ARIZONA AGRICULTURE
1954

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ARIZONA AGRICULTURE 1954

PRODUCTION, INCOME, COSTS

By George W. Barr[1]

Arizona farmers produced more cotton in 1953 than in any previous year. The state's livestock men sold more cattle than in any year since 1947. On the other hand the total cash income to the farms and ranches of Arizona was less than in the years 1951 and 1952 and the profits above expenses were far less. In fact, gross cash income from farm and ranch production decreased for the first time in fifteen years.

Cotton and vegetable farmers spent more money for irrigation water and for fertilizers than in any previous year. Prices were lower and profits were further depleted due to large expenditures for cotton harvesting machinery and by an expensive change-over in the vegetable industry from one type of packaging and cooling to another. The large sales of cattle were partly forced through drought conditions and the cattlemen received lower prices than in any year since 1946.

One million three hundred thousand acres were irrigated in 1953 with broad extensions of acreage in Yuma, Cochise, and Pima counties. Contrariwise, in some counties acreage reduction was brought about by greatly increased cost of irrigation water and scarcity. Two-thirds of all the water used for irrigation in the state was pumped from ground-water supplies.

Income

While the physical volume of production, as measured in bales of cotton produced, head of cattle sold, and in carlots of other commodities, was greater than in any previous year, yet total cash income decreased from a revised figure of $410,000,000 in 1952 to $370,000,000 in 1953. Even so the 1953 income was more than six times that of 1940 in terms of dollars. A part of the increase was due to inflation but 1953 income was nearly three times the earlier figure in terms of farmer buying power (Figure 1). Cotton lint and cottonseed together constituted the major source of income. Approximately one million bales of lint and 410,000 tons of seed brought $200,000,000; cattle and calves, $60,000,000. Other important sources of income were lettuce and other vegetables, $45,000,000; dairy products, $15,000,000; alfalfa and other hay, $12,000,000; commercial feed grains, $10,000,000; and sheep, lambs, and wool, $5,000,000. (Table 1)

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[1]Head, Department of Agricultural Economics, and assisted by members of the department: R. E. Seltzer, J. S. Hillman, J. S. St. Clair, A. Vanvig, T. M. Stubblefield, M. V. Waananen, K. L. Dunlap. Co-operating in furnishing data for this twenty-fourth annual summary was the Phoenix office of the Federal Crop and Livestock Reporting Service; also, growers' organizations and market operators.

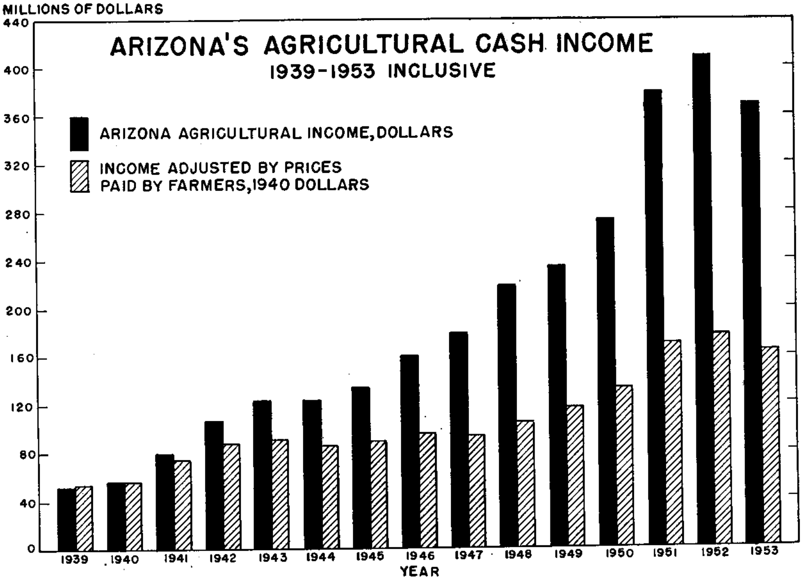

Figure 1.—From 1938 to 1953 cash income increased six-fold. After allowing for inflation, the real agricultural income increased nearly three-fold.

TABLE 1.—CASH INCOME FROM ARIZONA FARM AND RANCH PRODUCTION
(In Millions of Dollars)

Commodity	1953	1952	Average 1943-1952
Cotton lint and cottonseed	$200	$195[c]	$ 79
Cattle and calves	60	81	45
Lettuce and other vegetable crops[a]	45	62	43
Dairy products	15	17	11
Alfalfa and other hay[b]	12	16	10.3
Commercial feed grains[b]	10	12	7.5
Citrus fruit[a]	5	2.5	4.4
Sheep, lambs and wool	5	6	4.5
Eggs, chickens and turkeys[b]	5	5	4.6
Seed crops	3	3	3.9
Miscellaneous crops	6	7.4	8.3
Miscellaneous livestock and livestock products and Federal Government payments	4	3.1	3.5
Total Cash Income	$370	$410[c]	$225

[a]Year ended August 31. Value citrus fruit "on the tree."
[b]Represents cash sales only. In addition, in 1953, hay fed by Arizona producers had an estimated value of 5 million dollars; grains fed, 4 million dollars; and dairy, poultry, and other products consumed by producers, 3 million dollars.
[c]Revised.

Water

Supplying water for the extensive irrigated lands has become a major problem. About 5.5 million acre-feet of water were used for irrigation during the year 1953. Of this, the Salt River supplied 800,000 acre-feet; the Colorado River, 700,000; and the Gila River above the Salt, less than 100,000. Delivery of water from underground through pumping amounted to about 3.7 million acre-feet.[2] Thus, about 70 per cent of the irrigation supplies came from ground-water pumping. By comparison, until the year 1945, less than half came from ground-water supplies.

