had significantly higher yields at the 5% level than the Alar-top treatment for the October 15 digging date but failed to show any significant difference for the October 23 and 29 digging dates.

The check-cut and Alar-cut treatments had significantly higher yields at the 1% level than the check-top treatment for the October 15 digging date, and at the 5% level for October 29, but failed to show a significant difference for October 23.

The Alar-top treatment gave significantly higher yields at the 5% level than the check-top for the October 29 digging date, but failed to show any significant difference for the October 15 and 23 digging dates. As far as fruit earliness was concerned, the check-top had the latest fruit for the October 15 digging date, and the Alar-top had the latest fruit for October 23 and 29.

The Alar-top treatment showed the greatest improvement in yields from the October 15 and October 29 digging dates, but still had the latest fruit on October 29. Although it would appear that Alar reduced transplant shock when the tops were left on, this would not be a recommended practice for transplanting strawberry plants from northern California to other parts of the state.

The Alar-cut treatment showed the greatest improvement in yield from the October 23 to 29 digging dates, and had the highest yield and earliest fruit from the October 29 digging. The October 15 and possibly the October 23 digging dates apparently were too soon after the October 1 Alar spray, and resulted in reduced yields. The Alar-cut treatment shows some promise of being helpful on strawberry varieties like the Fresno. More information is needed on dosage and timing and on other strawberry varieties with high chilling requirements.

Alar also appeared to make the Fresno strawberry plants more drought-resistant. The check-top treatment had the poorest yields and definitely would not be a recommended practice.

In general, the later the Fresno strawberry plants are dug in the fall for immediate planting, the better. If there are night temperatures above 32°F, digging of Fresno plants should be stopped until after a series of five nights below 32°F.

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

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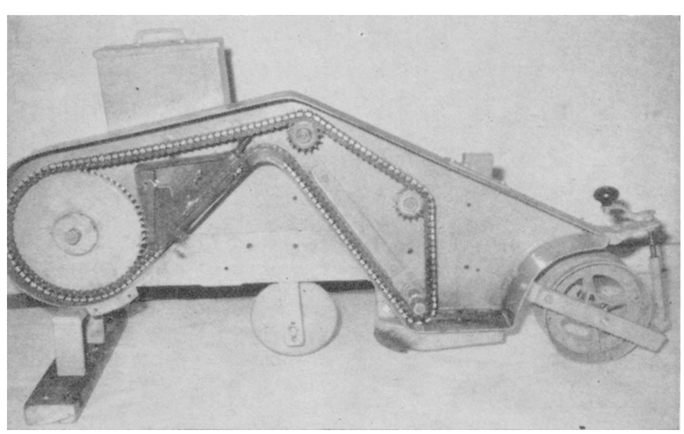
CURRENT CULTURAL PRACTICES in California lettuce require a thinned stand with single plants spaced 12 to 14 inches apart on a 40-inch double-row bed. The ideal situation would be to plant the precise number of seeds to obtain such a stand, but the many hazards to germination, emergence, and plant survival 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.)

