State's Productive Capacity

changes in resource requirements in fertilizer, pesticides, equipment, and labor supplies needed to reach 1955 goals

Trimble R. Hedges, Warren R. Bailey, and Arthur Shultis

This article is the fourth of a series of reports based on a study of California's agricultural productive capacity, that can be attained by 1955, which was conducted by the California State Committee on Survey of Agricultural Productive Capacity. The Committee included representatives of the University of California, the United States Department of Agriculture, and State agencies.

California's agricultural capacity attainable in 1955 can be reached only if the use of fertilizer, pesticides, and farm equipment is increased. More hours of agricultural labor will be required to attain the projected increase in California's production but one of the basic assumptions of this study was that in 1955 there would be a smaller number of agricultural workers available in the United States as a whole.

In 1950, California farmers used—in terms of the basic fertilizing constituent—125,000 tons of nitrogen, 60,000 tons of phosphoric acid and 12,000 tons of potash. The estimated figures for 1955 are: 172,000 tons nitrogen, 101,000 tons phosphoric acid, and 13,000 tons potash.

In 1950, nitrogenous fertilizer was used on approximately 3.3 million acres of California's 9.3 million acres of cropland, and on half of the 6.5 to 7.0 million acres of irrigated land. Nitrogen was applied on about 815,000 acres of fruit and nut crops, 454,000 acres of vegetable crops, and 2,000,000 acres of field crops. In 1955 it is estimated that nitrogen will be applied on about 881,000 acres of fruit and nut crops, 481,000 acres of vegetable crops, 3,358,000 acres of field crops.

Among the field crops, cotton, barley, sugar beets, alfalfa hay, winter wheat, and potatoes, in that order, make up the bulk of the fertilized acreage. About 57,000 tons of nitrogen were used on field crops in 1950. It is estimated that field crops will require 98,000 tons of nitrogen in 1955. About half of this increase—21,000 tons—will be used on cotton, mostly on additional acreage.

About 19,000 tons of nitrogen were used on vegetable crops in 1950; the estimate for 1955 is 21,000 tons. Among the fruit and nut crops about 49,000 tons of nitrogen were used in 1950, as against a projected 51,000 tons in 1955.

Fewer acres—roughly two thirds as many—are fertilized with phosphatic materials as with nitrogen. And yet, about 80% of the vegetable, 33% of the fruit, and 67% of the field crops received some phosphate. The total amount of phosphoric acid used in 1950 was 60,000 tons, of which 15,000 tons were applied on

vegetable crops, 8,000 tons on fruits and 37,000 tons on field crops. The estimated figures for 1955 are 16,000 tons for vegetable crops, 8,500 tons for fruit, and 76,000 tons for field crops. These projections mean about 1,600,000 additional acres of field crops to be fertilized at present rates.

Only 12,000 tons of potash were used by California farmers in 1950. And fruit was the only crop where any sizable proportion—20%—of the acreage received potash. Fruits got about one half, truck crops a third, and field crops a sixth of the potash used. This relationship will be the same in 1955, with a total potash requirement of 13,000 tons.

Total 1955 projections call for 46,000 tons more nitrogen, 42,000 tons more phosphoric acid and 1,163 tons more potash. The acreage fertilized with nitrogen would increase by 44%, with phosphates by 82%, and with potash by 8%.

The 1955 attainable production must have adequate quantities of pesticides to minimize the effects of plant diseases, insects, and weeds.

In the projections for 1955 requirements solvents, carriers, and other types of adjuvants were not considered. It was impossible to anticipate new materials, which by 1955 may substitute for an appropriate quantity of one or more materials included in these projections.

It is estimated that the requirements of DDT and DDD will be slightly lower in 1955 than they were in 1951. The requirements of many of the other chlorinated hydrocarbons—such as methoxychlor, benzene hexachloride, toxaphene and chlordane—were projected slightly higher, that of dieldrin much higher—20 tons in 1955 as against 1½ tons in 1951.

Parathion, TEPP and other organic phosphates were estimated at 902 tons in 1955 as against 454 in 1951. The arsenicals—primarily basic lead arsenate and standard lead arsenate—were projected higher, 631 tons in 1955 and 594 tons in 1951. Cryolite and other fluorine compounds were estimated lower—374 tons —in 1955 than in 1951 when the requirements were 441 tons. Plant insecticides— rotenone, pyrethrins, and nicotine—also

were projected lower in 1955 than in 1951.

