

# State's Agriculture Changing

shifts in California's pattern of agricultural production since 1941 accompanied by expanding over-all farm income

Sidney Hoos and E. Margery Jones

**Developments** in the agriculture of California—since 1941—have resulted in a different statewide pattern of crop production.

To make a comparative analysis of these developments, the agricultural products of the state were grouped into the four categories of fruits and nuts; vegetables; field crops; and livestock and livestock products. The counties of Imperial, Kern, Kings, Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, Tulare, and Ventura were considered as comprising southern California. The remaining counties were classified as northern California.

## North and South Compared

For the state as a whole—now compared with 1941 and in terms of value of production—livestock and its products, as one category, has remained the chief income earner, but field crops has replaced fruit and nuts in the second position. Vegetables remain in fourth place.

The farm value of the state's fruit and nut crops has averaged 60% in southern counties and 40% in the northern; these have been fluctuations but no persistent trend. Except for the war and early postwar years, the southern counties' proportion of vegetables has been near 45%. In field crops during the postwar years, the South has grown relatively more than the North, with the South increasing from about 40% to about 50% in recent years. A marked change has occurred in livestock and its products. Since 1950, the distribution has averaged 60% in the South compared with less than 50% during most of the 1940's. For all products combined, the South's position in recent years has grown to near 55% compared with less than 50% two decades ago.

## Northern California

In northern California, livestock and field crops have remained the two major product groups. However, in some years, returns from each of them were exceeded by those from fruit and nuts. In 1941, livestock accounted for 33% of the total value of farm production in northern California, field crops for 31%, fruit and nuts for 19%, and vegetables for 17%.

During the war years, the annual values of the fruit and nut crops in northern California generally increased, reaching as much as 33% of the total farm output value in 1946. However, the next year, the fruit and nut share declined to 14% of the total. During 1948–1956, the fruit and nut share varied between a low of 13% and a high of 34%, and in 1956 the proportion was 21%. Vegetables have increased in relative importance—after losing ground temporarily in the immediate postwar years—and in 1956 they also accounted for 21% of the total value of farm output in the northern counties.

During the 1940's, northern California livestock returns were consistently greater than those from field crops; but in most of the years since 1950 their relative positions were reversed.

## Southern California

In southern California, fruit and nut crops were the main source of agricultural income for many years; but in 1947 the value of those crops turned downward and was exceeded by the value of livestock and also by that of field crops. The southern livestock industry expanded steadily during 1941–1947, but in 1946 the value of southern field crops had just started to shoot upward. In 1941, the proportion of fruit and nuts—in the total value of southern California farm production—was 36%; of livestock, 30%; of field crops, 21%; and that of vegetables was 13%. After the immediate postwar adjustment the returns from fruits and nuts trended up although did not reach their prewar level and proportion of southern California total farm value; during 1948–1956 they varied between 20% and 23%. During the same period the proportion for livestock, close to 36%, and that for field crops, near 28%, have been highly stable. The proportion of the southern total accounted for by vegetables—averaging near 14% since 1947—is slightly less than at the end of the war.

The changes in the South have varied by product groups and in the individual southern counties.

The growth of the livestock industry in southern California took place particularly in counties which formerly specialized in fruit and nut crops. In Orange,

Riverside, and San Bernardino counties, the value of output of livestock is now greater than that of fruit crops. The relative shift into livestock has been much smaller in Tulare County, where grapes as well as oranges are grown, and especially so in Ventura County, the main producer of lemons. The only southern counties where the livestock industry has declined in relative importance are Kern and Kings, where it has met competition from cotton.

The development of cotton growing—into the largest single source of income—has resulted in a particularly large rise in agricultural income in Kern County and to a less extent in Imperial and Kings counties. It has also contributed to the increased importance of Tulare County.

The leading agricultural counties of southern California are now Tulare, Kern, and Los Angeles, in that order. In 1941, Los Angeles County was by far the most important, accounting for nearly one fourth of the value of southern California farm production. The county's greatest agricultural income was from livestock and its output comprised as much as one third of the southern California total. The county was also one of the three major growers of fruit and nuts and of field crops, and the second largest of vegetables. In fruit and nuts, Tulare and Orange, and in field crops, Tulare and

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## CALIFORNIA AGRICULTURE

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## UREA

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column the urea had penetrated, and how much had been converted to ammonium carbonate. In the first series, the columns were sectioned after all the urea had passed into the column, even though the wetting front had not quite reached the bottom. In the second series, the sections were analyzed 12 hours after the urea solution was added and in the third series the time interval was 24 hours.