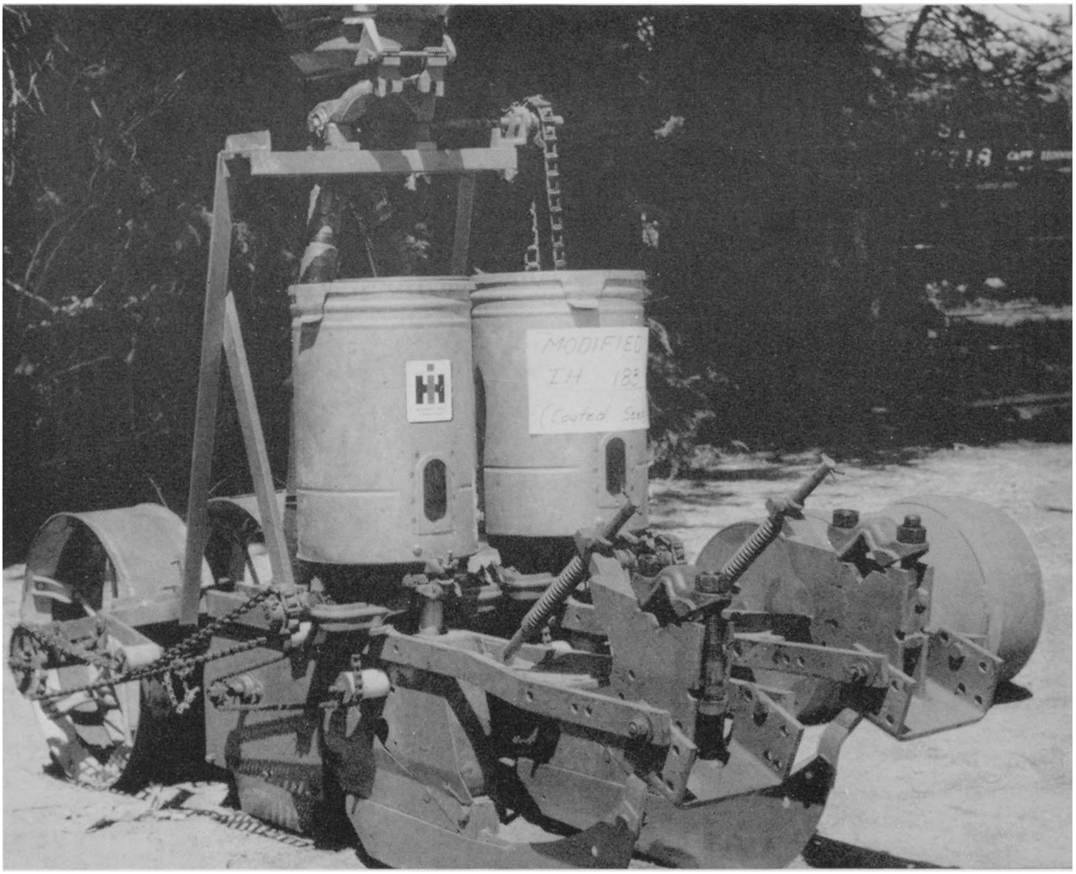
The Sanderson experimental precision planter and a modified International Harvester (I.H.C. 188) planter were used to plant full-coated lettuce seeds of the G. L. Bellaverde variety under three covering materials (conditioners) that had demonstrated crust alleviation possibilities in previous tests. 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.



I.H.C. modified precision planter, as used in Salinas Valley lettuce test program with soil conditioners and herbicides.

arrangement on a 30- × 40-ft setting using Rain Bird No. 14 sprinklers with $\frac{3}{32}$-inch 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 through the emergence period. This was equivalent to using coverings of vermiculite stabilized with polyvinylacetate, 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 treatment aided emergence because of other causes. This trend was not as noticeable with the modified I.H.C. planter—probably because of poor synchronization of the covering placement. The Sanderson planter, which applied covering materials as a continuous band, was effective in applying soil covering materials, but there were synchronization problems with 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 percent weed control regardless of the method of irrigation. Sprinkler irrigation increased the efficiency of CDEC.

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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.