Sulphur for insecticidal and fungicidal use—excluding soil sulphur—was estimated at 26,000 tons in 1955 against 27,000 tons in 1951. Oil used as pesticide was projected at four million gallons in 1955—500,000 gallons less than in 1951.

The projected use of herbicides for 1955 was higher than their estimated use in 1951. This was true particularly of petroleum oils, 2,4-D salts, 2,4-D acid, sodium chlorate and borate-chlorate mixtures.

If the 1955 attainable volume of production is to be reached, several categories of improved machines must be increased.

Mechanical cotton pickers should increase from the 1,400 in 1950 to 6,600 in 1955; nut harvesters from 75 to 2,400; and pruning rigs from 300 to 2,400. Pickup balers, bale loaders, and field forage harvesters also will be required in greater numbers.

Agricultural airplanes will be needed in greater number. War surplus airplanes and parts are becoming exhausted and

EFFICIENCY

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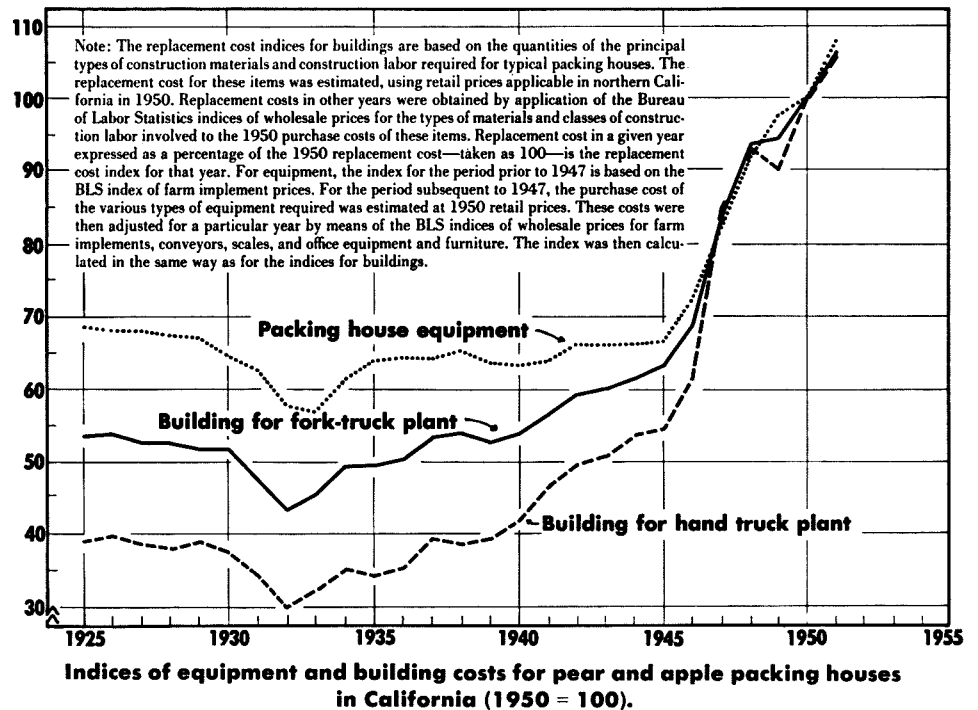From data similar to the above, the fixed costs for cannery fruit are estimated as $3.78 per ton with 100 hours operation per season, and only $0.76 per ton with 500 hours operation per season.

The graph indicates that fixed costs per unit of output are higher in the fork truck plant than in the hand truck plant, although the differences are relatively small when the length of season extends beyond 400 to 500 hours.

Replacement costs for apple packing houses are calculated to be roughly 5% higher than in the pear packing plants. The smaller weight per apple box—42 pounds net per standard apple box in comparison with 48 pounds net per standard pear box—results in a slightly lower fixed cost per standard box in the apple packing houses than in the pear packing houses.

Over a period of time, large variations in the price level result in corresponding variation in the costs of buildings and equipment. This is indicated in the index of costs for packing house equipment and for hand truck and fork-truck buildings for the period 1925 to 1951 on this page.

