Quick starting of seedlings and better plant survival were the primary results of fertilization for alfalfa seed production, according to three years of trials at the West Side Field Station, Fresno County. Alfalfa seed yields were not influenced by fertilizer applications (singly or in combinations) of nitrogen, phosphorus, potash, gypsum or minor elements when used on established stands. Plant distribution and density of stands were definitely shown to be factors in alfalfa seed setting. Thinning within the row was found beneficial, and the best three-year average yields were in thinned stands where rows were spaced 24 to 48 inches apart. The indicated dates to cut back stands to start a seed crop were from April 10 to 20 at this location.

Nitrogen and phosphorus (15 to 20 units of each) applied, at or before planting, and slightly below or to one side of the drilled seed, were beneficial in establishing stands, but usually failed to show an increase in yield.

Effect of fertilizer, row spacing and clipping on ALFALFA SEED

LUTHER G. JONES · C. R. POMEROY

First-year stands

In first-year stands, thinning within the row was beneficial for all row-widths. The amount of thinning (see Table 1) required to improve seed yields varied with different row-widths, ranging from 12 inches to 18 inches in 24 and 36-inch row spacing to 6 inches in wider spaced rows. In solid drill-row stands, 36-inch spaced rows were superior, but 48-inch spaced rows were only slightly lower in yield. The 24 to 42-inch spaced rows were better adapted to direct harvest. Rows spaced 48 inches and wider required special attention to avoid heavy losses of seed in harvest.

Second-year stands

In second-year stands, seed yields from row-spacing and within-row thinning were outstandingly good for demonstrating the effects of plant distribution and density of stands on seed yields. The highest yields in 1960 (see Table 1) were with 24-inch spaced rows when thinned to 6 x 18 inches (thinned 6 x 18 inches indicates 6 inches of row remaining, 18 inches of row removed or "blocked" out) in treatment No. 2 (T-2) and 6 x 36

GAMMA RADIATION DEVICE
aids study of water movement in soil

J. M. DAVIDSON · D. R. NIELSEN · J. W. BIGGAR

The ability of soil to transmit water affects the rate, frequency and method of irrigation—and can often limit cropping possibilities in non-irrigated areas. Knowledge can be obtained on water movement through soil by measuring changes occurring after different periods of time. The gamma ray apparatus measures soil moisture on the basis that fewer gamma rays will pass through a wet soil than a dry soil.

In the laboratory setup, water movement is measured by using a glass-enclosed soil column placed between two lead shields as shown in photo and diagram. Gamma rays emitted from a radioactive cesium source are directed through lead slits of less than .05 inch width. As the gamma rays pass through the soil, they are electronically detected and analyzed. Selected radiation from the analyzer is received by the rate meter and transferred to a recorder. Data from the recorder can be read directly to show a continuous measurement of water content with time. The soil column is translated to the left and right for continuous water content measurements at different locations along the column.

Previous methods of water movement through soil involved slow or inaccurate procedures. Gravimetric procedures necessitate the destruction of each sample and valuable time is consumed for oven drying. Many other methods required

PRODUCTION

inches (T-3); 36-inch spaced rows thinned to 6 x 6 inches (T-6); 6 x 12 inches (T-6); 6 x 18 inches (T-7); 6 x 24 inches (T-8); and 48-inch spaced rows thinned 6 x 12 inches (T-11). Plant populations were: 24-inch spaced rows, 6 x 18 inches, 16,300 plants, and 6 x 36 inches, 9,300 plants compared to 65,300 plants in unthinned 24-inch spaced rows; 36-inch spaced rows had 21,700, 14,400, 10,800, and 8,700 plants, respectively, compared to 43,500 unthinned. In the 48-inch spaced rows, there were 10,500 as compared to 32,600 plants in the unthinned stand.