To provide an approximately equal amount of underground water for an approximately equal acreage of irrigated crops, farmers purchased one-fifth more natural gas and one-fifth more electricity in 1953 than in the preceding year.[3] Enough gas and electricity were used with normal efficiencies to lift the water an average of 210 feet. In Pinal County the amount of electricity and gas used indicated an average lift of 300 feet. The average water lift in the state doubled in five years, 1948-1953, due partly to farming expansion in high lift areas, but also to falling water tables in almost all areas. From a study made by the Department of Agricultural Economics[4] it can be computed that with a 300-foot lift a farmer's cash costs for delivering 3½ acre-feet of water per acre would be between $23 and $28 in 1954. His total cost would be $40 or more per acre.

The foregoing statement may be made clearer as follows: In gas installations the cost of gas alone is about 1.1 cents to lift 1 acre-foot of water a distance of 1 foot.[5] Cash costs (power, repairs, taxes, lubricants, and attendance) have been found to average about twice the cost of gas itself, and all costs including "sunk costs" (interest and depreciation on well, pump, and power unit) were equal to four times the cost of gas alone when engine and pump are depreciated over a five-year period and the well over a ten-year period. For a 300-foot lift where 3.5 acre-feet per acre is used, the costs per acre are as follows:

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[2]U.S. Geological Survey, Ground-Water Division, reported pumping from ground water in 1952, 3,730,000 acre-feet from 5,500 wells equipped with 5 h.p. or larger motors.

[3]1953 usage for pumping: 1¼ million kwh and 5½ million cubic feet of gas, gas furnishing more than 20 per cent of the power in the state, although in Pinal County gas produced ⅝ of the power. By comparison, 1950 usage, 700 million kwh and 3½ million cubic feet gas.

[4]Ariz. Agr. Exp. Sta. Bul. 246 *The Cost of Pumping Irrigation Water, Pinal County, 1951*, by Rex D. Rehnberg.

[5]Obtained by multiplying the number of cubic feet of gas required to lift 1 acre-foot of water a distance of 1 foot, about 33, by the rate charged for gas which averages 33 or 34 cents per thousand cubic feet. In nine out of seventeen wells, where careful measurements were made at several times during the season, the use of gas varied between 28 and 35 cubic feet. The gas rate used is based on Arizona Corporation Commission 1953 Schedule.

Gas, 1.1c × 300 feet × 3.5 ac. ft. = \$11.50
Cash Costs including gas, \$11.50 × 2 = \$23.00
All Costs, \$11.50 × 4 = \$46.00

In electric installations the cost of electricity alone is 2 cents for lifting 1 acre-foot of water a distance of 1 foot.[6] To this must be added about one-third for repairs, taxes, lubricants, and attendance, in order to obtain an estimate of all cash costs. To estimate *total costs* which include sunk costs, the cost of electricity may be multiplied by 2. Then for a 300-foot lift, where 3.5 acre-feet per acre is used, the costs per acre are as follows:

Electricity, 2c × 300 feet × 3.5 ac. ft. = \$21.00
Cash Costs including electricity, \$21.00 × 1⅓ = \$28.00
All Costs, \$21.00 × 2 = \$42.00

Cost of Production

One of the major elements in cost of production, cultural operations, promises to be about the same in 1954 as in the preceding two years. Custom rates, obtained by interviewing five custom tillage operators and four spray-dust operators, indicate no immediate downward adjustments in line with lower crop prices. Table 5 shows the rates in effect as of the beginning of the year 1954.

In a specialty crop area, when the price of the commodity falls or when a governmental restriction program is put into effect, the farmer may face a decision as to whether to crop all of his land. The decision should be based upon *direct* or *cash costs.* These costs are those which he would not incur if he did not grow a crop on the land. It is for this reason that emphasis needs be placed upon the item of direct costs. Furthermore, *direct costs* can be much more accurately determined than *all costs.* The latter includes a return for investment in the land, an amount quite variable. On farms that have their own pumps it includes *sunk costs* which depend in a rather large degree upon the number of years of service that can be obtained from a well and from a pumping plant. Sunk costs are especially high in the analysis on page 3 because the life of the well was estimated at only ten years and the life of the pump and power unit at five years.

Irrigation water will be higher in 1954 for most farmers. The lift will be greater resulting in a proportionately higher cost for water. The electrical power rate will continue to be between nine-tenths and one cent for most electrical pumping. Some of the largest operators will have a slightly lower average rate. For most of those who use gas, the charge will average about 33 or 34 cents per 1,000 cubic feet.

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[6]At 100 per cent efficiency, 1.024 kwh lifts an acre-foot of water a distance of 1 foot. Assumed here is an efficiency of 50 per cent which means a requirement of 2 kwh and we have used a price of 1 cent per kwh or a cost of 2 cents to lift 1 acre-foot of water 1 foot.

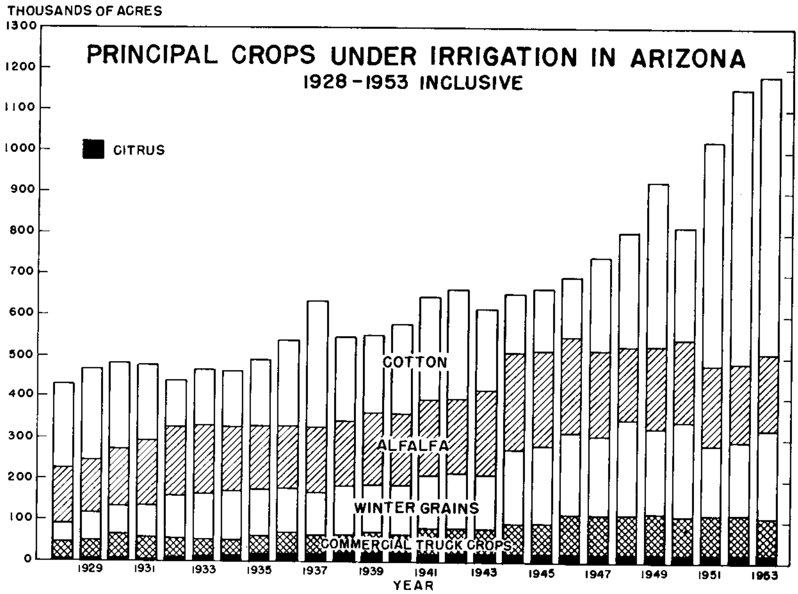

Figure 2.—In four years of Arizona history, 1937 and 1951-53, cotton was planted on about one-half the irrigated acreage. Winter grains comprise barley grown for grain, hay or pasture; also wheat and oats harvested for grain.

