Effects of covering materials and incorporated herbicides on lettuce stands under three irrigation treatments

DAVID RIRIE • HARRY AGAMALIAN • L. J. BOOHER • CLAY BROOKS

CURRENT CULTURAL PRACTICES in California lettuce require a thinned stand with single plants spaced 12 to 14 inches apart on a 40-inch double-row bed. The ideal situation would be to plant the precise number of seeds to obtain such a stand, but the many hazards to germination, emergence, and plant survival make it impossible to plant consistently to a stand. At present, it appears more practical to precision-plant fewer seeds than are now planted commercially — and then thin to the desired stand with a selective thinner. This is a progress report of work to develop such a planting system. Factors studied were irrigation techniques, chemical weed-control treatments, and the use of covering materials for soil-crust prevention. (Two planters were used, but no effort was made to compare the two machines.)

The Sanderson experimental precision planter and a modified International Harvester (I.H.C. 188) planter were used to plant full-coated lettuce seeds of the G. L. Bellaverde variety under three covering materials (conditioners) that had demonstrated crust alleviation possibilities in previous tests. The beds into which the plantings were made had been rototilled to incorporate three herbicides (for each irrigation test) at recommended commercial rates. Three separate experiments were conducted, based on differing irrigation techniques.

Irrigation patterns

The first technique consisted of furrow application of water until the beds were completely wetted across the top, after which no further irrigation was applied (table 1). The second was a sprinkler

Sanderson precision planter, right, used in the Salinas Valley lettuce tests, has a visible seed supply container (seen to right of large drive wheel on left), a self-cleaning seed belt, turn crank for depth control (knob to right), and a rolling coulter (bottom, center) to aid in opening furrow.

R. E. Pafler is Farm Advisor, Los Angeles County; V. Voth is Specialist, Department of Pomology; and H. J. Bowen, Jr., is Laboratory Technician II, University of California South Coast Field Station, Santa Ana. R. H. Gripp is Farm Advisor, Shasta County.
arrangement on a 30- x 40-ft setting using Rain Bird No. 14 sprinklers with \( \frac{3}{4} \) -in. nozzles; these plots were sprinkled with one inch of water after seeding and remained unirrigated for 16 days until the stand-count data had been taken (table 2).

In the third technique, the test area was irrigated by sprinkling (with one inch of water) after seeding, followed, after four days had elapsed, by further sprinkler applications on each of four consecutive days until the surface was rewetted. This required one-fourth inch at a time, except the first day, when one-half inch was applied. On the fifth day after this resumption of irrigation, there was a trace of rain, and on the sixth day 0.12 inch fell. Both days were foggy and misty, the surface soil did not dry, and no irrigation water was applied. On the seventh and eighth days the plot was again irrigated with one-fourth inch per day. This resulted in an almost completely wet condition of the surface soil throughout the germination period. (The plots under furrow irrigation and under one sprinkling also received the 0.12 inch of rainfall, but were almost completely dry at the surface during the emergence period.)

Soil crusting was not significant in the furrow-irrigated test plot, and was nonexistent in the constantly irrigated area. Some crusting of the soil occurred in the plot that was sprinkled only once. It was not as severe as often occurs under sprinkler irrigation on this soil type, and may have been because the nozzles used were of much lower capacity than those used by commercial growers.

Counts of lettuce seedlings were taken 16 days after seeding, which was more than adequate time for the stand to emerge. Weed counts were made at approximately the same time. In addition, a second lettuce count was made following a period of rainy weather that occurred between April 2 and 21, 1965. Except for the test area which was repeatedly wetted, the rain caused no appreciable number of additional plants to emerge.

**Conditioners**

The results of the emergence counts are reported in table 1 for the experiment that was conducted under furrow irrigation. For the Sanderson planting, vermiculite plus polyvinylacetate over the seed resulted in a significantly higher lettuce emergence at the earlier count, but not at a later date—suggesting that the treatment gave a faster and more uniform emergence, which is important since such a stand would be expected to mature more evenly. This trend was not observed with the I.H.C. planter, and might be explained by the fact that the I.H.C. mechanism was not properly synchronized and, in some cases, the seedlings were required to emerge through the soil instead of the intended conditioner covering.

Under furrow irrigation, loamite treatment did not result in a significant increase in stand with either planter. Noticeably better initial emergence resulted when the seeds were planted under coke with the I.H.C. planter compared to other covering materials, although plant survival through the subsequent wet weather was low. The reason for the improvement under coke compared with the other materials is unknown, but may involve a temperature increase because of its black color. However, the same result was not observed when other irrigation methods were used.

**Herbicide treatment**

There was no significant effect of herbicide treatment on lettuce stands, but the plants appeared to be somewhat stunted when CDEC was used as a pre-emergence herbicide.

Emergence counts are reported in table 2 for the experiment with one sprinkler irrigation. The conditioners that were used instead of soil as a covering resulted in significantly better lettuce emergence with both planters. There were also indications that the emergence was more uniformly early. Covering materials provided considerable insurance against loss of stand due to crusts that were more severe under the moisture conditions imposed by only one sprinkling. CDEC probably had an effect on the lettuce, although it was not significantly lower than the check (at the 5% level). The other materials showed no measurable effect upon the stand counts.

The stands of lettuce under repeated sprinkler irrigation through the emergence period are reported in table 3. Under conditions where sprinkler irrigation was employed to keep the soil moist throughout the period of germination, the use of covering materials over the seed showed little benefit. On this particular soil, appropriate water application was demonstrated to overcome stand reduction that would otherwise occur under conditions of soil crusting. There was no significant effect on lettuce stands because of incorporated herbicides under this water regime.
The results of weed control with herbicides under three methods of irrigation are reported in Table 4.

Regardless of which method of irrigation was used, CIPC treatments resulted in the highest percentage of weed control, followed by IPC and CDEC.

The primary difference between overall herbicide performance was the tolerance of certain weed species to certain chemicals. CDEC is generally not effective on *Solanum* and *Brassica* sp. However, as sprinkler irrigations were increased, CDEC gave better performance—probably due to the increased activity of the chemical under this method of irrigation.

Soil crusting as a deterrent to planting lettuce at reduced planting rates was effectively controlled by keeping the soil surface wet by daily light sprinkler irrigation throughout the period. This was equivalent to using coverings of vermiculite stabilized with polyvinyl-acetate, loamite, or petroleum coke in place of soil behind the planters as a soil crust preventive measure following one sprinkler application of water.

Results of the first counting date indicated that, where lettuce is furrow-irrigated to produce a stand, vermiculite stabilized with PVA was effective when the Sanderson planter was used. Since crusts were not serious it appears that the modified I.H.C. planter. When the synchronization was correct, however, the I.H.C. was satisfactory. Although the performance of CIPC, IPC, and CDEC was acceptable for hand thinning, they did not provide a weed-free seed line necessary for synchronous machine thinning. CIPC consistently provided the highest increased the efficiency of CDEC.

David Ririe and Harry Agamalian are Farm Advisors, Monterey County; Lawrence J. Booher is Extension Irrigationist and Clay Brooks is Agricultural Engineer, University of California, Davis.

Spreckels Sugar Company supplied the land and irrigation water for these experiments, and Rain Bird Sprinkler Manufacturing Company supplied the sprinkler heads used in the studies.