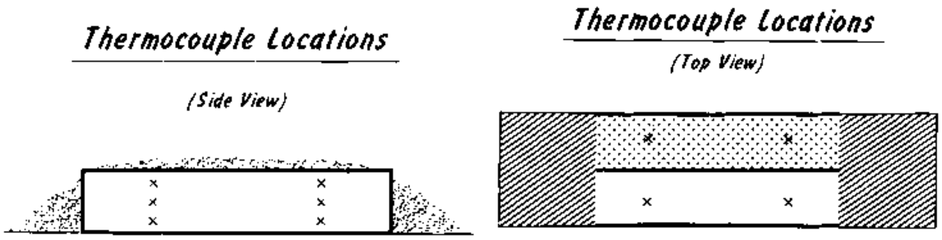
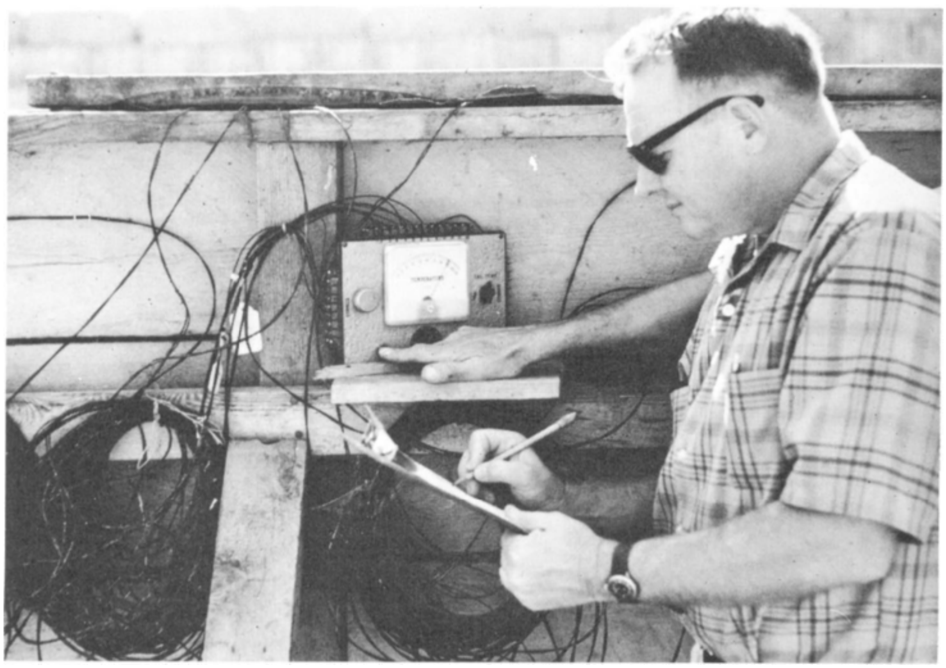
SEALING BUNKI