COTTON

A 1953 crop of 990,000 bales short-staple cotton and 33,000 bales long-staple cotton was indicated as of January 15, 1954. This was the largest Arizona crop in history on the largest acreage. Acreage reductions occurred, however, in the two major cotton producing counties, Pinal and Maricopa, and for the second time in a decade, Maricopa County had more total cotton acreage than Pinal County. In both 1952 and 1953 about half of all the irrigated acreage in the state was in cotton. (Figure 2)

The foregoing estimates indicate a yield of 740 pounds *per acre* for short staple and 380 pounds *per acre* for long-staple. This is the second highest Arizona yield of Upland cotton on record, and for the fifth consecutive year the Arizona yield exceeded that of any other state. An unusually favorable picking season made it possible to harvest all the crop.

Cotton-picking machines numbered about 2,000 for the 1953 season compared with 900 in 1951, 140 in 1949, and 10 in 1947. In 1953 for the first time machines picked more than half the crop. The greatest number of hand pickers (47,000) were employed around October 15, and the greatest number of machines reported operating in the field at one time (1,850) was about November 17.

When the cotton growers voted on December 15 approving a cotton reduction program, Arizona farmers had been allotted

TABLE 2.—COST OF PRODUCING UPLAND COTTON PER ACRE, CENTRAL ARIZONA, 1954*

		Salt River Project	Pump Areas	
			200′ lift	300′ lift
Direct Costs				
Growing or preharvest				
Water—3½ acre feet[1]		$ 15	$ 19	$ 28
Land preparation	$10.00			
Seed	2.50			
Planting	1.50			
Cultivating	6.00			
Hoeing	13.00[2]			
Irrigation & ditch labor	7.50			
Dust application	9.00[3]			
Fertilizer & application	18.00[4]			
Industrial insurance	2.00			
Production credit	2.50			
		$ 72	$ 72	$ 72
Harvest Costs	Per bale			
Picking $3 per cwt.	$43.50			
Weighing .25 per cwt.	3.60			
Hauling	1.75			
Ginning, bags & ties	15.00			
Insurance & storage	1.50			
	$65.35			
Less Seed credits				
800 lbs. @ 50 per T.	20.00			
net per bale	45.35			
For 1½ bales per acre		$ 68	$ 68	$ 68
Total Direct Costs		$155	$159	$168
Other Costs				
Interest on land investment		$ 25	$ 20	$ 10
Real estate taxes		5	3	2
Non-cash pumping costs			9	14
Total Cost of Producing Cotton		$185	$191	$194

*Costs for machine operation based on custom rates where operation is commonly hired, and on farm costs for operation where farmer normally uses his own equipment.
[1]In pump areas, cash cost only for electric installations. See page 4 for formula.
[2]Varies depending on weed condition on particular farm.
[3]For 60 lbs. dust containing 10% DDT and 50% Sulphur for 3 applications @ 10c per lb. for dust and 5c per lb. for application.
[4]Cost of 100 lbs. actual Nitrogen applied.

under the existing law 288,000 acres of short-staple cotton and 16,000 acres of long-staple cotton. As this is written, Congress is considering a bill which would provide a maximum acreage of 415,000 for Arizona.

An increasing amount of commercial fertilizer has been applied to cotton in recent years. Insects were not as damaging in 1953 as in many past years. It is estimated that 18 to 20 million pounds of dust was applied.

The direct per acre costs of growing and harvesting a 1½ bale cotton crop in 1954 will be about $140 plus water cost. The $140 item is made up of $72 for preharvest cultural costs and $68 for harvesting by hand picking after crediting cottonseed, Table 2.

All costs including water and land charges will run to $200 on many farms before any return for management.

Central markets have given increased recognition to the quality of western cotton. A decade ago both California and Arizona cottons were discounted rather heavily, in addition to freight-rate differentials. With the coming of California 4-42 variety in 1949, there came better recognition of California cotton, and with the adoption of Arizona's A-44 in the early '50s, there has been a narrowing of the spread between rain-grown and Arizona cotton of the same class, an improvement of about $4 per bale. As a result of a research study[7] showing that the use of lint cleaners is not generally profitable to producers except when used on low grades, and due to the apparent increasing resistance of certain mills to the purchase of cotton which has been processed with saw-type lint cleaners, it is likely that a lower percentage of the 1954 cotton crop will be recleaned.

