

the leaves differed as to the time of peak larval densities in August. Thus, as previously mentioned, in the leaf samples larval abundance and leaf damage were greatest the week of August 8 to 15 when 75% of the larvae found were small; however, the net sweeps recorded the highest number of larvae the following week, August 15 to 22. The sweep-net method apparently did not collect sufficient numbers of small worms to accurately reflect larval densities of cabbage looper when the majority of larvae present were less than 1/2 inch in length.

**Bollworm**

An assessment of the field populations of bollworm eggs and larvae was made by examining terminals, squares, and both small and large bolls at weekly intervals. In each treatment, 400 structures of each category were examined—a total of 1600 plant parts per week. There was good correlation between the field counts of bollworm eggs and larvae and the mean number of moths collected in the two light traps (graph 4). The upward trend in moth abundance began the week of August 15 to 22, and an increase in egg and larval numbers was found in the field counts made the week of August 29 to September 5. Thereafter, the numbers of eggs and larvae recorded increased until the end of the test period.

**Conclusions**

Two light traps located 3.75 miles apart and each situated about 1 mile from a test field were used effectively to trap moths of cabbage looper and bollworm, and reflected similar patterns in timing, magnitude, and duration of moth flights. Increased collections of moths in the traps were followed by a rise in egg and larval populations in the field. Through a combination of light-trap information and adequate field sampling procedures, a more effective means for detecting the onset of infestations and assessing the population levels of cabbage looper and bollworm in cotton appears possible.

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# DUAL-USE RETURN-WATER IRRIGATION SYSTEM

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This study indicates that where tailwater is a necessity to provide an appreciable increase in production of a relatively high-value crop, a large investment in the irrigation return-water system can still be economically feasible.

**R**ECENT STUDIES in the surface-irrigated citrus areas of southern California have shown that insufficient water application at the lower ends of orchards has sometimes decreased fruit production. To overcome this problem without a prohibitive increase in irrigation labor, it has been necessary to irrigate for a longer period of time—resulting in excess tailwater. With Colorado River water costs as high as \$30 per acre foot, it is imperative that the tailwater be reused. Gener-

ally when this tailwater is reused, the high content of suspended solids creates silting problems when the water is introduced directly into an irrigation pipeline.

The study reported here is of a dual system constructed for conservation of tailwater and removal of suspended solid material. Applying sufficient water to replenish soil water in the entire orchard resulted in an increase in orange production of about 1.5 boxes per tree on the lower third of the orchard, with tailwater amounting to about 25% of the water applied. Irrigation water applications at a rate of 100 gallons per minute per acre for 24 hours produced about 1 1/3 acre-

Intake for return-flow irrigation system at Irvine Ranch, Orange County.



