m × 7.6 cm diameter rigid polyethylene intake pipe. The intake pipe was moved manually along the vat bottom. The 3.7 kW gasoline-powered pump delivered 5.7 to 6.3 L/s to the Hydrasieve, which had a rated flow capacity of 9.5 L/s. The three stainless steel sloping screens used in this study were 1.37 m long × 0.71 m wide, and had bar screen openings of 0.25, 0.51 and 0.76 mm. Solids rolled off the screen by gravity and were collected in a weighing trough positioned on a 227 kg capacity platform scale.

Experimental Design

The experimental design consisted of a 3 × 3 factorial arrangement of treatments in a randomized block design. The following treatment levels were applied: (a) screen aperture size—0.25, 0.51 and 0.76 mm; (b) screening time period—½, 1 and 2 h per 1,000 head dip-

ped. The nine treatment combinations were applied at random after approximately 400 head of cattle were dipped per treatment.

Prior to these scheduled experiments 3,300 head of cattle had already been dipped in the 12.1 m³ vat. The vat needed recharging in the opinion of the feedlot veterinarian. The Hydrasieve was operated in an initial "vat cleanup test" of 5.67 h duration, or 1.7 h/1,000 head dipped. This test was followed immediately by the nine scheduled screening tests.

The original experimental plan called for operating the Hydrasieve immediately after dipping (i.e. "post-dip screening"). It was quickly learned, however, that advantage could be gained by also screening prior to dipping. This "pre-dip screening" process captured solids that settled too slowly to be picked up by post-dip screening. It also helped promote vat agitation prior to dipping. For each treatment combination, a 12.5 min period of pre-dip screening was utilized.

Sampling

In each experiment, vat contents were sampled at the following stages of the vat operating sequence:

Sampling Stage

- 1 Before agitation (in quiescent vat).
- 2 Immediately following agitation but before dipping cattle.
- 3 Immediately following cattle dipping but before screening.
- 4 Midway through post-dip screening.
- 5 Immediately after screening.

Vat contents were sampled at the midpoint of the vat using a stoppered-bottle sampler (Clymer, 1974). Three 250 mL bottles were mounted to an aluminum shaft at sampling depths of 1/6, 1/2 and 5/6 of the liquid depth. Stoppers on the sampling bottles were pulled by wire leads.

Top and bottom sub-samples (250 mL each) were mixed together and frozen. The combined 500 mL sample was later packed in ice and shipped in an insulated container to a private laboratory for analysis of total volatile solids and total dissolved solids and chemical oxygen demand (COD).

The middle sub-sample (250 mL) from each sampling stage was analyzed on-site for dissolved oxygen concentration using a direct reading portable dissolved oxygen meter. The sub-sample was then split into 125 mL portions from which the following were determined:

- 1 Odor intensity—conducted with 9 to 12 odor panelists using 5-bottle liquid dilution technique at Texas A&M University (Reddell and Sweeten, 1975).
- 2 Volumetric solids and coumaphos concentration—conducted by APHIS-USDA laboratory personnel in Beltsville, MA.

Halfway through the post-dip screening operation, two 1,000 mL grab samples were extracted from the Hydrasieve headbox and from the filtrate return duct to ascertain solids concentration immediately before and after passage over the screen. A composite sample of screened residue was extracted after each experiment. These three samples were frozen and shipped to a private laboratory where solids (total, volatile, dissolved and suspended) and COD were determined. Sediment (grit) which settled in the Hydrasieve headbox was collected after each experiment and weighed. In addition, floating

TABLE 1. SUMMARY OF PESTICIDE USE FOR CATTLE DIPPING, OLTON FEEDYARDS, 1971-1978

Data source	Vat charging interval		Pesticide usage	
	Days	No. head	*Coumaphos g/head	Toxaphene g/head
A. Toxaphene—Without Hydrasieve (6/71 - 10/74): (22 vat cycles)				
1. Mean	25.0	3,105	—	7.8
2. 95% C.I.				
(a) Upper limit	30.4	3,416	—	8.6
(b) Lower limit	19.7	2,796	—	7.1
B. Coumaphos—Without Hydrasieve (12/73 - 5/76): (20 vat cycles)				
1. Mean	29.7	3,705	83.5	—
2. 95% C.I.				
(a) Upper limit	34.7	4,223	94.3	—
(b) Lower limit	23.6	3,189	73.0	—
C. Coumaphos—With Hydrasieve (5/76 - 3/78): (15 vat cycles)				
1. Mean	41.9	6,324	63.1	—
2. 95% C.I.				
(a) Upper limit	50.9	6,792	67.1	—
(b) Lower limit	33.0	5,857	59.0	—

* Adjusted to a common base of 12 kg of 25 percent wettable powder per m³ water.

solids—largely cattle hair—were manually skimmed from the liquid surface just after dipping, as was the customary practice.