In Salinas clay both the urea and ammonia showed a concentration gradient after one hour, indicating that part of the urea was retained in the upper part of the column, and that some of the urea had been hydrolyzed to ammonia even in that short interval. After 12 hours hydrolysis was essentially complete. Although the soil was uniformly wetted throughout the

length of the column the distribution of added nitrogen decreased markedly with depth.

In Hanford sandy loam, urea distribution at the end of one and one quarter hours was quite uniform down to 6" and was reflected in the uniformity of the ammonia distribution after 24 hours when most of the urea had been hydrolyzed.

A comparison of the movement of urea, ammonium sulfate, and calcium nitrate applied at the surface of Yolo loam showed that nitrate moves along with the wetting front and is concentrated at the bottom of the column, whereas urea moves downward less readily, and ammonium sulfate hardly moves downward at all.

In experiments where both urea and nitrate were applied to the top of a soil column at the same time, and then water added to move the fertilizers downward,

it was found that nitrate was first to appear at the bottom of the column. For example, all added nitrate was leached from a 9" column of Salinas clay by application of 5.7" of water, whereas 7.1" were required to accomplish the complete removal of an equivalent amount of urea.

These experiments indicate that urea is retained by weak absorption forces in the soil, and that until hydrolysis occurs urea is intermediate between nitrate and ammonia in its susceptibility to leaching.

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## OLIVE

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gen would soon disappear. Under such conditions, a pronounced response of olive trees to nitrogen fertilizers—as found in these experiments—would not be expected. This would be the case, not only in the initial fertilizer applications, but year after year, as added fertilizers would tend to be lost by leaching and the low level of organic matter in the soil would not be conducive to a natural build-up of soil nitrogen.

In the heavier clay soils on flat ground—as in the Tehama County orchard—nitrogen would tend to be more stable because of the higher organic content and the reduced amount of leaching. Even with no added soil nitrogen, the nitrogen level in the trees would tend to stay for some years well within the range adequate for the needs of the tree; hence, the lack of an immediate response to a single nitrogen application, or to the withholding of a single nitrogen application, is not surprising. Under fertile soil conditions, and where a consistent annual fertilization program is carried on, it is unlikely that any one application of nitrogen could be expected to cause a marked stimulation in the immediate crop.

Maintaining olive trees at the optimum nitrogen level under the soil conditions found in the Tulare and Tehama olive districts would be relatively simple. Because soil nitrogen does not fluctuate appreciably and trees at adequate nitrogen levels do not respond immediately to a single nitrogen fertilizer application, the only problem is that of adding nitrogen to the soil at intervals to maintain the trees at an optimum nitrogen level. The frequency of these intervals can be

determined best by leaf analysis, but the appearance of the trees gives a fair indication of their nitrogen status. Dark green foliage together with vigorous annual shoot growth implies ample nitrogen. Further addition of nitrogen fertilizers to trees in this condition or with a leaf nitrogen content of 1.8% to 2.0% is probably not justified because the trees are unlikely to absorb nitrogen much in excess of those values. Even at such high nitrogen levels, however, trees will gradually decrease in nitrogen content after several years and should receive added nitrogen before the leaf nitrogen content drops below 1.2% to 1.3%.

Maintaining olive trees at the proper nitrogen level under conditions such as those found in the Butte County olive district would be much more difficult and is likely to be a major problem of the olive grower. Shallow, gravelly soil with low organic matter and fertility, coupled with heavy leaching due to the rolling topography and high rainfall causes a rapid loss of soil nitrogen, necessitating frequent additions of fertilizer. For trees grown under such conditions, which tend to be continually low in nitrogen, adding the proper amount of nitrogen at the proper time is of definite importance in influencing fruit set and the consequent fruit size.

The problem of nitrogen fertilization encountered in orchards of low soil fertility is twofold. Nitrogen must be added frequently to maintain adequate conditions for growth and to induce adequate fruit setting. However, large amounts of nitrogen should not be applied, especially in the spring just preceding the fruit setting period, as excessive fruit set and, consequently, unprofitably small fruit sizes may result.

In orchards tending toward alternating

bearing, heavy nitrogen fertilization in the spring of the on-year would tend to promote the development of a heavy crop, followed by the lack of a crop in the off-year. In such situations a better practice may be to delay the nitrogen application in the on-year until summer—after the fruit setting period—and to apply the nitrogen in the off-year in the spring, preceding the fruit setting period, to stimulate fruit setting.

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Kern, were the other leading counties in 1941. Then, Imperial was the major vegetable producing county.

