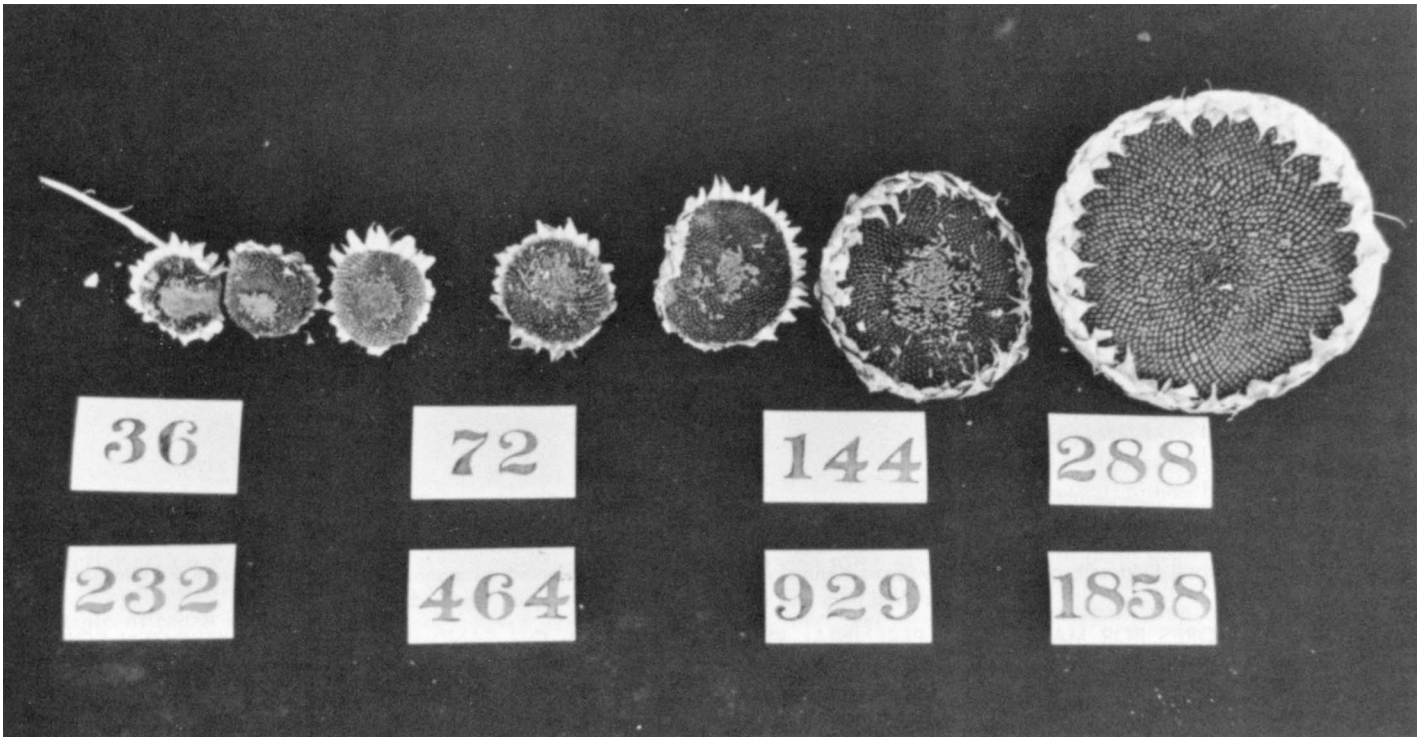

Sunflower heads from plots with different plant spacing. The average spacing per plant is shown in square inches (upper) and square centimeters (lower).

SUNFLOWERS

in the Desert Valley areas of Southern California

W. F. LEHMAN · F. E. ROBINSON · P. F. KNOWLES · R. A. FLOCK

From this series of studies it appears that sunflowers are well adapted (and needed) as a crop in the low desert valley areas. However, production with the varieties presently available is marginal-to-poor. Improvements in insect and disease resistance, coupled with benefits derived from use of hybrids, could make this a profitable crop for these areas in the near future.

THE SUNFLOWER is a New World plant which has been developed into a valuable source of edible oil and meal, and is now receiving considerable interest both in the United States and worldwide by farmers, processors, and consumers.

Sunflowers produce an unsaturated oil which has a fatty acid content similar to corn oil. However, strains of sunflower containing different oils have been found that could be used as sources of germplasm for the development of sunflower varieties with new types of oil. Sunflower meal is high in protein and contains a good balance of all amino acids except lysine.

Through plant breeding, sunflower varieties have been developed which are well adapted to modern agricultural methods. The plant has been shortened to about 4 to 5 ft in height; the oil content of the seed has been increased to about 50%; and the growing season has been reduced to a range of 90 to 120 days. These improvements make it possible to harvest the crop mechanically and grow it in more areas and cropping patterns. In addition—and perhaps of most interest—plant breeders are now actively

working on hybrids and on developing plants with disease and insect resistance.