Dissolved oxygen levels in the dip vat solution were measured to determine if oxygen entrainment was occurring through the Hydrasieve and could assist in lowering odor levels by promoting an aerobic condition.

RESULTS

Extended Life of Pesticide Solution

The mean number of cattle dipped per vat charge without the Hydrasieve was 3,105 head for toxaphene and 3,705 head for coumaphos (Table 1). With the Hydrasieve, an average of 6,324 head were dipped in 15 complete vat cycles from May 11, 1976, to March 30, 1978. Thus, the Hydrasieve allowed a 71 percent increase in the number of cattle that could be dipped before vat recharging with coumaphos.

Reduced Pesticide Usage and Cost

Before installation of the Hydrasieve, coumaphos pesticide usage was 83.5 g/head (Table 1). By contrast, only 63.1 g/head were needed with the Hydrasieve, for a pesticide savings of 20.4 g/head, or 24 percent. Hence, cost savings for pesticide using the Hydrasieve was \$0.135/head with coumaphos priced at \$6.61 per kg. At that rate, the \$4,500 capital cost of the system would be recovered when 33,300 cattle have been dipped. Thus, a 30,000-head feedlot with a 200 percent annual turnover of cattle could pay for the system in less than seven months from pesticide savings.

Reduced Pesticide Disposal Requirements

Disposal of waste pesticide solution for the 40 months of data before Hydrasieve use averaged 3.2 L/head. The 95 percent confidence of interval for disposal volume was:

$$2.8 \leq \text{Disposal Quantity, L/hd} \leq 3.7$$

During the experimental phase of this study the Hydrasieve reduced disposal requirements to 1.3 L/head, a savings of 59 percent. Each liter of pesticide solution contained 12 g of formulation and 3 g of active ingredient.

With the Hydrasieve in use from May 1976 to March 1978, some 98,000 cattle were dipped and the vat was recharged 15 times. During this period the Hydrasieve reduced disposal requirements to a mean of 1.5 L/head. The 95 percent confidence interval around the mean is:

$$1.1 \leq \text{Disposal Quantity, L/hd} \leq 1.9$$

This represents a 53 percent reduction in pesticide disposal requirements.

In less than two years, the amount of pesticide and solution requiring disposal were reduced by 1944 kg and 162,000 L, respectively.

Effects of Hydrasieve on Solution Strength

Pesticide strength of the dip solution was not measurably reduced by screening using the Hydrasieve. Coumaphos concentration in the vat solution for all Hydrasieve treatment combinations averaged 0.31 percent after dipping just prior to screening and averaged 0.30 percent after screening. This difference was not statistically significant.

The coumaphos concentration increased from an average of 0.27 percent to 0.31 percent during dipping. This difference was statistically significant ($\alpha = 1$ percent). The 12.5 minute pre-dip screening plus 5 to 10 min aeration evidently were not sufficient to thoroughly agitate the vat. By contrast, coumaphos concentrations taken in a quiescent vat averaged only 0.12 percent due to settling of coumaphos powder. Quiescent vat samples yielded significantly lower coumaphos concentrations ($\alpha = 1$ percent) than samples from other sampling stages.

Hydrasieve Effects on Dissolved Oxygen

Oxygen concentrations were very low throughout the tests, ranging from 0.0 to 0.9 mg/L, which is less than 10 percent of the O₂ saturation for fresh water at the temperatures encountered.

Statistical analysis showed no significant difference in dissolved oxygen content between samples taken before and after vat agitation; before and after post-dip screening; or before and after passage over the Hydrasieve screen. Oxygen transfer may have occurred using the Hydrasieve system. However, the dissolved oxygen level did not increase due to the high chemical oxygen demand of dip solution (6,000 to 40,000 mg/L). By contrast, the Hydrasieve-induced dissolved oxygen increase reported by Neal (1976) was recorded on municipal sewage, which typically has a COD of only 400 to 600 mg/L.

Chemical Oxygen Demand

Across all treatment combinations, Hydrasieve treatment reduced COD levels from an average of 28,600 mg/L before screening to 27,400 mg/L after screening.