Effect on



THERMOCOUPLE PLACEMENT IN SILOS

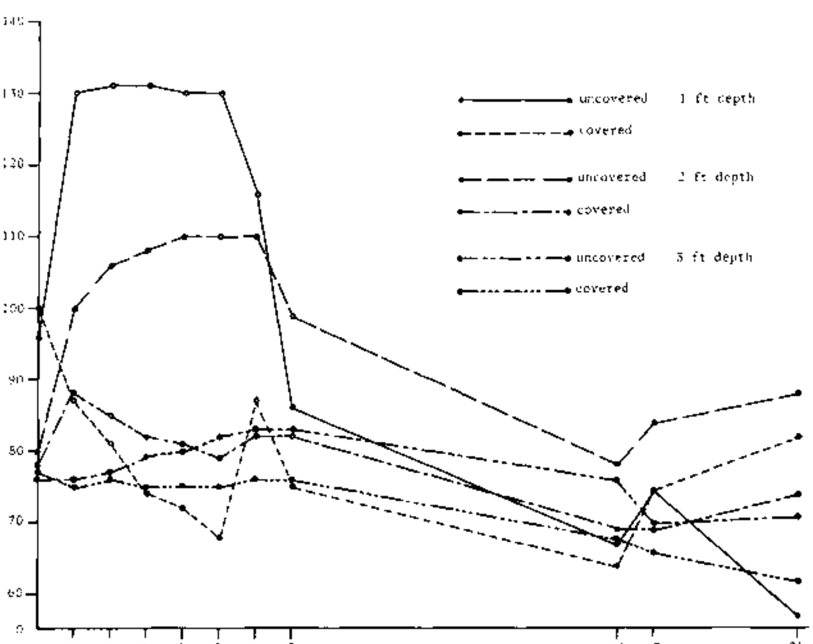


Apparatus for recording temperatures in silage packs

Trials were conducted in Madera County to test the effect of covering and sealing bunker silos filled with either corn or oat silages. Lower temperatures within the silage mass and a considerable increase in preserved silage resulted from covering and sealing the silos with 6 mil black polyethylene.

THE PREVIOUS ARTICLE reported that carefully covering and sealing the silage pack with black polyethylene seemed to have more effect on the ensiling process and amount of preserved silage recovered from the bunker silos than the silage additive which was tested. This observation is further documented by previous work by Toenjes and Marble in Glen County (*California Agriculture*, November 1970). In order to test this observation under more controlled conditions, a series of trials was designed to measure the effects of covering and sealing on silage losses from bunker silos and to record temperatures within the silage pack.

Four experimental silos, 16 ft long, 10 ft wide, and 5 ft high (see photo in previous article), located on the Henry Massaro Ranch in Chowchilla, California,



TEMPERATURE RECORDINGS FOR THE ENTIRE TRIAL

KER SILOS:

on silage losses

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were filled with overly matured oats and vetch forage (40% dry matter). The material was weighed into the silos and samples were taken to determine moisture content of the forage as it was ensiled. Due to the low moisture content of the material, water was added to all four of the silos via a garden sprinkler after they were filled with forage and packed with a tractor. Two of the silos were covered with 6 mil black polyethylene sheets which were weighted down with discarded auto tires placed close together. The other two silos were left uncovered to serve as controls during the 147-day trial.

Monitoring temperature

The following fall the trial was repeated with corn silage, but with some modifications in the procedure. One divider wall was removed from the bunkers, making two long silos for more effective use of loading and packing equipment. Temperature was monitored by burying thermocouples at six locations in each silo at the time of filling (see graph). The thermocouples were connected to a monitoring station outside the silos, allowing easy access with a calibrated, direct read-out galvanometer (see photo). The temperatures were monitored daily for the first ten days, then at greater intervals thereafter throughout the storage period.

Immediately after filling and packing, one of the two silos was sealed with 6 mil black polyethylene, which was weighted down with discarded auto tires placed closely together. The other silo was left uncovered for the 147-day duration of the trial.

The effect of the black polyethylene cover on the recovery of preserved silage in these two trials is shown in the table. In the case of the overly-matured oats and vetch silage, the recovery of preserved silage from the sealed silo was 70.1% of the ensiled forage, compared with 47.6% from the uncovered silo.

In the corn silage trial, where more favorable packing conditions prevailed, recovery of preserved silage was 74.2% from the covered silo, compared to only 58.1% from the uncovered silo.