ALTERNATIVE CROPS

In view of the Federal crop limitation program farmers are looking for crops to replace cotton. This is not a simple problem because no crop grown extensively on Arizona lands has proven to be nearly as profitable per acre as cotton. Alternative crops should be divided into those that have been tried on large acreages and crops that are still in the experimental stage. In the first category are alfalfa, barley, and grain sorghums. Alfalfa, as an alternative, is more or less restricted to areas with a plentiful supply of water. Those farmers who plan to make a profit from the sale of hay must be able to obtain water at a cost per acre-foot which is reasonable in terms of price of hay. Those farmers who plant it only to improve the soil structure must wait several years for a return. *Direct* per acre costs of growing alfalfa will be about $55 plus water cost; and *total* cost, a little more than $100 in the Salt River Project. (Table 3)

Barley and grain sorghums have been grown successfully in Arizona on extensive acreages for many years. They are comparatively low consumers of water. A minimum price guaranteed by the government for 1954 amounts to about $2.20 per hundred for barley and $2.45 per hundred for grain sorghums after storage charges. Yields have been better in recent years probably due in part to use of nitrate fertilizers. While it is reasonable to expect a 1½ ton yield from these crops on southern Arizona farms under average growing conditions, still the farmer who is planning to grow these grains must be assured that the growing costs (Table 4) are less than the probable gross return. The costs of growing barley and grain sorghums are shown in Tables 4 and 4a under the double cropping plan. Where the water supply or the soil structure or fertility will not permit double cropping, then the total costs for each crop will be increased by $15 or more per acre.

[7]Release of the Department of Agricultural Economics dated October 3, 1953.

TABLE 3.—COST OF PRODUCING ALFALFA HAY PER ACRE, CENTRAL ARIZONA, 1954[a]

		Salt River Project	Pump Areas 200′ lift	Pump Areas 300′ lift
Direct Costs				
Establishing stand				
Land preparation	$10.00			
Seed, 20 lbs. @ 25c	5.00			
Fertilizer, 50 lbs. P_2O_5 & application	5.00			
Drilling	1.00			
Irrigating, twice	2.00			
Water, 1 acre-foot	4.00			
One-third charged each year		$ 9.00	$ 9.00	$ 9.00
Growing Costs				
Water, 4 acre-feet		17.50	21.00	32.00
Irrigation labor		8.00	8.00	8.00
Fertilizer & application, 50 lbs. P_2O_5		5.00	5.00	5.00
Harvesting Costs				
Mowing & windrowing		9.50	9.50	9.50
Baling, 4 tons		24.00	24.00	24.00
Total Direct Costs		$ 73.00	$ 76.50	$ 87.50
Other Costs				
Interest on land investment		$ 25.00	$ 20.00	$ 10.00
Real estate taxes		5.00	3.00	2.00
Non-cash pumping cost			11.00	16.00
Total Cost of Producing Alfalfa		$103.00	$110.50	$115.50

[a]These calculations represent anticipated costs during 1954 on owner-operated farms, assuming a yield of 4 tons per acre. No item was included for farm automobile expense, farm overhead, or for management, and no return credited for pasture.

And then there are the group of crops which have an appeal because they are new and untried. Two of these are castor beans and soybeans. Limited acreages of castor beans were produced in 1951, 1952, and 1953 with reasonable success in the last two years. Acreage in 1953 included 2,700 in Maricopa, 660 in Pinal, and 55 in Yuma. Yields ranged from 1,200 to 1,900 pounds per acre. In the 1954 program the Commodity Credit Corporation will support castor beans at 6 cents per pound compared to the government support price of 9 cents in 1953 for hulled beans.

During the last decade, while soybeans have become a very important crop in the Corn Belt area of the United States, the desert valleys of Arizona have not been able to produce them because the beans would shatter before harvest. With the coming of a shatter-resistant soybean developed by the U.S. Department of Agriculture at its new Brawley, California, station, it now appears possible that soybeans may gradually become an important crop in Arizona. A limiting factor for 1954 is the shortage of seed. The Arizona Crop Improvement Association, in cooperation with the Experiment Station, is arranging for the increase of seed of the new variety this year and seed should be available for commercial plantings in 1955.

TABLE 4.—COST OF PRODUCING BARLEY PER ACRE, CENTRAL ARIZONA, 1954

		Salt River Project	Pump Areas	
			200′ lift	300′ lift
Direct Costs				
Growing or preharvest				
Water, 2¼ acre-feet		$ 10.00	$ 12.00	$ 18.00
Seed	$ 4.00			
Land preparation	6.00			
Fertilizer, 65 lbs. N	12.00			
Drilling	1.00			
Irrigation & ditch labor	5.00	28.00	28.00	28.00
Harvesting				
Combining	6.00			
Hauling, 20-25 miles	4.00	10.00	10.00	10.00
Total Direct Costs		$ 48.00	$ 50.00	$ 56.00
Other Costs				
Interest on land investment*		12.50	10.00	5.00
Real estate taxes*		2.50	1.50	1.00
Non-cash pumping costs			6.00	9.00
Total Cost of Producing Barley		$ 63.00	$ 67.50	$ 71.00

*One-half charged to barley and one-half to sorghums under double cropping plan.

TABLE 4a.—COST OF PRODUCING GRAIN SORGHUMS PER ACRE, CENTRAL ARIZONA, 1954

		Salt River Project	Pump Areas	
			200′ lift	300′ lift
Direct Costs				
Growing or preharvest				
Water, 3 acre-feet		$ 14.00	$ 16.00	$ 24.00
Land preparation	$ 5.75			
Seed	.75			
Fertilizer, 100 lbs. N	17.00			
Planting	1.00			
Irrigation & ditch labor	8.00			
Cultivating	2.50			
Dust & application	3.00	38.00	38.00	38.00
Harvesting				
Combining	7.00			
Hauling	4.00	11.00	11.00	11.00
Total Direct Costs		$ 63.00	$ 65.00	$ 73.00
Other Costs				
Interest on land investment*		12.50	10.00	5.00
Real estate taxes*		2.50	1.50	1.00
Non-cash pumping costs			8.00	12.00
Total Cost of Producing Grain Sorghums		$ 78.00	$ 84.50	$ 91.00

*One-half charged to barley and one-half to sorghums under double cropping plan.