This reduction was statistically significant ($\alpha = 5$ percent) but has little practical significance. There were no significant differences in COD between the three screen

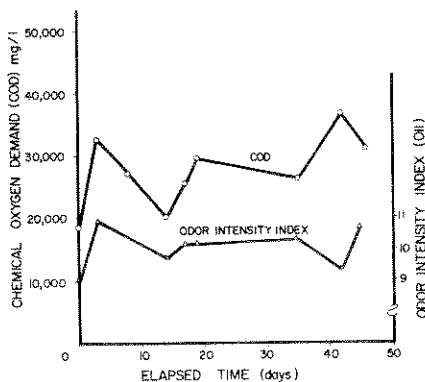


FIG. 2 Odor intensity and chemical oxygen demand of cattle dip solution during Hydrasieve experiments.

sizes or screening durations. COD levels after screening increased from 18,000 mg/L initially to 31,000 mg/L over the 46-day testing period (Fig. 2).

The COD of screened residue varied widely from 10,000 mg/L to 400,000 mg/L. The largest values were observed for the smallest screen size (0.25 mm) and vice versa.

Effects on Odor Intensity

There was no significant difference in odor intensities attributable to sampling stage, screen size, or screening duration. The mean odor intensity index (OII) for all treatment combinations and samples was 10.01. (The Odor Intensity Index (OII), is the number of times the concentration is halved by dilution to achieve a 50 percent panelist response.) At this level, the dip vat concentration was diluted 1,031 times, or $2^{10.01}$. A 95 percent confidence interval around the mean OII was:

$$9.73 < \text{OII} < 10.29$$

By comparison, the mean odor intensity index for 0.3 percent coumaphos solution mixed and stored in the laboratory and not used for cattle dipping averaged 7.01 OII over a two-month period. This is equal to only 128 dilutions.

Odor intensities did not vary with the time during the Hydrasieve tests (Fig. 2).

Solids Concentration Reductions

Solids concentration as measured by the APHS-USDA graduated cylinder test (volumetric method) was reduced by Hydrasieve treatment from an average of 8.4 percent before screening to 7.3 percent after screening. This difference was not statistically significant, however, because of some rather large variations in the data (Fig. 3).

Total suspended solids concentration of vat contents was reduced from an average of 36,000 mg/L before screening to 33,800 mg/L after screening. Volatile solids concentration was likewise reduced from 18,900 mg/L to 17,600 mg/L. Volatile solids amounted to 44 percent to 51 percent of total solids. Grab samples taken from the Hydrasieve headbox and discharge duct did not show measurable decreases in total solids or volatile solids concentrations.

There were no significant differences in volumetric solids content, total suspended solids or volatile solids concentrations attributable to either screen sizes or

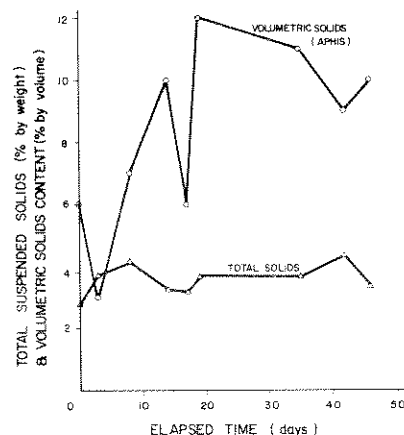


FIG. 3 Variations of cattle dip solids content with time during Hydrasieve experiments.

screening durations.

Even though solids were removed by screening, volumetric solids content and total solids increased throughout the 46-day testing period (Fig. 3). This increase was believed to be fine particles that could not be removed by the Hydrasieve. The increase in total solids (weight basis) was much more gradual and less erratic than for volumetric solids. Total solids content leveled off at 4.0 to 4.5 percent solids, whereas the volumetric solids content kept increasing to 12 percent. Thus, volumetric solids may be a relatively poor indicator of actual solids content.

Total Solids Content of Screened Residue

A composite sample of screened residue was collected for each treatment combination. This material resembled fresh beef cattle feces. It varied in consistency from a matted fibrous filter cake to a thick slurry with free-standing liquid upon collection. Difficulty was experienced in obtaining representative samples.

Measured total solids contents of residue ranged from 4.4 percent to 28 percent. Average total solids contents were highest for the 0.76 mm screen and lowest for 0.25 mm screen slot size which was unexpected. However, no significant differences were found that could be attributed either to screen slot size or filter duration.