Since many changes have been made in sunflower and more will be forthcoming in the near future, a series of tests was designed to determine the potential of this crop in the low desert valleys of California. These areas have a very long growing period and need short season crops which can fit into a double cropping system, especially during the hot summer months. Experiments were designed to determine the adaptability of sunflowers under a variety of practices, to monitor insect pests and diseases, and evaluate the quality of the seed produced. A typical short-seasoned, short-statured, oil-type variety (Tchernianka) was used in all tests. Additional varieties were used where possible to determine the value of the existing germplasm.

Date-of-planting experiment

Sunflowers were planted at the Imperial Valley Field Station for three years on shallow beds spaced 40 inches apart. Two and four rows were planted per bed at a spacing of 8 inches between plants within the row. Safflower was planted with sunflowers in the January and February plantings, and sorghum in the others. Results will be shown for only the 1971 plantings where five dates covering a seven-month period were used. Data from three dates of planting made in 1970 were in general agreement with the 1971 data.

Production

Yields per acre of 2,500 to 2,800 lbs were obtained from the January and February plantings (graph 1). Production then dropped 1,000 or more lbs in the March or later plantings. On the basis of observations made during these and other trials it seems the early plantings escape diseases and insects, which lower production in later plantings. Contrary to the 1970 and 1971 results, yields of Tchernianka in a variety trial planted February 15, 1972, were 1,107 lbs. This low yield seemed to be due primarily to a powdery mildew infection which resulted in a loss of all the lower leaves on the plants.

Production of the safflower variety Royal used as a check crop for the January and February, 1971, plantings was 4,305 and 4,008 lbs per acre, respectively. In the February 15, 1972, planting Royal produced 2,545 lbs per acre. Sorghum yields for the March and May, 1971, plantings were 6,622 lbs and 4,363 lbs per acre, respectively. Birds damaged the July planting of sorghum.

Days to maturity

Days to maturity decreased from a high of 145 days in January plantings to a low of about 85 days in May and July plantings. There was some uneven ripening on all dates, but the crop appears to have the potential of being a short season summer crop, which can be used in a double cropping program between two winter crops. Use of hybrids would result in more even ripening.

Sunflower matured three to four weeks sooner than safflower, and about three weeks sooner than sorghum (RS 610) in the March planting. Substituting sunflower for these crops would probably eliminate the need for one irrigation, and provide three additional weeks for growth of the following crop.

Percent oil

Oil content was about 46% in the January and February plantings, and varied from 42% to 30% for the other plantings. Oil content of Royal safflower (44 to 45%) was very similar to sunflower in the two early plantings.

Seed weight

Total yield and quality reflect the importance of individual seed weight. Both seed weight and total yield are highest during the January and February plantings, and then both decrease progressively as plantings are further delayed. The lighter seeds at the later planting dates usually have a well-developed hull but a light, underdeveloped seed.

Honeybee visitation

Sunflowers require honeybees or some other insect for pollination. In this test, honeybees, which were located in hives about ¼ mile away near a good source of water, were the main insect pollinators. However, fairly high populations of moths such as the beet army worm and cabbage looper moth were found on the May and June plantings. Populations of these insects seem too variable to be depended upon for good pollination. Honeybee populations (graph 2) were recorded during peak bloom on the variety Tchernianka eight times each day for four days at each planting date. Bee populations of 1.54 bees per flower were highest for the January planting and decreased to a low of about 0.23 bees per flower during the May and July planting. Pollination seemed satisfactory at all planting dates.

Bee populations also varied within each day. For the early plantings, populations were highest between 8:00 and 10:00 a.m. Later in the year as temperatures increased, populations were lowest in the hottest part of the day.

Varieties

Two types of sunflower varieties are available. The better known is a tall, large-seeded variety usually used for confection purposes, or bird seed. The second type is short in stature, usually has small black seeds, and is used primarily for oil production. At present, most of the oil-type varieties have been developed and used in Russia and Eastern Europe. Because the products from the oil varieties will have a greater demand on the market, the acreage for this type of sunflower is expected to increase in the next few years, whereas the demand for the confection types may remain relatively constant.

Most of the tests reported here have been conducted on the variety Tchernianka which is typical of the short-statured, oil-type varieties. Limited testing has been conducted on other varieties. In these tests Tchernianka and Romania 52 (a hybrid) had the highest performance. Production under the economic conditions of the desert valley areas is low for all varieties now available. As oil-type hybrids with disease and insect resistance are developed, production is expected to increase to profitable levels.