VEGETABLES

From the standpoint of cash income, the vegetable industry ranked third in Arizona in 1953 bringing in a total of $45,000,000 from 95,000 acres. First among the vegetables was lettuce, the harvesting and marketing of which has gone through a revolution in two years. In these two years has come a new container, a new place of packing, a new place for inspection, and a new type of cooling. Even varietal changes have occurred in the period of a few years.

The 1953 fall lettuce season in the Salt River Valley consisted of around 6,000 carlots, about 85 per cent of which was dry-packed in cartons usually containing two dozen heads. The peak of the season shipments was reached in the third week of November, while in the five-year period ended with 1950, the seasonal peak was usually reached the first week of December. The carton was packed in the field, inspected and graded in the field, and routed through a vacuum cooling plant to the railroad car. A carload consisted of 640 cartons to the car, weighing up to 40 pounds per carton. The city trade has demanded this type of packaging which proved satisfactory in many ways to growers up until the period of heavy freezing. While Imperial varieties of lettuce are still predominant, the addition of the Great Lakes variety has advanced the harvest season in the fall and extended the season in the spring.

The lettuce seasons in the year ended August 31, 1953, produced 17,500 carlots from a fall acreage of 13,800 acres in the Salt River Valley, a spring acreage of 13,300 acres in the Salt River Valley, and 14,800 acres at Yuma. The value of the crop measured on cars at shipping point has averaged about $1.30 per half crate in the fall of 1953, or $2.60 per crate equivalent. This compares with a price of $2.85 in the spring of 1953, and $3 in the fall of 1952, and with an average during the decade of the '50s of $2.88 for spring lettuce and $3.28 for fall lettuce.

Cantaloupes were second in importance among the vegetables: 10,386 cars from 22,951 acres brought 12.5 million dollars. Of the total cantaloupe acreage 63 per cent was in the Yuma area, the remainder in the Salt River Valley. Carrots were the third most important vegetable crop. Production of this crop amounted to 3,053 cars from 4,750 acres. Almost 60 per cent of this came from the Salt River Valley and the remainder from the Yuma area. Other vegetable crops of importance included 138 cars broccoli from 630 acres; 554 cars cauliflower from 745 acres; 448 cars cabbage from 1,460 acres. Arizona harvested in June and July 3,500 cars of early potatoes from 5,000 acres, production being localized in Maricopa and Pinal counties. In 1953 more than 4,500 acres of watermelons were produced with 30 per cent coming from the Yuma area.

CATTLE

After being subjected to one of the greatest downward price adjustments suffered by any major Arizona industry in recent years, a renewed confidence prevailed among the state cattle interests at the beginning of 1954. Net marketings of 335,000[8] head of cattle in the twelve months ended October 31, 1953, were the largest annual net marketings since the year 1947. These large net marketings were partly the result of dry ranges in parts of Arizona during 1953 and also in part due to financial pressure because of falling prices. Thus, the figures for income to the industry, as reported in Table 1, of $60,000,000 compared to $81,000,000 a year earlier, do not fully reflect the decrease in prices. The price reduction was most noticeable in the lowest grades of cattle, but even the best fat steers sold at reduced prices. Best price obtained for fat steers at Phoenix in December, 1953, and early January, 1954, was about 24 cents compared to 36 cents in the months of highest prices, September to November, 1951. While the livestock feeders carried the brunt of falling prices in late '51 and '52, the range producers felt the squeeze between high operation costs and low sale prices in 1953.

Lower retail prices for beef came at a time when consumer demand was high and the surplus of beef was reduced. The U.S. public consumed 27 per cent more beef per capita during the first nine months of 1953 than the average consumption of the first nine months of the years 1950, 1951, and 1952—the greatest rate of beef consumption per capita shown by government records.

The renewed confidence of cattlemen was indicated in the January sales of breeding stock at Phoenix where the animals brought higher prices than was anticipated; and indicated by 2c to 4c increase in feeder calf and yearling prices from October '53 to January '54; and also indicated by a continuance of the feeding program on a large scale with 85,000 head reported in pens in early January, 1954, compared to 80,000 a year earlier. In addition, there were many thousands of head on valley pasture, a large part of which may go directly from the pasture to the slaughter house. Feedlots are utilizing cheaper feeds than formerly. The process will continue as rapidly as more information is available on practical substitutions.

Following the introduction, some years ago, of a device that provided a more even distribution of supplemental feeds on the range at reasonable cost, there has developed a trend among range producers to maintain a minimum productive weight for range cows through supplemental feeding. Probably more study needs to be made of the exact conditions under which supplementary feeding is economic.

DAIRYING

Arizona's more than 50,000 dairy cows produced milk that sold for $15,000,000 in 1953. By comparison a study made by the University Dairy Department showed that in the year 1952, the

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[8]Total outward movement 462,000 head, slaughterings 121,000, inward movement for the twelve months ended June 30, 1953, 248,000.

processing plants purchased $17,000,000 worth of milk from Arizona producers, and that after adding some out of state products, such as dried milk, these same companies sold over $30,000,000 worth of products.

Improvements aimed at increased cleanliness and reduced costs have been carried out by the dairy industry. Approximately 80 per cent of the milk produced in the state was being handled in January, 1954, through farm tank installations. On these dairies the milk goes directly from the cow through a pipeline to the farm tank. One million dollars was invested in farm tanks in the three-year period 1951-1953. From the farm tank it is pumped directly into tank trucks for transportation to the milk plant. In addition, there is an increase in the number of walk-in type barns.

Dairymen were faced with falling wholesale prices for both Grade A and Grade D milk during 1953, a drop of about 15 per cent during twelve months. At the same time no reduction occurred in the price of retail milk except that a greater percentage of milk is now being sold from stores. A new type of selling is through the drive-in "Jugs" in the Salt River Valley.