Though the total value of the Los Angeles County farm output is now nearly twice as much as in 1941, its share in southern California agriculture has declined to 13%. Among the 12 southern counties, Los Angeles now ranks seventh in fruit and nut crops, and fifth in vegetables and in field crops. However, the value of the county's livestock output—especially dairy products—continued to expand, until recently. And, while it has lost ground as compared with other counties—its share in this group having fallen below one fourth of the total—Los Angeles remains the leading livestock county.

Tulare County was the second largest agricultural producer among the southern counties in 1941, although the value of its output was little more than half

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that of Los Angeles County. Since 1950, Tulare has exceeded Los Angeles. In general, fruit and nuts have been the main crops of Tulare which is one of the few counties whose output of this group has increased in value since the war. Consequently, Tulare's record fruit and nut crop of 1957 accounted for as much as 34% of the total value of the southern California fruit and nut crop.

The expansion of the livestock industry in Tulare County is most striking. The value of the industry's output in the last three years was more than 2.5 times as great as in 1945 and nearly six times the 1941 figure. Tulare still ranks second to Los Angeles in livestock but its share in the southern California output has increased to 14%. The value of Tulare's field crops—influenced heavily by cotton—expanded until 1951, then tended to fall, more sharply than that of Kern or Imperial counties. But Tulare remains the third largest producer of field crops in southern California. Tulare is a comparatively unimportant producer of vegetables.

Kern County exceeds Los Angeles County in value of total farm output—prewar it was less than half as much—

mainly because of expansion in field crops and in vegetables. In the last three years Kern County has accounted, on average, for nearly 30% of the total southern California output of field crops and 20% of the vegetables. Also, Kern County produces nearly half the southern California cotton crop and derives a third or more of its agricultural income from cotton. However, there is no marked upward trend in total agricultural returns or in the values of any of the four product groups in Kern County.

Orange County ranked third among the 12 southern counties prewar and then exceeded Kern, but the value of its farm production today is only half that of Kern County. The relative decline of Orange County in farm value is linked with the fruit and nut sector, particularly with oranges. Until 1956 oranges were the chief product and the source of two thirds of its agricultural income. The value of the orange crop never recovered the high end-of-war levels, but the subsequent contraction has been more than offset by a rapid and continuous increase in the output of livestock products, especially dairy products and eggs.

San Bernardino County which also derived two thirds of its prewar farm income from fruit and nuts—mainly citrus fruits—has experienced a similar devel-

opment. The contraction in the fruit and nut crops was even more severe than in Orange County and the present dollar value of those crops is little more than in 1941. However, livestock production expanded earlier and more rapidly, and the recent output of this group of products was worth more than twice as much as the fruit and nut crops. Much of this expansion was in eggs and San Bernardino County is now by far the largest egg producer in southern California.

Ventura and Riverside counties also specialized heavily in fruit and nuts prewar, but like Tulare, have more than maintained the value of these crops during the postwar period and recently obtained record dollar returns from them. Ventura County has become the second largest fruit producing county, producing about half as much as Tulare; and Riverside County has also become relatively more important. Nevertheless, the extent of this specialization, especially in the case of Riverside County, has declined. The outputs of livestock—mainly cattle and calves—in both counties and of vegetables in Riverside County have grown rapidly and livestock has replaced fruit as Riverside's major product group. In Ventura County—though there has been a sudden recent expansion in the small

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## PRODUCTION

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vegetable crop—citrus fruits still remain the source of more than half of the county's agricultural income. The Ventura orange crop has not fully recovered in dollar terms to the high level of the immediate postwar years; but its lemon crop—since the 1930's the largest in southern California—continued to expand until recently.

Imperial County—the major prewar vegetable producer—has experienced a relative shift to field crops and is now the second largest field crop producer among southern counties. The value of field crops has increased as much as eight times, compared with a twofold increase in the vegetable crops. Even livestock returns, which grew steadily, are about as high as those from vegetables. Much of the recent increase in the field crop total stems from the introduction of cotton.

San Diego County derives about 40% of its agricultural income from livestock, especially eggs and dairy products in recent years. It has, however, achieved a remarkable expansion in vegetables and is now one of the largest producers.

Kings County—where agriculture was formerly almost equally divided between field crops and livestock—has concentrated on field crops, particularly cotton, and has become the third largest cotton producer, after Kern and Tulare counties.

Santa Barbara is the only county which has expanded its production of fruit and nuts relative to other agricultural products, but its fruit crops are small compared to counties such as Orange, Tulare, or Ventura. Santa Barbara's farm value of vegetable output has trended down during the past decade.

San Luis Obispo County, which derives nearly half its agricultural income from livestock, is the smallest agricultural pro-

ducer among the 12 counties. Since 1941, San Luis Obispo has not changed the pattern of its agriculture to any marked extent.

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