The total solids contents of screened residue from all treatments are adequately represented by the following 95 percent confidence interval:

$$11 \leq \text{Total Solids Content, Percent} \leq 21$$

The average total solids content of 16 percent (i.e. moisture content of 84 percent) was subsequently used in computing the amount of dry solids removed from each treatment combinations.

Solids Removed by Hydrasieve

The amount of dry solids screened from vat solution during the initial 5.67 h vat clean-up test totaled 53.2 kg dry solids. This equates to 0.016 kg for each of the 3,300 cattle previously dipped.

Dry solids removals during the subsequent nine Hydrasieve experiments are reported in Table 2. Post-dip screening produced 8.0 to 19.1 kg dry solids, or 0.019 to 0.033 kg/head. Over all treatments, solids removal with post-dip screening averaged 0.029 kg/head. The 12.5 min period of pre-dip screening yielded an average of 0.007 kg/head dry solids removal. Thus, the total

TABLE 2. SOLIDS REMOVED BY HYDRASIEVE TREATMENTS

Date	Screen aperture, mm	Screening duration,* h/1,000 head	Cattle dipped, head	Dry solids removal by Hydrasieve		
				Pre-dip kg	Post-dip kg	Total kg
6/14	0.76	0.51	421	†	8.0	12.6±
6/22	0.76	1.00	425	1.7	14.1	15.8
6/17	0.76	2.00	382	3.7	12.6	16.3
7/1	0.51	0.53	409	4.4	9.1	13.4
7/3	0.51	0.99	403	0.4	13.4	13.8
6/28	0.51	1.99	403	1.7	13.1	14.8
7/26	0.26	0.50	498	4.6	12.4	17.1
7/19	0.26	0.99	655	4.5	19.1	23.6
7/30	0.26	2.00	542	2.8	16.4	22.6
Totals			4138	27.2	118.1	198.8
Avg./head				0.007	0.029	0.036

*Post-dip screening only; does not include 12.5 min pre-dip screening.

†Observation not available because test was run immediately following 5.67 h vat clean-up test.

‡Calculated from missing data formula to allow statistical comparison (Steele and Torrie, 1961).

amount of solids removed by Hydrasieve screening averaged 0.036 kg/head.

Grit that settled out in the Hydrasieve headbox (upstream from the static screen) consisted primarily of sand and gravel-sized soil particles. The grit quantity ranged from 7 to 34 kg (wet basis). Sufficient sample analysis are lacking, but the materials fell within a solids content range of 34 to 81 percent, and volatile solids accounted for only 16 to 28 percent of total solids. For all treatments, headbox grit amounted to 0.047 kg/head wet basis, or 0.027 kg/head dry solids.

Floating solids skimmed from the vat solution surface after dipping and before Hydrasieve operation varied in amount from 0.049 to 0.084 kg/head of cattle dipped (average of 0.062 kg/head). No analysis was performed on this material.

Effect of Screening Time

The 5 h-40 min vat "clean-up test" before the scheduled experiments demonstrated that solids removal efficiency was greatest at the beginning of screening and tapered off thereafter. The first 25 percent of screening time yielded 51 percent of the solids, while only 19 percent of solids were removed during the last half of screening time (Fig. 4). During the first 99 min of screening (equal to 0.5 h/1,000 head dipped), solids removal rates ranged from 10 to 26 kg/h.

The next 99 min gave removal rates of 8 to 17 kg/h. (The second "peak" removal rate may have been influenced by settling which occurred at 150 and 160 min of net Hydrasieve operation.) The solids removal rate decreased to only 3.4 kg/h during the last 150 min of screening. Thus, comparatively little was achieved by continuing with screening past 1 h/1,000 head.

During the nine scheduled experiments, solids removal rate (kg/h) consistently decreased with increased screening time (Fig. 5). Solids removal rates averaged 43, 32 and 16 kg/h for post-dip screening durations of 0.5, 1 and 2 h/1,000 head.

The average amount of dry solids removed per head (i.e. solids removal efficiency) was 0.029 kg for all treatments. From 67 to 80 percent of this dry solids removal occurred during the first 0.5 h/1,000 head of screening time (Fig. 6). Solids removal was essentially complete at the screening time of 1 h/1,000 head.