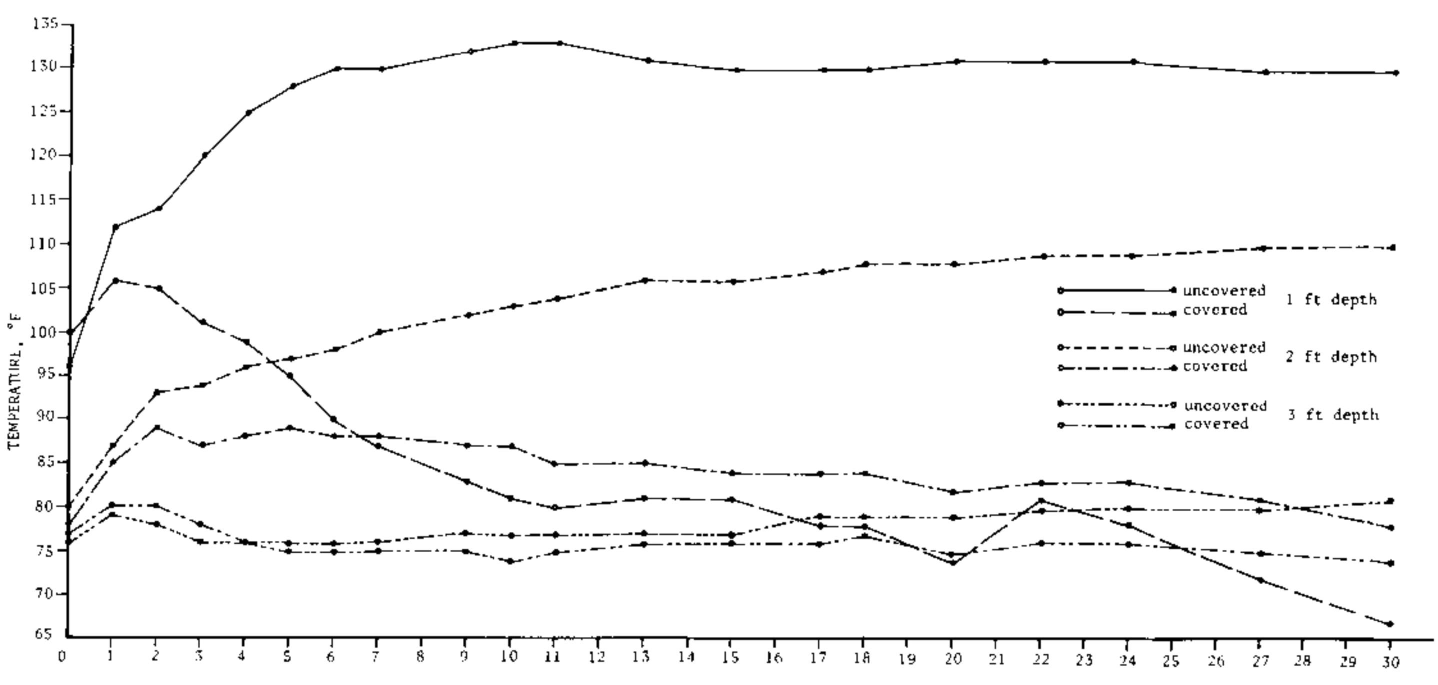
The effect of the cover on the dry matter content of the spoiled silage is also very apparent. Dry matter percentage of the spoiled oats and vetch silage from the

EFFECT OF COVERING AND SEALING BUNKER SILOS ON SILAGE LOSSES

	Oats and Vetch		Corn	
	Covered	Uncovered	Covered	Uncovere
Forage into silos (lb)	27,450	26,190	45,655	47,990
Dry matter (%)	38.1	39.4	25.3	25.3
Dry matter into silos (lb)	10,472	10,314	11,551	12,141
Preserved silage (lb)	22,005	13,033	34,690	27,780
Dry matter (%)	33.3	37.7	24.7	25.4
Preserved silage dry matter (lb)	7,336	4,911	8,568	7,056
Preserved silage (%)	70.1	47.6	74.2	58.1

covered silo was 20.9%, compared with 86.9% from the uncovered silo. Similar figures for the spoiled corn silage were 13.4% and 41.5%. The much higher dry matter content of the spoiled silage indicates that the uncovered silos got hotter due to air entry into the silage pack. This not only results in great losses of nutrients through oxidation, but also denaturation and reduced digestibility of any protein left in the spoiled silage. Total dry matter recovery as spoiled silage also was much greater from the uncovered silos (9.1% and 7.9% from the covered silos, compared with 34.0% and 28.1% from the uncovered silos).

The effect of the black polyethylene seal on the temperatures in the corn silage pack was quite striking, as illustrated in the graphs. Temperature recordings for the first 30 days of the trial are shown in graph 3 and for the entire 147 days in graph 4. Immediately after filling, temperatures at the monitoring site one ft below the surface of the silage started to rise in both silos. In the case of the un-



TEMPERATURE RECORDINGS FOR FIRST 30 DAYS OF TRIAL covered silo, the temperature reached a peak of 133°F at the end of ten days, leveled off at that point for 33 days, and then dropped following cold, rainy weather. After 33 days at 130-133°F, there probably was not much organic matter left to oxidize in the top ft of silage.