RESEARCH

Investigations into the agricultural problems of the state have been conducted by the Agricultural Experiment Station of the University of Arizona, and by certain government agencies and by farmers for years. Many valuable findings are not directly measurable in dollars but outstanding among the achievements growing out of research are such accomplishments as doubling the per acre yield of short-staple cotton from 370 pound per acre average in the first four years of the '30s compared to 765 pounds per acre in the first four years of this decade. Less striking increases have occurred in yields of some grains, vegetables and minor crops. Lying back of these increases in yield has been the development of new varieties and of new strains better suited to Arizona conditions, the development of procedures tending toward more even and more adequate penetration of irrigation water, and the development of control measures for injurious insects and plant diseases.

Imbedded in the mind of the research worker has been the goal of producing a greater economic wealth *per acre*. This objective, incidentally, has been nation-wide. Now may be an opportune time for the investigational agencies of Arizona to strike out on a new venture with a new goal, the latter being production of more economic wealth *per unit of irrigation water*. The change appears to be urgent because of the belated recognition that Arizona's limiting factor is irrigation water and not acres. This would result in a shift of emphasis from production *per acre* to production *per acre-foot*. A serious drive by the State of Arizona and its research agencies in part might take the form of a determination to find ways to utilize for economic good a

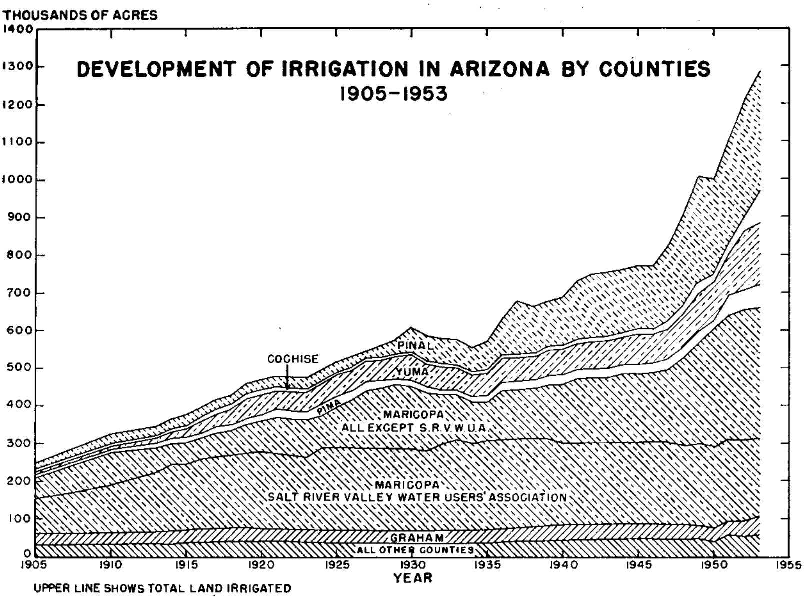

Figure 3.—Until 1923 diversion from streams and surface storage provided the irrigation water. In the thirty years following 1923, major extensions have depended upon pumping from ground water except for the Coolidge Dam storage completed in 1930, and the Colorado River diversions in Yuma County in the 1950's.

greater share of the rain that falls in Arizona each year. Probably no more than one-fifth of this actually produces economic wealth. Much is transpired by uneconomic plants and evaporated from surface reservoirs and from the surface of irrigated areas.

An earnest attempt to get more out of an acre-foot of irrigation water might include research into an almost untouched field of investigation designed to find varieties of cotton, alfalfa, and grasses that produce more pounds of lint or more tons of hay *per acre-foot* than do the varieties now produced commercially. Added to this could be the development of new varieties with this primary objective in mind. So little has been done in this field of research that the possibilities are unknown, but it is challenging to think that the average farmer is now applying 1,100 tons of water to get 1 ton of alfalfa hay.

MAP OF IRRIGATED AREAS

More than 1,500,000 acres irrigated in 1953, or equipped for irrigation, are shown on the map which accompanies this publication. This is a revision of the map prepared by the Department of Agricultural Economics six years earlier at which time about 1,000,000 acres were shown as having been irrigated or equipped for irrigation. The major increases from 1947 to 1953 were in Pinal and Maricopa counties; but percentage-wise the increases were largest in Cochise, Pima and Yuma counties. Each of these three more than doubled its acreage. The greatest six-year acreage extensions were in the Maricopa-Stanfield and the Queen Creek-Magma areas of Pinal County; in the area west of the Agua Fria in Maricopa County including areas as far west as the Harquahala Valley; in Yuma County including the Gila Project, the Colorado River Indian Reservation, and the Bouse Wash area near Vicksburg; also in Cochise County, the Kansas Settlement, Bowie-San Simon development and extension of areas south of Elfrida; and finally in the Avra Valley of Pima County.

The approximate acreage irrigated in 1953 in each county is shown in Table 6, and the acreages irrigated by areas and districts on the following pages. Depicting the growth of irrigation by counties since the beginning of the century, Figure 3 shows that the acreage irrigated in 1900 was doubled by 1916, doubled again by 1946, and practically doubled again in the seven years ended in 1953.