The three screening durations produced highly signifi-

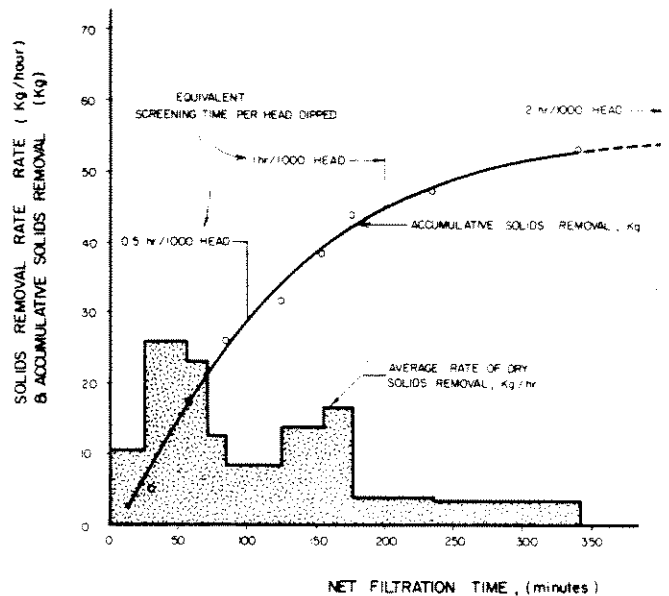


FIG. 4 Solids removal rate for initial vat cleanup test conducted after 3300 head of cattle were dipped June 14, 1976.

cant differences ($\alpha = 1$ percent) among solids removal rates (kg/h) and significant differences ($\alpha = 5$ percent) among solids removal efficiencies (kg/head). The most productive screening period was 0.5 h/1,000 head, while the 2 h/1,000 head treatment period was clearly unproductive.

Effect of Screen Slot Size

For the shortest screening period solids removal efficiency (kg/head) was highest for the 0.25 mm screen and lowest for the 0.76 mm (Fig. 6). However, the 0.51 mm and 0.76 mm screens both yielded 12 percent more solids than the 0.25 mm screen at the 1 h/1,000 head screening duration and 8 percent more at the 2 h/1,000 head duration. It appears that all three screen sizes would give essentially equal performance with a screening period of 0.7 to 0.8 h/1,000 head.

The total amount of dry solids removed by Hydrasieve operation was 0.038, 0.035 and 0.037 kg/head, for the 0.26, 0.51 and 0.76 mm screens, respectively. This in-

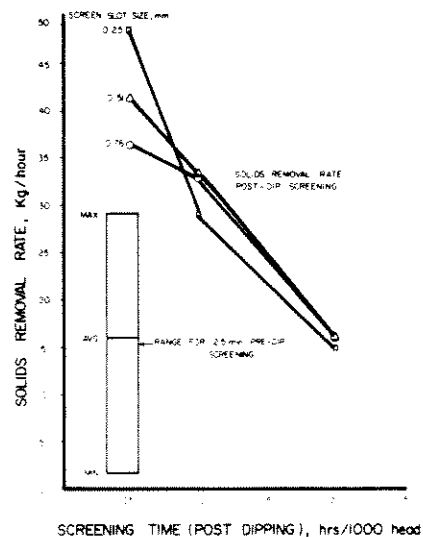


FIG. 5 Effect of screening duration on rate of dry solids removal for post-dip screening with Hydrasieve.

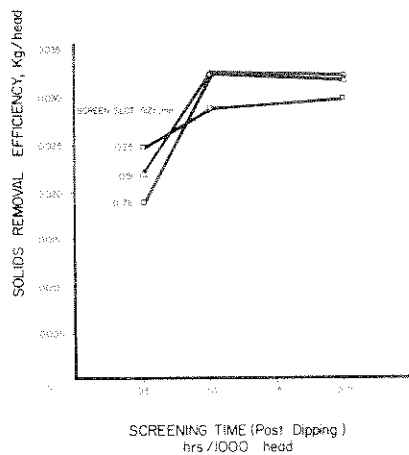


FIG. 6 Effect of screen slot size and screening duration on solids removal per head.

cludes both pre- and post-dip screening.

Comparison of Pre-Dip vs. Post-Dip Screening

Average pre-dip solids removal rates for 0.26, 0.51 and 0.76 mm screens were 25, 10 and 13 kg/h, respectively. As shown in Fig. 5, these rates were only 25 to 60 percent of the removal rates for post-dip screening for the same screening period of 0.5 h/1,000 head.

Solids removal efficiency for 12.5 m of pre-dip screening averaged 0.017, 0.005 and 0.007 kg/head for the 0.26, 0.51 and 0.76 mm screen slot sizes, respectively. This was only 1/3 the levels achieved with post-dip screening (Fig. 6).