Irrigation

A trial was conducted with both furrow and sprinkler irrigation on March 15, an intermediate planting date. Irrigation treatments were designed to range from wet to dry and were based on pan evaporations of 1.5, 2.5, 3.5, and 4.5 inches of water. Plants were uniformly irrigated until they were about 3 inches tall. No significant differences were obtained among treatments for production. However, the drier treatment in both tests yielded less than all other treatments. Yields averaged 2,517 lbs for the sprinkler, and 1,676 lbs per acre for the flooded treatments. These two experiments were about half a mile apart, and it is probable that both the irrigation method, and the test location contributed to the yield difference. From these experiments, it appears sunflowers can tolerate fairly large differences in water application rates once the plants have become established.

Spacing

Plant spacing was 8 inches within rows, and a comparison of two and four rows planted on a 40-inch bed was made in most date-of-planting trials. This produced 19,602 and 39,204 plants per acre, respectively. In addition to this, a special plant spacing experiment was grown under sprinkler irrigation. Plants in this trial were grown in a grid (uniform spacing in both directions) in populations ranging from 21,800 to 174,200 plants per acre. Production in both tests increased slightly as the space between plants increased. The uniform spacing of the grid-type planting seemed to produce uniformly large heads which were greater in size than a comparable population in a row spacing.

Pests and problems

The main limiting factor in sunflower production in the desert valley areas seemed to be diseases and insects which became more severe in later plantings. Problems varied within, and between seasons, but a partial list by date was compiled over a three-year period. Frost affected January and earlier plantings. Sunflowers seem to tolerate some frost in the cotyledon or first leaf stage, but become more susceptible in later stages. Warm weather or good growing temperatures prior to a frost also make the plants more susceptible to frost.

One February planting was severely affected with powdery mildew. Root rot was usually apparent after flowering in the March and later plantings. Salt marsh caterpillars and other caterpillars affected all plantings to some degree, but were more severe in later plantings. Stalk borers, primarily *Suleima helianthana*, were found in all plantings, but were usually more severe later in the season. Sunflower moth infestations were very light in early plantings, but heavy in April and later plantings. Lace bugs were found in plantings made at various dates. The sap beetle (Nitidulidae) was a secondary insect in heads affected by sunflower moth in later plantings. Birds caused damage at times and could become a serious problem if large acreages were planted.

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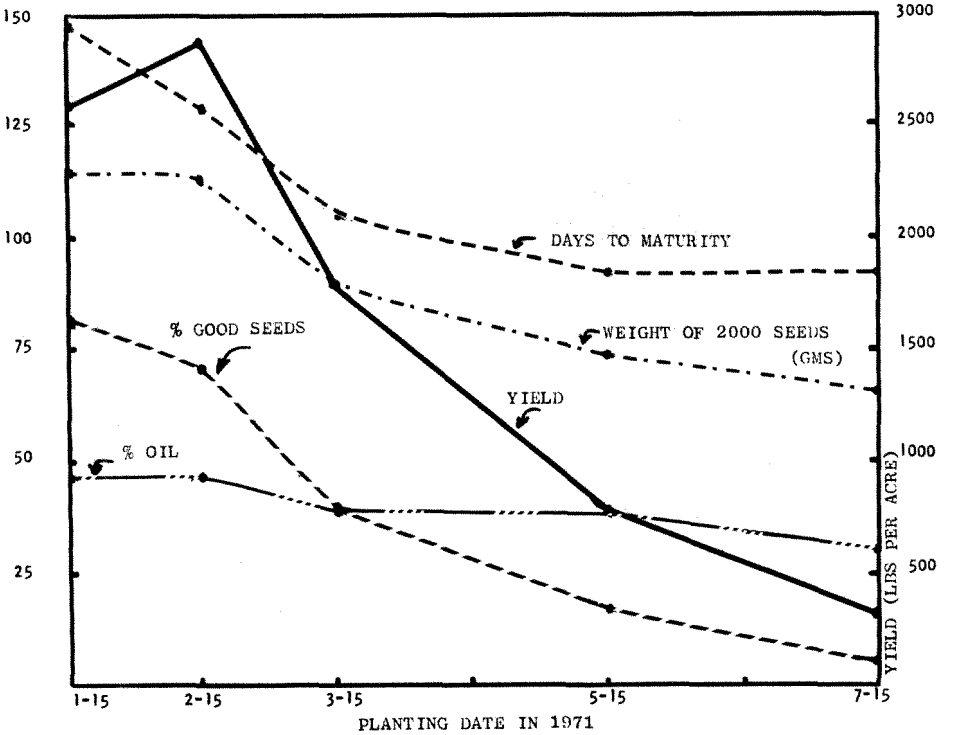
GRAPH 1. REACTION OF FIVE CHARACTERISTICS OF SUNFLOWERS PLANTED AT A RATE OF ABOUT 39,000 PLANTS PER ACRE AT FIVE DATES IN 1971.



GRAPH 2. AVERAGE NUMBER OF BEES PER FLOWER OBSERVED SIX TIMES EACH DAY ON SUNFLOWERS FLOWERING ON FIVE DATES (PLANTING DATES INDICATED BY ARROWS).