IRRIGATED AREAS IN ARIZONA[a]

	Approximate acreage irrigated	
	1947	1953
YAVAPAI COUNTY — Total	11,000	17,000
1. Big Chino Valley		2,200
2. Chino Valley	4,200	5,500
3. Bridgeport area	1,300	
4. Oak Creek Canyon	2,000	8,000
5. Camp Verde area	3,400	
6. Skull Valley including Kirkland		1,100
Date Creek[b]		400
MOHAVE COUNTY — Total		7,000
Bullhead area[b]		400
7. Fort Mohave area		3,000
Irrigation along Big Sandy[b]		3,000
YUMA COUNTY — Total	82,000	162,000
8. Colorado River Indian Reservation, land irrigated	6,000	30,000
9. Colorado River Indian Reservation, lands proposed for irrigation—90,000 to 100,000 acres including land now irrigated		
10. Bouse Wash area		6,000
11. Ehrenberg north to Indian Reservation		700
12. Cibola area		2,900
13. Areas in Colorado River bottom outside the levee		3,500
14. Yuma County Water Users' Association	46,000	49,000
15. Yuma Auxiliary Project (Unit "B")	2,100	2,300
16. "Island" area		3,000
Gila Project		
17. Yuma Mesa Unit, irrigated	5,200	15,000
18. Yuma Mesa Unit, proposed for development—10,000 acres		
19. North Gila Valley Irrigation District	5,500	7,500
20. South Gila Valley and adjacent areas, including Yuma Irrigation District	10,000	10,500
21. Wellton-Mohawk Division, Colorado River water		21,000
Wellton-Mohawk Division, Pump	6,000	3,000

[a]Area reference numbers are shown on map in dotted outline.
[b]Not shown on map.

22. Wellton-Mohawk Division proposed for development—54,000 acres		
23. Gila River area about Gila Project		7,000
MARICOPA COUNTY — Total	415,000	560,000
24. Areas west and northwest of Gila Bend to Agua Caliente and the Yuma County line	19,000	22,000
25. Gillespie Dam to Gila Bend including Enterprise Canal	3,000	9,000
26a and 26b. Centennial Wash area and Harquahala plains		11,000
27. Arlington Canal Co. and adjacent areas	3,900	5,000
28. Roosevelt Irrigation District	33,200	38,122
29. Areas along the Hassayampa north of Arlington area		1,500
30. Buckeye Water Conservation & Drainage District	16,200	17,300
31. Waterman Wash area and nearby developments south of the Gila River		9,500
32. Maricopa County Municipal Water Conservation District No. 1	18,200	35,000
33. Goodyear Farms at Litchfield	8,500	10,000
34. Adaman Municipal Water Company	2,500	2,500
35. Other pumping west of the Agua Fria River	20,650	26,500
36. Pumping lands between New and Agua Fria rivers including Marinette Ranch	9,000	15,000
37. Deer Valley (north of the Salt River Project and between New River and Cave Creek)	10,800	22,000
38. Salt River Valley Water Users' Association (Salt River Project)	215,000	215,000
39. St. Johns Irrigation District	1,100	1,968
40. New State Irrigation District		2,253
41. Peninsula Horowitz & Champion Irrigation & Drainage District	2,300	2,220
42. Gila River Indian Reservation—lands lying along the Gila River in Maricopa County and south of the Salt River, farmed by Indians	2,150	5,500
43. Gila River Indian Reservation "Improvement Leases" in Maricopa County, including Broadacres and Lone Butte Farm	6,500	10,700
44. Paradise Valley (north of Arcadia Water Co. and the Arizona Canal)	1,300	3,600
45. Arcadia Water Company	900	1,500
46. Salt River Indian Reservation including "Improvement Leases" of 1,140 acres in 1947 and 3,850 acres in 1953	4,500	11,000
47. Roosevelt Water Conservation District	32,000	39,411
48. Areas east of R.W.C.D. and north of Queen Creek area	3,500	8,000
49. Ocotillo Pumps, not including Indian land leases	5,000	7,600
50. Chandler Heights Irrigation District	1,000	1,200
51. Queen Creek area in Maricopa County including Queen Creek Irrigation District	10,000	25,000
PINAL COUNTY — Total	200,000	310,000
52. Queen Creek-Magma area	6,800	30,000
53. Gila River Indian Reservation outside San Carlos Project		1,850
54. Indian Portion, San Carlos Project	27,400	17,500
55. Maricopa (Ak Chin) Indian Reservation	4,390	11,172

56. Maricopa-Stanfield (excluding Maricopa Indian Reservation)	24,260	85,000
57. San Carlos Irrigation & Drainage District	32,000	22,500
58. Pump areas interspersed with S.C.I.&D. District including areas north of Casa Grande		45,000
59. Eloy areas south of S.C.I.&D. District to county line		90,000
San Pedro and Aravaipa River Areas[b]		3,000
PIMA COUNTY — Total	30,000	60,000
60. Marana-Cortaro area	15,400	20,000
61a and 61b. Avra Valley		13,000
62. Rillito Creek area and area between Rillito Creek and Tucson	1,000	7,000
63. Area south of Tucson to and including San Xavier Indian Reservation	3,150	4,000
64. Sahuarita-Continental area	9,000	14,000
San Pedro River Valley[b]		350
SANTA CRUZ COUNTY		
65. Santa Cruz River Valley	3,500	5,500
COCHISE COUNTY — Total	23,000	85,000
San Pedro River		
Casabel area[b]		300
66. St. David-Pomerene	2,100	2,500
67. Hereford & Palominas	500	1,787
Sulphur Springs Valley		
68. Stewart District	4,800	17,000
69. Kansas Settlement	300	18,000
70. Whitewater Draw	14,500	27,762
71. Bowie-San Simon area	600	12,000
72. Rodeo & Portal area		1,760
GRAHAM COUNTY — Total	35,000	42,000
73. Upper Gila Valley area with decreed water rights	32,500	32,500
Other irrigated lands in the Gila River district[b]		4,500
74. Artesia Area		3,500
Klondike Area[b]		900
75. Area north of Willcox		1,500
GREENLEE COUNTY — Total	6,000	6,000
76. Upper Gila Valley	5,500	5,500
APACHE COUNTY — Total	13,000	13,000
77. Lyman Dam Project and surrounding area	3,500	3,000
78. Round Valley	3,000	1,860
Hunt[b]		600
Concho[b]		400
Indian Reservation,[b] estimated		5,000
NAVAJO COUNTY — Total	8,000	13,000
Winslow area[b]	300	500
79. Joseph City-Holbrook	1,100	2,300
Woodruff[b]	500	500
80. Snowflake-Taylor	3,000	3,000
81. Showlow-Lakeside	1,400	1,400
Hay Hollow[b]		500
Indian Reservation,[b] mostly flood irrigation		5,000
COCONINO COUNTY — Total	3,000	5,000
82. Fredonia area	1,400	1,200
83. Oak Creek Canyon	300	250
84. Hay Lake area	1,000	1,200
Indian Reservation,[b] estimated		2,000