Nevertheless, pre-dip screening may be desirable (a) to remove slowly settleable solids left after previous treatment with post-dip screening; (b) to entrain settled coumaphos from the vat bottom; and (c) to agitate the vat. More than 12.5 min of such activity is probably of questionable value. The 0.26 mm screen slot size appears best for pre-dip screening.

SUMMARY AND CONCLUSIONS

Experiments were conducted in June - July, 1976 at a 30,000-head Texas cattle feedlot to determine whether the useful life of coumaphos pesticide cattle dip solution could be extended by screening suspended solids using a Hydrasieve static screen. Feedlot dipping records for the previous four years were analyzed to allow comparisons of vat management practices before and after installation of the Hydrasieve. Treatments consisted of three Hydrasieve screen aperture sizes and three screening durations. An average of 460 cattle were dipped per treatment combination. The system was evaluated on the basis of solids removal rate and efficiency, cattle dipped per vat charge, pesticide usage, solids concentration reduction, and odor abatement.

From these experiments the following conclusions were drawn:

1 Use of the Hydrasieve screening system allowed almost twice as many cattle to be dipped without emptying and recharging the dipping vat with pesticide solution; this reduced pesticide usage by 30 percent.

2 With the Hydrasieve, pesticide disposal requirements were reduced by 50 percent thereby lowering potential environmental impact from land disposal of waste pesticide solution.

3 Savings in pesticide cost equal the cost of the

Hydrasieve system when 32,000 cattle were dipped with coumaphos.

4 Pesticide concentration in the vat solution was not measurably affected by use of the Hydrasieve.

5 Dissolved oxygen content was not significantly increased by vat aeration and agitation nor by gravity flow over the Hydrasieve. This is believed attributable to the high chemical oxygen demand (COD) of the cattle dip solution.

6 Each Hydrasieve treatment significantly reduced chemical oxygen demand; nevertheless, COD increased slowly throughout the 46-day testing period.

7 Odor intensity did not increase throughout the testing period and was not affected by screen size or filter time.

8 Total suspended solids concentration and volumetric solids (APHIS-USDA method) were both reduced by Hydrasieve treatment; however, these reductions were not statistically significant.

9 Solids concentration in cattle dip after screening was not significantly affected either by Hydrasieve screen slot size or screening duration.

10 The three screening durations studied (0.5, 1 and 2 h/1,000 head) significantly affected solids removal rates and efficiencies.

11 The most productive screening duration (post-dipping) was 0.5 h/1,000 head dipped while the 2 h/1,000 head treatment was the least productive.

12 At the shortest screening duration the finest screen slot size (0.26 mm) gave the highest solids removals, while the 0.51 mm and 0.76 mm aperture screens were both more efficient for screening durations of 1 h or more per 1,000 head dipped.

13 All screens would appear to give essentially equal performance at a screening duration of 0.75 h/1,000 head dipped.

14 Screening before vat agitation and dipping (i.e. pre-dip screening) is helpful, but it is less efficient than post-dip screening and should not exceed 0.5 h/1,000 head dipped.

15 An average of 0.036 kg/head of dry solids can be removed from pesticide solution in a cattle dipping vat by pre- and post-dip screening using a Hydrasieve. Another 0.027 kg/head settles out in the Hydrasieve headbox, and 0.06 kg/head of floating debris (wet basis) can be removed by the customary practice of surface skimming after dipping.

References

- 1 Clymer, Bill C. 1974. Cattle Scabies control demonstration. Texas Agricultural Extension Service. The Texas A&M University System, Amarillo.
- 2 Miller, Donald D. 1975. Evaluation of the Bauer separation equipment as a dip vat filtration system. (Unpublished Report) Animal & Plant Health Inspection Service, USDA, Beltsville, MA.
- 3 Neal, R. C. 1976. Hydrasieve dissolved oxygen enhancement evaluation tests. Special Report. C-E Bauer Company, Springfield, OH.
- 4 Reddell, D. L. and J. M. Sweeten. 1975. Evaluation of odor intensities at livestock feeding operations in Texas. In: Managing Livestock Wastes. 358-361 pp. ASAE, St. Joseph, MI 49085.
- 5 Steele, Robert G. D. and James H. Torrie. 1960. Principles and Procedures of Statistics. NY: McGraw-Hill Book Co., Inc.
- 6 Sweeten, John M. and Jack D. Price. 1974. Evaporation ponds for feedlot pesticide disposal on the Texas High Plains. MP-1126, Texas Agricultural Extension Service. The Texas A&M University System, College Station.
- 7 Utterback, William. 1976. Personal Communication. Animal & Plant Health Inspection Service, USDA, Austin, TX.