SUMMARY OF LETTUCE EMERGENCE DATA IN SALINAS VALLEY WEED CONTROL TESTS WITH SOIL CONDITIONERS AND HERBICIDES

TABLE 1. FURROW IRRIGATION TESTS

	Sanderson Planter				I. H. C. Planter			
	April 2, 1965		April 21, 1965		April 2,1965		April 21, 1965	
	Mean seedlings per 100″	Emergence	Mean seedlings per 100″	Emergence	Mean seedlings per 100″	Emergence	Mean seedlings per 100″	Emergence
		%		%		%		%
COVERING MATERIALS*								
Check	12.4	56.4	14.6	66.4	7.3	60.8	8.1	67.5
V + PVA.	17.3	78.6	17.3	78.6	7.8	65.0	9.5	79.2
Coke	. . .	. . .	. . .	. . .	10.8	90.0	10.2	85.0
Loamite	12.1	55.0	14.9	67.7	7.8	65.0	7.8	65.0
LSD .05	2.6		N.S.		1.7		1.6	
LSD .01	3.6		N.S.		2.4		N.S.	
HERBICIDES**								
Check	13.8	62.7	15.8	71.8	8.8	73.3	9.0	75.0
IPC.	13.4	60.9	16.3	74.1	8.8	73.3	9.3	77.5
CIPC	14.1	64.1	14.6	66.4	8.3	69.2	8.3	69.2
CDEC	14.3	65.0	15.8	71.8	7.8	65.0	9.1	75.8

TABLE 2. SPRINKLER IRRIGATED ONCE AT PLANTING

	Sanderson Planter				I.H.C. Planter			
	April 2, 1965		May 10, 1965		April 2, 1965		May 10, 1965	
COVERING MATERIALS*								
Check	8.8	40.0	12.6	57.3	4.4	36.7	5.1	42.5
V + PVA.	15.2	69.1	15.2	69.1	7.6	63.3	7.5	62.5
Coke					7.3	60.8	7.0	58.3
Loamite	14.7	66.8	13.5	61.4	8.3	69.2	8.2	68.3
LSD .05	3.74		1.90		1.76		1.82	
LSD .01	5.16		2.62		2.39		2.47	
HERBICIDES**								
Check	12.7	57.7	12.9	58.6	5.5	45.8	7.2	60.0
IPC.	13.7	62.3	12.8	58.2	6.0	50.0	7.4	60.3
CIPC	13.8	62.7	15.4	70.0	5.6	46.7	6.5	54.2
CDEC	11.4	51.8	13.9	63.2	3.7†	30.8	6.7	55.8

† The emergence of seedlings in the CDEC-treated plot was significantly lower at the first date than IPC and CIPC, but not significantly lower than the check. No other differences were statistically significant.

TABLE 3. TESTS UNDER REPEATED SPRINKLER IRRIGATIONS AFTER PLANTING TO EMERGENCE

	Sanderson Planter		I.H.C. Planter	
	April 2, 1965		April 2, 1965	
COVERING MATERIALS*				
Check	15.3	69.5	8.6	71.7
V + PVA.	17.0	77.3	8.9	74.2
Coke			7.8	65.0
Loamite	12.4	56.4	9.7	80.0
LSD .05	2.8		1.5	
LSD .01	3.8		2.0	
HERBICIDES**				
Check	15.3	69.5	8.3	69.2
IPC.	15.4	70.0	9.3	77.5
CIPC	15.0	68.2	8.6	71.7
CDEC	13.9	63.2	8.8	73.3
LSD .05	N.S.		N.S.	
LSD .01	N.S.		N.S.	

* In all three experiments the rates (in lbs per acre) were as follows:

	Sanderson Planter	I. H. C. Planter
Vermiculite	650	330
Loamite	2700	1000
Petroleum Coke	.....	1200

** *There was no significant difference between herbicides or in the interaction between herbicides and conditioners.*

TABLE 4. MEAN PERCENTAGE OF WEED CONTROL BY SPECIES

Herbicide	Rate of application	Method of irrigation	Weed species						
			Urtica urens	Chenopodium murales	Amaranthus retroflexus	Brassica campestris	Sonchus pleraces	Solanum saricoides	all species
	lbs.								
CDEC	6	Furrow	75	91	99	0	26	22	70
CIPC	3	″	100	72	80	67	0	99	83
IPC	6	″	99	63	98	15	0	91	76
CDEC	6	Sprinkler	85	95	97	31	75	11	78
CIPC	3	″	99	65	79	37	0	100	83
IPC	6	″	99	47	84	1	4	90	76
CDEC	6	Continuous Sprinkler	80	95	99	27	69	0	82
CIPC	3	″	95	76	67	40	0	92	88
IPC	6	″	94	58	77	26	0	86	85