For each index, the replacement cost at the 1950 price level is taken as 100 and the relative costs in other years is shown as a percentage of the 1950 cost. For example, the building for the fork-truck plant used in the preceding examples was estimated to have a replacement cost in 1950 of $75,000. The 1940 replacement

Note: The replacement cost indices for buildings are based on the quantities of the principal types of construction materials and construction labor required for typical packing houses. The replacement cost for these items was estimated, using retail prices applicable in northern California in 1950. Replacement costs in other years were obtained by application of the Bureau of Labor Statistics indices of wholesale prices for the types of materials and classes of construction labor involved to the 1950 purchase costs of these items. Replacement cost in a given year expressed as a percentage of the 1950 replacement cost—taken as 100—is the replacement cost index for that year. For equipment, the index for the period prior to 1947 is based on the BLS index of farm implement prices. For the period subsequent to 1947, the purchase cost of the various types of equipment required was estimated at 1950 retail prices. These costs were then adjusted for a particular year by means of the BLS indices of wholesale prices for farm implements, conveyors, scales, and office equipment and furniture. The index was then calculated in the same way as for the indices for buildings.

Indices of equipment and building costs for pear and apple packing houses in California (1950 = 100).

cost index for this type of construction is given by the diagram as 54. This indicates that the replacement cost in 1940 would have been 54% of the 1950 cost, or approximately $40,500. Similarly, the construction cost index for the fork-truck plant in 1951 is 107, and the replacement cost in 1951 is 107% of the 1950 cost, or about $80,000.

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A more detailed report on this topic is available, which provides data for estimating replacement costs for plants having different types of packing equipment, different proportions of cannery and packed fruit, and involving the use of different construction methods for the building. Agricultural Publications, 22 Giannini Hall, University of California, Berkeley 4, California.

CAPACITY

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commercially built airplanes designed for agricultural use must take their place. In 1950, some 750 planes were in use; the estimate for 1955 is 1,250.

A more abundant supply of irrigation facilities is required to realize the projected acreage increase of 400,000 acres of cropland between 1950 and 1955. In 1955 the number of pumps will have to rise from 88,000 to 120,000, sprinkler systems from 3,500 to 8,000, gated-pipe systems from 150 to 300, wells from 72,000 to 100,000, and well-drilling rigs from 600 to 1,000.

The high level of technology makes California agriculture extremely vulnerable to shortages of machines and repair parts. Seedbed preparation, seeding, cultivation, and pest control are almost completely mechanized, and tremendous strides have been made in mechanizing the harvest. Harvest mechanization is within sight for practically all field crops, many of the vegetables, and nuts. Such

technological developments are vital under the conditions of short labor supplies assumed for 1955.

Because California agriculture is already largely mechanized, no general drastic reduction in labor required per acre and per unit can be expected by 1955.

Cotton is an outstanding exception in which 37 hours per acre—of which 33 are in harvest—are expected to be cut from 1950 average labor requirements. Sugar beets is another crop with an important percentage reduction—11 hours from the present 80 hours per acre. Most of the other reductions are small, though important in total. Among the vegetable crops, carrots, celery, and tomatoes—processing and for fresh marketing—are expected to show reductions in labor requirements. As these crops require considerable hand labor a reduction is highly important. Almonds, apricots, peaches, and walnuts among the deciduous fruits, and lemons and oranges, among the citrus, also are expected to show reductions in labor requirements per acre.

Reductions in labor requirements per

beef breeding cow, dairy cow, lamb on feed, laying hen and broiler are expected. Reductions assumed in hours required per head are 5% for dairy cows, 7% for beef cows, 2% for sows, and 10% for laying hens and broilers.

Although the labor requirements are expected to be lower per unit in 1955, the number of animal units will increase so that the total labor required in California's 1955 agriculture will be above that of 1950.

Field crops, vegetables and flowers totaled 9,390,000 acres in 1950, and are projected at 10,475,000 acres in 1955. While the labor-per-acre requirement is expected to drop from 53 to 49 hours, acreage increases will boost total labor requirements from 494 million man-hours in 1950 to 511 million man-hours in 1955.

Similarly, livestock—including poultry—production is expected to increase from 3,592,000 animal units in 1950 to 4,009,000 animal units in 1955. While labor requirements are estimated to drop from 42 to 39 hours per animal unit, increased production will require a total

Cattle Grub Control

rotenone applied during larvae stage of heel fly most effective

_____ Kenneth G. McKay

The cattle grub causes an annual estimated loss of $100,000,000 to the beef and dairy industries of the nation.

The pest is held responsible for a 10% to 20% drop in milk production during the grub season.

At least 12,700,000 pounds of meat are lost annually because the cattle flesh around the encysted grubs—known as jellied beef—must be trimmed out and discarded.

A cowhide with many grub holes is considered worthless for tanning and is commonly sold for by-products. As the hide represents 7% of the live-weight and 11% of the value of the average steer, price docks due to hide damage average from $50 to $150 per carload of market cattle.