TABLE 5.—CUSTOM OPERATION RATES, CENTRAL ARIZONA EFFECTIVE TO JANUARY, 1954*

Operation	Unit Acre	Most common rate (dollars)
Land preparation, tillage & crop care		
Disk plowing, 12 in.	"	4.50
Renovating, 8-10 in.	"	3.00
Subsoiling, 18-20 in. depth with shanks 3 ft. apart	"	5.00
Land planing (twice: first time $3; second time $2-2.50)	"	5.00-5.50
Disking	"	1.50-1.75
Dragging	"	1.50-1.75
Bordering	"	.75
Planting—Rowcrops	"	1.50
Drilling grains	"	1.75-2.00
Broadcast Seeding	"	.75
Cultivating	"	1.25
Fertilizing cotton[1]	"	1.25-1.50
Ground Dusting—cotton, lettuce	"	.75-1.00
Ground Spraying—grains	"	1.50
Ground Spraying—Oil spray—carrots	"	2.00
Ground Spraying—onions	"	3.00
Operations by Airplane[2]	"	
Seeding alfalfa[3]	"	1.20
Seeding small grains[4]	"	1.20
Fertilizing, 100 lb. application	"	1.25-2.00
Dusting cotton, 20 lb. application[5]	"	.90-1.00
Dusting vegetables[6]	"	1.00
Insecticide spraying, 5 gal. application[7]	"	1.70
Defoliating cotton, 10 gal. application	"	2.65
Harvesting		
Combining barley, wheat[8]	"	6.00
Combining sorghum	"	7.00
Baling hay	Ton	6.00
Cutting sorghum for silage	"	1.00
Picking cotton (mechanical)	cwt	2.50
Hauling[9]	Ton	1.75

*Based on interviews with custom operators.
[1]For 300 lbs. per acre $1.25; 400-600 lbs. per acre $1.50.
[2]Where custom operator furnishes flagmen. If farmer furnishes flagmen rates are about 10c per acre lower.
[3]5c per lb. but minimum charge of $1.20 per acre.
[4]1c per lb. but minimum charge of $1.00 per acre.
[5]4½c per lb. but 90c per acre minimum.
[6]5c per lb. with $1.00 per acre minimum.
[7]Rates vary from 4 gal. @ $1.50 per acre to 15 gals. @ $3.15 per acre.
[8]Under 2000 lbs. yield $5.00; over 4000 lbs. yield $7.00 per acre.
[9]For first 5 miles, 5c per ton for each additional mile.

TABLE 6.—PRINCIPAL ARIZONA CROPS IN 1953 — ACREAGE BY COUNTIES AND PRODUCTION FOR THE STATE

	State Totals[a]	Apache	Cochise	Coconino	Graham	Greenlee	Maricopa	Navajo	Pima	Pinal	Santa Cruz	Yavapai	Yuma
Acres Irrigated[b c]	1,300,000	13,000	85,000	5,000	42,000	6,000	560,000	13,000	60,000	310,000	5,500	17,000	162,000
Alfalfa: acres[d]	183,000	4,400	4,200	1,000	5,800	1,000	98,000	3,200	1,200	14,000	600	4,000	45,000
Tons cut for hay[d]	567,000												
Cotton:													
Upland—acres harvested	640,500		38,000		12,200	3,100	239,000		47,000	224,000	2,750	50	75,000
bales	990,000												
Amer—Egypt acres	41,500		400		16,800		13,600		3,250	6,900	50		500
bales	33,000												
Feed grains:													
Barley—acres harvested	141,000	1,000	700	600	2,800	200	83,200	900	1,400	40,000	600	2,300	7,000
Tons of grain	186,120												
Corn—acres	34,000	11,000	800	3,600	700	400	2,200	11,000	600	500	300	1,500	900
Tons of grain	14,280												
Grain Sorghum—acres	55,000	200	1,200		200	600	42,000	500	1,300	6,000		300	2,700
Tons of grain[e]	52,808												
Wheat: acres	23,000	1,000	400	5,200	100	200	6,500	2,200	400	3,000		1,600	1,100
Tons of grain	17,940												
Dry edible beans: acres	8,000	600	300	5,000					200			1,900	
Tons harvested	1,950												
Vegetables: acres[b f]	95,000	900	500	300	30	100	55,000	400	400	1,300	50	200	35,000
Cars shipped[b f]	45,000												
Grapefruit: acres[b]	7,000						6,000		30				1,000
Tons sold[b f]	100,000												
Oranges: acres[b]	9,000						8,500		40				500
Tons sold[b f]	45,000												
Lemons & tangerines: acres[b]	1,700						900						800

Source: Federal Crop & Livestock Reporting Service, Phoenix, except as otherwise noted.

[a]State totals include estimates for Mohave and Gila counties.

[b]Estimates of the Department of Agricultural Economics, University of Arizona.

[c]Figures represent both irrigated crops and irrigated pasture. Acreage double cropped is counted but once. In addition, it is estimated that dry-land crops were harvested from approximately 100,000 acres. Hence the figures on this line do not represent crop acreage totals.

[d]Acreage alfalfa does not include land that was pastured only and alfalfa tons do not include hay crops pastured off.

[e]Does not include grain in 14,000 acres harvested for silage and forage.