Almond Hulls

tested as feed for dairy cattle and lambs showed promise and limitations in value

Robert F. Miller

Some of the 40,000 tons of almond hulls produced annually in California—as a by-product in the process of hulling almonds—are fed to dairy cattle, sheep, and milk goats.

The principal ingredients of almond hulls are sugar and starches, 55% to 60% and crude fiber, which is of low value, about 17%. Protein and fat are both very low. The composition of the hulls varies with the varieties and with the moisture content.

Several years ago an attempt was made to fatten lambs by feeding one lot almond hulls and alfalfa hay and the other lot a similar ration with some barley added. The hulls had been stored in sacks for about six months, and for some reason, the lambs ate very sparingly and the gains were unfavorable in both lots.

Dairy Cows

Last year considerable work was done in studying the feed value of almond hulls for dairy cows. One group of cows was fed a small amount of grain mixture with alfalfa hay and almond hulls. The cows ate quite freely, consuming from 10 to 12 pounds of hulls per day.

The cows continued to milk normally and the hulls were replacing about one-half of the alfalfa hay. The hay and grain were then discontinued, and the cows were fed almond hulls alone. The cows consumed from six to seven pounds only of hulls per day and there was considerable evidence of severe scouring. This was proof that it was inadvisable to attempt to feed almond hulls alone. When the hulls were fed in conjunction with hay and grain, the cows seemed to be quite normal in both appetite and milk production.

Lambs

A feeding trial was conducted with lambs using fresh hulls soon after harvesting. The hulls were of the IXL variety of very good quality. They were hauled direct from the almond huller, but due to considerable moisture being present, they were spread out on a cement floor to permit further drying before they were sacked. When hulls are piled too soon—with the moisture content too high—they will heat and mold.

The following rations were fed:

Lot I—10 head—Rolled barley and chopped alfalfa hay.

Lot II—10 head—Rolled barley 50%, ground almond hulls 50%, and alfalfa hay.

Lot III—10 head—Rolled barley 25%, ground almond hulls 75%, and alfalfa hay.

The lambs were fed for 47 days and ate the barley and almond hull mixture very readily. The lambs weighed at the beginning about 85 pounds apiece, and the two lots fed almond hulls gained almost 0.3 pounds a lamb a day which is a satisfactory gain.

The lambs fed rolled barley and alfalfa hay—for some reason—went off-feed after they had been fed for 30 days. The grain had to be greatly reduced, and these lambs never completely recovered in this short feeding trial. Hence, the results do not give a fair comparison.

When slaughtered the lambs fed almond hulls weighed on an average of 99 pounds each, the dressed yield was a little over 50%, and the carcasses graded choice and good. This would indicate that the lambs were well finished as to condition.

It might be concluded that in this trial, ground almond hulls when making up either one half or three fourths of the concentrate diet, proved rather high in feed value. The ground almond hulls appeared to be of high quality, and very palatable, as the lambs seemed to relish the hulls throughout the trial.

Digestion Tests

Following the lamb feeding trial, a digestion trial was conducted with four wether lambs using a diet of 50% chopped alfalfa hay and 50% ground almond hulls—a portion of the hulls left over from the feeding trial.

There was no difficulty in getting the lambs to eat this mixture. The over-all digestibility was very favorable, resulting in a total digestible nutrient factor of 64.6%. This figure is comparable to the nutrient value of culled fruits, such as dried figs or dried prunes. Furthermore, this favorable digestible nutrient factor substantiates the feeding value of these hulls as shown in the lamb feeding trial.

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Red Kidney Beans

symptoms of zinc deficiency disappear following application of foliage spray

R. S. Baskett and C. Emlen Scott

Red kidney bean plants with chlorosis—a typical symptom of zinc deficiency—recovered their normal color within three weeks after a trial foliage spray application of zinc sulfate and hydrated lime.

The zinc deficiency spray test was conducted in a field planted to red kidney beans near Linden in San Joaquin County. The 110-acre field included an old corral spot of an acre or two near the center of the field where chlorosis in the beans was pronounced.

When first examined on August 12, 1948, the affected plants were stunted, the foliage showed interveinal chlorosis and very few pods had set. The immature leaflets were abnormally narrow and were crinkled or ruffled. These symptoms agreed with the description of zinc deficiency in beans in Florida.

The chlorotic plants were sprayed with a dosage applied at the rate of two pounds of zinc sulfate and one pound of hydrated lime in 50 gallons of water to cover one acre.

Immature bean leaves which were tagged in the spray plot on August 17th were normal on August 24th. Similar tagged leaves in the unsprayed area showed definite zinc deficiency symptoms on the latter date.

On September 8th, all but a very few of the normal leaves in the spray plot were normal and some of the older leaves had recovered their normal color. Blossoming was in progress and new pods were setting. By that time the unsprayed plants in the deficiency area were stunted and had set few pods.

On August 12th the deficiency area had

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STORAGE

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to storage the grapefruit were washed with ½% soap solution, then treated with 1¼% of Exchange Wax No. 22.