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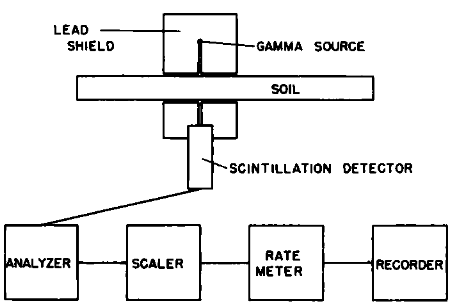
such a large sample that theoretical considerations of the water movement problem were nearly impossible. Variations of the dissolved constituents in the soil solution also make water determinations by other methods unreliable.



In addition to using the gamma ray device to understand how water moves through soil, it may be used directly for other problems in agriculture. Soil moisture extraction patterns by plant roots growing in greenhouse pots may be measured without plant disturbance. Soil compaction experiments may be carried out with great precision owing to the ability of the gamma device to measure bulk densities with extreme accuracy.

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A first-year stand of skip-row planted alfalfa for seed production.

Third-year stands

In the third year of production 24-inch spaced rows thinned 6 x 18 inches and 36-inch spaced rows thinned 6 x 6 and 6 x 18 inches yielded best. Plant size in the 1961 season prevented lodging, and this condition permitted all of the better treatments (2, 3, 4, 5, 6, 7 and 8) to produce similarly. Yields of seed went up and managerial problems increased as the stands advanced in age (see both tables). The control of harmful insects, the elimination of volunteer seedlings and weeds, and the correct application of irrigation water were the main problems.

Row spacing is a factor in alfalfa seed production and can improve yields when adapted to the soil type and the available water for irrigation.

Within-row thinning proved beneficial throughout the life of the stands when adapted to the particular row-widths, soil type and total water availability.

Skip-row trials

Skip-row plantings, two rows in and one out, proved superior on certain soil types. This was particularly the case on lighter soils where water penetration was more rapid and a lesser moisture storage capacity per unit volume of soil became a limiting factor to growth of higher plant populations. Under these circumstances yields were improved 20 to 30 per cent. The reverse was true on the heavier soils where moisture holding capacity was higher and smaller plants prevented lodging. Here yields were in favor of 36-inch spaced rows with no out rows. Better water management and improved pest control were factors contributing to the improved yield of skip-row plantings.

Clipping dates

Clipping data for 1959, 1960, and 1961 (see Table 2) indicated that April 20 was the best date to clip during this period,

TABLE 1—ROW SPACING, THINNING, PLANT POPULATION AND YIELDS OF ALFALFA SEED

Treatment number	Row & spaced inches apart	Thinned		Plants/acre	Per cent yield when T-4 = 100 per cent in			3-year average
		Left in inches	Removed inches		1959	1960	1961	
1	24	solid		65,300	95	87	92	91
2	24	6	18	**16,300**	107	114	106	109
3	24	6	36	**9,300**	80	123	100	101
*4	36	solid		43,500	100	100	100	100
5	36	6	6	**21,700**	114	110	101	108
6	36	6	12	**14,400**	119	118	98	112
7	36	6	18	**10,800**	105	116	101	107
8	36	6	24	**8,700**	100	109	95	101
9	36	6	36	6,200	77	97	85	86
10	48	solid		32,600	98	97	90	95
11	48	6	12	10,500	96	116	81	98
12	48	6	24	6,500	75	88	87	83
13	72	solid		21,100	76	80	82	79
14	72	6	6	10,500	86	88	88	87
15	72	6	12	7,000	76	77	71	75

* The yield of No. 4: 1959, 634; 1960, 1074, and in 1961, 1413 pounds/acre.

TABLE 2—CLIPPING DATA COMPARISONS FOR ALFALFA SEED TRIALS

Treatment No.	Date clipped	Per cent yield 1959	1960	1961	3-year average
1	None	91	96	89	92
2	4/4		94	94	94
3	4/10	99	94	95	96
*4	4/20	100	100	100	100
5	5/2		93	82	88
6	5/16	84	84	89	86
7	6/1	56	74	84	71
8	6/16	29	31	68	43

* The yield of No. 4: 1959, 646; 1960, 1258, and 1961, 1339 pounds/acre.

however, in 1959 all dates from April 10 through April 20 were equally favorable. It would be expected with more years of data that the favorable period would be roughly April 10 to April 25. The drop in production of stands clipped after May 1 was too high to risk a later clipping date.