The temperature in the covered silo at the one-ft level peaked at 106°F within 24 hours after filling and gradually decreased to normal silage temperatures of around 75-80°F after ten days. The temperature remained at this level until the windy and rainy weather at day 33, at which time it rose to 95°F. This probably resulted from air getting into the silage pack during the windy weather because of inadequate sealing with the polyethylene.

The monitoring site at the two-ft level below the surface of the uncovered silo showed a gradual increase in temperature up to 110°F after 33 days of storage, indicating the oxidative effects of air entry into the pack at two ft below the surface level. Temperature at the two-ft level in the covered silo peaked at 89°F at day 5. It gradually decreased to 85°F at day 13 and stayed below 85°F for the duration of the trial.

As might be expected, neither the covered nor the uncovered monitoring sites showed any effects of air entry at three feet below the silage surface. Only an initial 5°F rise was exhibited at the 24-hour monitoring due to trapped air in the silage pack. By the third day, the temperature at the three-ft depth in both silos had dropped to 78°F and remained near there throughout the trial.

These trials showed that a 6 mil black polyethylene cover effectively excludes air from the silage pack when well weighted down. Lower temperatures in the covered silo showed that oxidation was greatly retarded and resulted in a reduced spoilage rate of the silage material in both the oat and corn silages. The temperature probes in the corn silage demonstrated that silage at least two feet down in the pack was being affected by air entry and oxidation in the uncovered silo.

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Wax and meal changes in

JOJOBA SEED

Wax content of jojoba seed increased rapidly from the first to the fourth week. Protein content of jojoba meal increased at a slow, steady rate during the entire period. Seed harvested 20 days prior to full maturity had essentially the same wax and protein content as mature seed, but it had lower dry seed weight and excessively high moisture content.

Laboratory evaluations of jojoba wax indicate that it is a unique product with a wide spectrum of potential industrial applications. The major drawback which prevents extensive commercial utilization of jojoba wax at present is the limited supply of seed. Seed can only be obtained from native plant populations in California, Arizona, and Mexico. These sources are inadequate not only because they cannot produce sufficient quanities of seed to meet the anticipated demand, but also because: (1) total potential production from these populations can only be guessed at because they have never been harvested systematically and thoroughly; (2) fluctuations in climatic conditions cause major changes in seed yield, compounding the uncertainty about seed availability; and (3) experience gained to date in California indicates that native jojoba populations can only be harvested efficiently by hand. Thus these plants constitute a seed source which is highly unpredictable, expensive, and of unknown productivity. Despite these shortcomings, however, harvest must continue, at least until seed can be supplied by cultivated jojoba plantations. Any information that contributes to maximizing harvest efficiency is of great importance as long as seed production is dependent on native stands.

When jojoba seed is mature it gradually separates itself from the maternal plant and drops to the ground. Although seed collected from the ground has maximum wax content and dry seed weight and minimum moisture content, the plant's bushy, low-branching growth habit and the length of the dehiscence period, which extends over several weeks, makes seed collection from the ground difficult. In harvesting trials in California over the last three years, seed has been collected as close to maturity as possible before dehiscence. But this practice gathers seeds at different stages of development, so that it becomes important to investigate differences in quantity of wax and meal when seed is harvested before complete maturation. In this report, data are presented on the moisture, wax, protein, amino acid and fatty acid content, and composition of jojoba seed harvested during eight weeks preceding maturity.

Seed samples were obtained from the large native stand of jojoba in the vicinity of Aguanga, California. Sampling started June 20, 1973, and continued at weekly intervals until August 15, 1973. On each sampling day the most developed (i.e., largest) seeds were hand-collected from each of 15 plants. Moisture was determined by comparing the seed's initial weight, not including the capsule walls, with its weight after drying in a vented oven at 80° C until sample weight at successive weighings remained constant. The seed was then pressed in a Carver laboratory press to 703 kg/cm², and the wax collected from each sample was used for gas-liquid chromatography analysis. Protein content of the meal (N × 6.25%) was determined on duplicate meal samples from each seed sample by Kjeldahl analysis. Amino acid content of these samples was determined with a JLC-5AH amino acid analyzer.

Major changes following definite trends were observed in the qualitative