Compared to nonsprayed fruit, those sprayed with either eight or 16 ppm 2,4-D had a reduced amount of surface decay, aging and black buttons throughout the storage. There was also a decrease in internal Alternaria decay as shown by cutting the black button fruit after storage.

After 15 weeks of storage, the fruit from trees sprayed with 16 ppm 2,4-D was rated the best with regard to firmness, color and general appearance. The eight ppm 2,4-D fruit rated next best, and the nonsprayed fruit was the poorest of the three lots.

2,4-D Treatment After Harvest

On May 17, 1948, after washing and waxing, both light green and green lemons from non-2,4-D-sprayed trees were dipped for two minutes in a lanolin emulsion containing either 500 or 1,000 ppm acid equivalent of the butyl ester of 2,4-D.

Another sample of green lemons was exposed for 69 hours to the vapor of the isopropyl ester of 2,4-D. After exposure, the treated lemons were placed in the storage chamber with the nontreated fruit.

Inspection showed that after 115 days of storage at 58° F to 60° F and 88% relative humidity, the nondipped light green lemons had 1.88% surface decay and 51.3% black buttons.

In contrast, after 162 days of storage, the light green 2,4-D-dipped lemons had only 3% with black buttons and none with Alternaria decay. At this time no surface decay had developed on the dipped fruit compared to 3.85% on the nondipped.

The green lemons dipped in either 500 or 1,000 ppm 2,4-D solutions had failed to develop a single fruit with a black button or Alternaria decay after 162 days of storage. Surface decay was 0.60% for the dipped fruit compared to 12.25% for the nondipped.

The 2,4-D vapor treatment of green lemons for 69 hours at the beginning of storage also reduced black buttons and Alternaria decay as well as surface decay compared to nontreated fruit. The reduction was much less than for the dip treatment.

Wax Preparations

In addition to the dip and vapor 2,4-D treatments, 500 ppm 2,4-D as the butyl ester was added to the Exchange Water-Wax preparations. In comparison to nontreated lemons in all color groups there was a remarkable reduction in percentage of fruit with black buttons, internal Alternaria decay and surface decay.

In a single storage test of Valencia oranges dipped in 2,4-D solutions, it was found that, as with the lemons, they developed fewer black buttons than the nontreated fruit.

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POMEGRANATES

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being sharply delimited. The lower two fruits have the blemish occasionally found on pomegranates, but not associated with the mites. The checked and dark brown discolored areas coincide and are sharply defined. There is no tendency for the blemished area to be concentrated at the stem end of the fruit.

Control

In experiments made in 1948 it was shown that all the commonly used mite treatments will control the *Brevipalpus* mite, but since sulfur dust is highly effective as well as being inexpensive, it is recommended as a control measure. Experimental and commercial control treatments made in June and July 1948 with one half pound of sulfur dust per tree, resulted in excellent control, while untreated check trees were severely infested, with a high percentage of blemished fruit.

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ALMOND

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There is a great variation in the type of hulls obtained in harvesting different varieties of almonds. Certain hulls, such as the IXL which were used in this test, are thick and meaty, while those from some other varieties are thin and papery. The nutritive value of the hulls undoubtedly varies accordingly. It is planned to do further work on almond hull feeding this fall.

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SULFUR

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yses of the lemon peel. Thus it was proved ground sulfur can enter citrus fruits as sulfur vapor or gas.

Sulfur vapor alone in a glass bottle heated to the melting point of sulfur will combine with hydrogen to produce hydrogen sulfide. Oxygen is needed for this reaction and sulfur dioxide is produced in the process.

Glass tubes having the same surface as the lemons used in the experiments were sulfur dusted and placed in a bottle which was kept at 105° F. At the end of two days time, no hydrogen sulfide nor sulfur dioxide gas had been formed. This, it is believed, shows that elemental sulfur must get into citrus fruit to make hydrogen sulfide and sulfur dioxide gases at atmospheric temperatures.

Plants need sulfur to build proteins. Sulfur, usually in the form of sulfate, is supplied to plants through the soil. The sulfate may be put on the soil as a neutral salt or as a weak solution of sulfuric acid. The roots absorb sulfate, but must be able to change the sulfate into other forms in order to build the sulfur into protein.

Enzymic Action Suggested

Another experiment was conducted to observe what would happen if citrus fruit were dipped in weak radioactive sulfuric acid and kept at about 115° F for several hours. The fruit yielded slightly radioactive sulfur dioxide and hydrogen sulfide gases, very radioactive sulfate and protein. The sap in the peel had become more acid.

It might be said in passing that the fruit resembled sulfur-burned fruit as did the fruit kept at 105° F in hydrogen sulfide or sulfur dioxide gas for a few hours.

This experiment suggests that enzymes are present in the fruit peel which can change sulfate to other forms of sulfur. But the rate of change of sulfur to sulfate is a more rapid process than the one changing sulfate back to other forms of sulfur.

Experiments are under way to determine the effect of temperature on the relative rates of changing sulfur to sulfate or vice versa.

Other experiments in which lemons are being treated with radioactive hydrogen sulfide and sulfur dioxide are being run. This and other work probably will bear out the evidence already found on how ordinary elemental sulfur is changed to sulfuric acid.

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