Early clipping

Clipping too early also has its drawbacks. First, there must be time after spring begins to clean out weeds and volunteer seedlings. This is done most effectively after spring rains are over, or in late March or early April. Second, based on chalcid emergence data, alfalfa clipped back from April 15 to April 25 would miss better than 93 per cent of the overwintering chalcid emergence. Seed pod formation on these stands would start about May 20 to June 1, and suitable pods for chalcid egg deposition would be available June 4 to 15. In 1961 overwintering chalcid fly emergence was over on June 9, resulting in less than 7 per cent of the overwintering brood being present to infest the early developing seed pods.

Chalcid infestation

The chalcid infestation in per cent of seed destroyed in 1959 was 23.8, 1960—12.4, and 1961—6.4 per cent. In 1961 there was no clear cut increase in chalcid injury exhibited on the various cutting back dates. In previous years the later dates, May 15 to June 16, showed higher chalcid damage. Plant populations resulting from within-row thinning, row-widths and skip-row plantings did not influence the chalcid infestation as measured by seed damage.

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KAPAREIL

Kapareil, a new small-kernel almond variety, may be the answer to demands of manufacturers of candy bars for small-sized nuts—an almond industry marketing problem that has existed for many years. Because of the need for such a variety, Kapareil is being released now by the California Agricultural Experiment Station for unrestricted propagation. The variety has consistently produced a high percentage of the desired sizes in different seasons, from different test plots. The tree shows promise of effective use in orchards although certain undesirable characteristics have been recognized. These and long-time productivity can best be analyzed with commercial plantings.

Kapareil was tested under the number 18-24. It resulted from a cross made in 1951 between Nonpareil and Selection 24-6. The 24-6 selection was the seedling from a cross of Eureka × A5-25 (Nonpareil × Eureka). The original seedling tree of Kapareil is growing at Davis. Most records have been taken from a tree that was top-worked in March, 1953, at the Wolfskill Experimental Orchard, Winters. Initial selection of this promising seedling was made from 1955 nut samples and confirmed in 1956. In spring 1957, field test plots were established in principal almond growing counties by topworking mature trees. Samples were obtained from these trees in 1959, 1960 and 1961. During the winter 1959–60 several commercial test plantings of Kapareil were established utilizing June budded nursery-grown trees. At the same time test plots in which Kapareil limbs were grafted into mature Nonpareil trees were established in three locations.

Tree characteristics

Trees resemble Nonpareil in growth habits except that they tend to produce smaller diameter shoots and more lateral branches on new growth. Average size of mature trees has not been determined but probably will be no larger than the size of Nonpareil trees and may be smaller. Kapareil blooms profusely and begins to bloom at a young age. The time of bloom is the same as Nonpareil or two or three days before. In hand-pollination tests the variety cross-pollinates readily with Nonpareil, Mission (Texas) and Davey. Individual trees have been productive. Comparative yields with other varieties on an acreage basis are not available. Hulls dehisce like those of Nonpareil but begin to open as much as a week earlier. Harvesting dates of different plots have varied from shortly after the first of August to near the first of September. Normally harvesting should be just prior to Nonpareil.

So far no evidence of bud-failure (crazy-top) has been observed on any tree although it is probably too early to be certain that symptoms will not appear. Specific tests on bud-failure susceptibility are underway.

Kapareil is not compatible with Marianna 2624 rootstock.

Nut characteristics

The shell is paper thin and with a shelling percentage of about 70. In samples examined so far the seal of the shell along the suture varies from well closed to quite open, depending on season and area. This characteristic may be a disadvantage and