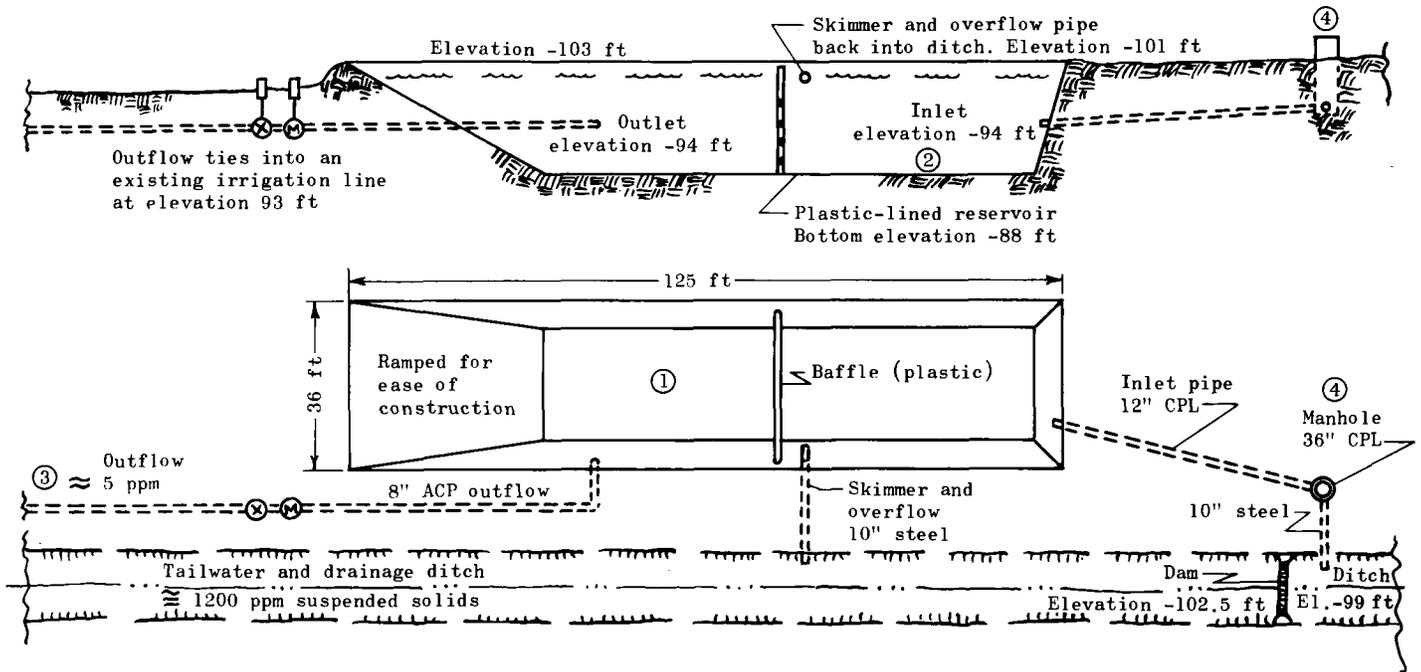
**COST SUMMARY**

The installation costs (including \$3,500 for material) were approximately . . .	\$7,000
Value of land and trees removed for the reservoir . . . . .	1,100
<b>Total investment . . . . .</b>	<b>\$8,100</b>
Yearly depreciation cost \$8,100 × (Capital Recovery Factor-6%-30 yr) . .	486
Annual maintenance . . . . .	1,000
<b>Total annual cost . . . . .</b>	<b>\$1,486</b>
Estimated annual cost per acre . .	\$6.30

**BENEFITS**

1.5 box increase in orange production per tree (30 trees affected per acre, or 45 boxes per acre)	
At \$1 per box, value of system per acre	\$45.00
Cost for return-flow system per acre . . .	6.30
<b>Return per acre . . . . .</b>	<b>\$38.70</b>
Annual value of tailwater reused . . . .	\$4,050
<b>About 150 acre-feet at \$27.00</b>	

## TAILWATER REUSE SYSTEM—THE IRVINE COMPANY



1. Reservoir large enough to give the retention time required for settling the suspended solids. 2. Reservoir settling area below inlet and outlet pipes is large enough to require cleaning once a year and still not require cleaning close to the plastic. 3. Discharge ties into an existing gravity irrigation main for reuse. 4. Manhole on inlet pipe to permit cleaning pipes if required.

inches of tailwater at each irrigation.

Laboratory tests indicated optimum settlement of silt and clay occurred in about 10 hours. A reservoir was designed for this system to accommodate a flow of 300 gallons per minute or 18,000 gallons per hour. For the 10 hours needed for settlement, the reservoir capacity necessary was 180,000 gallons or 24,000 cubic ft. The reservoir constructed averaged 105 feet long, 34 feet wide, and a depth above the outlet pipe of 7 feet, making a total volume of 25,000 cu ft available.

Analyses of tailwater samples indicated silt and clay in suspension of 0.131% by weight. This amounts to 4710 lbs per day

for a flow of 300 gallons per minute or about 47 cu ft of settlement per day. The dimensions of the reservoir below the outlet pipe were 100 × 25 × 4 ft or a volume of 10,000 cu ft. If the settlement occurred at the same rate throughout the volume of the reservoir, it would need to be cleaned every 213 days, or 7 months.

A trial operation for four months indicated that 40 acre feet at a flow of 90 gallons per minute into the reservoir settled silt and clay near the inflow pipe rather than equally throughout the reservoir. This required removal to prevent interference with the inflow. The removal and maintenance cost for the period was

about \$250. Assuming the reservoir is operated at the rate of 150 acre-feet per year, it is estimated that three to four cleanings will be required per year or a \$1000 total maximum maintenance cost.

During the period of peak use of water, 21 days should be the maximum time between irrigations. The dual system can serve 12 acres a day or 250 acres during the peak use period.

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Irrigation return-water system reservoir, is shown in photo below, and check gate, photo to right.