In California the grub—the larval stage of the heel fly—makes its appearance under the skin in the loin area of cattle during early fall.

The grubs must be destroyed at this stage. Otherwise they enlarge their breathing holes by means of a secretion that dissolves the skin tissue permitting the grubs to emerge and fall to the ground where they develop into adult heel flies.

Within half an hour after the grub emerges it becomes a heel fly able to sustain itself on the wing. In a few minutes it can fly freely and is ready to mate.

The female may begin laying her quota of from 300 to 500 fertile eggs on cattle 20 minutes after mating, or only slightly more than an hour from the time of emergence from the pupal case. When the eggs hatch, the tiny larvae enter the skin of

the animal. In the animal tissues the larvae move about for 9 months until they reach the loin area on the back of the cow where they make a breathing hole through the hide. Soon a cyst forms around each larva where it stays until it drops from the animal's back.

Control

Rotenone is the only toxicant recommended for the control of cattle grubs and no benefits can be expected until the year after treatment. Killing the grub breaks the life cycle of the pest and reduces the heel fly population during the following season.

Tests have been made with a number of chlorinated hydrocarbon insecticides including DDT, DDD, methoxy-DDT, chlordane, toxaphene, and BHC. Counts of larvae in the backs of cattle six months later showed that there were as many grubs present in the sprayed animals as in the unsprayed controls.

Rotenone-bearing products—ground cube or derris root—should be of 325-mesh fineness, and contain 5% rotenone. When powders with less than 5% rotenone are used, the quantity of powder should be increased so the final spray, dust or wash will contain rotenone equivalent to the 5% product.

Spray

Power spraying is the most rapid method of applying treatment, and is recomended for use on large herds of cattle.

From 7½ to 10 pounds of cube or derris powder containing 5% rotenone should be added to each 100 gallons of water. A wetting agent, at the rate of one pound per 100 gallons of water, is desirable.

The spray material must be kept agitated while spraying. A minimum pressure of 400 pounds per square inch at the nozzle is necessary. Even with pressures of 400 pounds or more per square inch a 100% kill can not be expected at each spraying.

In a 50-foot length of hose having one nozzle with a ³⁄₆₄" aperture, pressure is lost at the rate of a pound per foot of hose between pump and nozzle.

Nozzles producing either fan or cone shaped sprays may be used. In each case,

a driving spray is essential. With cone-producing nozzles, whirl plates must be removed. Disk openings should be ⁴⁄₆₄" on multiple nozzle booms, and ⁵⁄₆₄" on guns equipped with only one or two nozzles. Nozzles should be held within 12" of the backs of the cattle. The amount of spray required is generally one gallon per head. Only the area of the back where the swellings are observed needs to be sprayed.

Dusts

Dusts should consist of one part of cube or derris powder of 5% rotenone content, and two parts of carrier such as tripoli earth, pyrophyllite or frianite.

At least three ounces of dust should be used for each animal. The material should be distributed from shaker cans, and rubbed into the grub cyst opening with the fingers. Dusts are well adapted for use in very cold weather.

Washes

Washes result in high cattle grub mortalities, but the procedure is tedious. A good preparation consists of 12 ounces of cube or derris powder of 5% rotenone content, and approximately one-half ounce of a wetting agent per gallon of water. From one pint to one quart of wash is used per animal, depending upon the size of animal and length of hair coat and must be kept agitated during treatment. Stiff fiber brushes with bristles not shorter than 2" are used to distribute the washes over the back. The backs should be brushed vigorously to insure penetration into the grub cyst openings.

Oilcan Treatment

Commercial benzol may be applied in a common oilcan, but this type of treatment is not recommended because benzol is explosive.

Frequency of Application

No matter what method of application is used, correct timing of treatment is essential for adequate grub control. For most effective control, treatment should be applied approximately 30 days after the appearance of the first grubs in the backs, and thereafter at 30- to 45-day intervals throughout the grub season.

Rotenone is highly toxic to fish and drainage from spraying operations should not be permitted to get into streams, ponds, or lakes. Cattle recently treated should not be allowed access to such waters. Rotenone readily deteriorates when exposed to sun and air.

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labor increase from 152 million to 158 million hours between 1950 and 1955.

If 1955 production goals are achieved, total labor required in California agriculture will increase from an estimated 703,288,000 man-hours in 1950 to a projected 1955 total of 727,304,000 hours in 1955 —an increase of 3.4%.

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