Alfalfa Hay Quality

leaf shatter loss greatest when hay is handled at low moisture content

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Raking alfalfa hay at the wrong time increases leaf shatter—loss of leaves—and may reduce yield by 20% to 30% which means $8.00 to $12.00 of every $40.00 worth of hay may be left in the field.

The quality of alfalfa hay is determined in a large measure by the degree of leaf shatter because most of the protein, carotene and other nutrients are contained in the leaves.

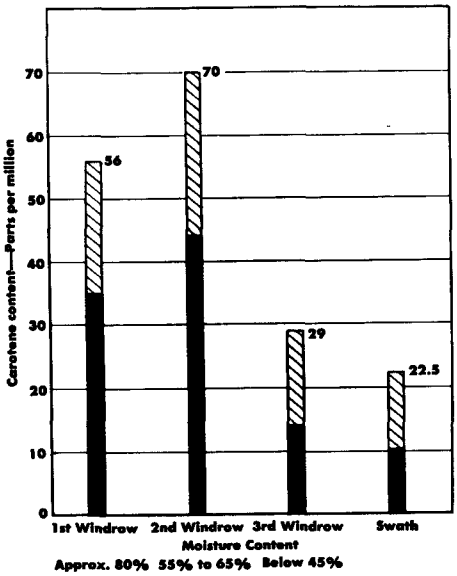
Leaf shatter with its resultant reduction in nutrient content and weight, is most pronounced under conditions of low humidity when the hay is handled at a moisture content below 55%.

A study made on the effect of moisture content on leaf shatter—and of the effect of leaf shatter on hay quality—included laboratory tests of hay cured in the swath and the windrow and correlated with field handling.

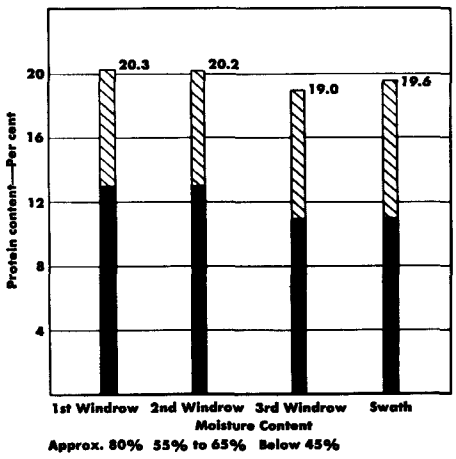
Leaf shatter was determined in a specially built tumbler designed to approximate field handling, particularly raking. All samples of hay received identical treatment to obtain comparable results. Each sample was tumbled for 50 revolutions at a speed of 13 revolutions per minute, and the shattered leaves were collected and weighed.

Samples of approximately 500 grams dry weight, at intervals of 5% to 10% in moisture content, were taken from the swath of freshly mowed hay to the laboratory in wire mesh boxes, and tested.

Leaf shatter losses—as affected by moisture content—increase sharply below 55% moisture content and continued to increase rapidly as the moisture content dropped to about 30% where they leveled off. The moisture content of thoroughly wilted hay is 55% to 65%.



Comparison of carotene retention in hay cured in swath and in windrows. Each column shows the total carotene content, the angle-lined portion, losses due to handling and the black, the residual of the treated sample.



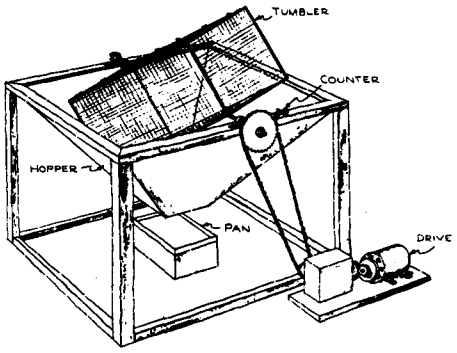
Comparison of protein contents in hay cured in swath and in windrows. Each column shows the total protein content, the angle-lined portion, losses due to handling and the black, the residual of the treated sample.

Above 55% moisture content, the shattered portion consisted mainly of diseased leaves and trash. By the time the total sample was 55% moisture content, some of the leaves—those that shattered—were below 20% moisture content.

Because the leaves dried faster than the stems nearly all were dry when the moisture content for the whole sample was 30%. Almost as many leaves were shattered at 30% as at 15% moisture content.

On the basis of leaf shatter alone, raking should be done above 55% moisture content. Below this, raking should be done in early morning when the hay is tough as a result of high relative humidity or dampness from dew. However, tests comparing morning and afternoon handling below 50% moisture content indicate that early morning handling under conditions of high humidity reduced leaf shatter losses to 5% or below.

Leaf shatter-protein relation was determined by examining the protein content of whole field samples, the remains of the tumbled samples, and the shattered leaves. Protein loss followed leaf shatter loss rather closely since the shattered leaves were high in protein content. Protein loss due to shattering was very low when the moisture content was above 55% but increased rapidly from 55% to 30% moisture content. The whole hay sample dropped about one percentage point—from 21% to 20%—in protein content, because of the necessary handling in gathering samples, and to natural plant processes. However, the remains of the tumbled sample dropped in protein content from 21% to 10.5%, as a result of the leaf shatter caused by the tumbling.



Specially built to approximate field raking to determine leaf shatter the tumbler—2' by 2' by 3'—was made of reinforced hardware cloth, mounted on a frame and equipped with a pan to catch the shattered leaves.

Loss of carotene because of leaf shatter also became important below 55% moisture content. However, loss in carotene resulting from exposure and enzymic action greatly overshadowed the loss from leaf shatter. The green hay contained from 250 to 320 ppm—parts per million. The untreated swath samples contained 22.5 ppm when cured. Even though the carotene content was greatly reduced by exposure and enzymic action, leaf shatter at 30% moisture content accounted for a carotene loss of more than 50%. Below this there was little change in carotene content, indicating that the carotene content of field cured hay would be enhanced by raking above 55% moisture content.

Hay in windrows made by hand at specified conditions, was allowed to field cure until ready for storage. At that time samples from each windrow were subjected to the same tests as the swath samples.

The first windrow was made immediately after mowing, the second at 55% to 65% moisture content, and the third at 40% to 45% moisture content. Samples were also cured in the swath.

When dry, windrowed hay was as much subject to leaf shatter as hay taken from the swath; shattering seemed to result from mechanized handling when too dry rather than from the curing method.

However, proper timing of windrow-

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ALFALFA

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ing does affect the quality of alfalfa hay. Carotene losses as result of leaf shatter are indicated by angle-lined portion of the graph in the first column on page 4 of windrows 1st, 2nd, 3rd and swath. The protein losses are similarly depicted in the graph in the second column on page 4.

The second windrow, made at 55% to 65% moisture content was well above all others in carotene retention. The slower drying of the first windrow retarded the inactivation of enzymes, causing a greater reduction of carotene than in the second windrow. The low carotene content of windrow three and the swath were the results of greater exposure to the elements.

The first and second windrows were highest in protein content, but the third windrow was lower than the swath. Some shatter occurred from hand raking at this lower moisture content, causing a loss of over one percentage point in protein, even though raking was usually done in the morning to minimize its effect.

To compare laboratory results with actual field operations using conventional haying equipment, machine raked windrows of hay made at varying moisture contents were studied. When cured, the hay was baled and weighed for each treatment and the results compared with similar laboratory tests.

Here, again, leaf shatter was low and the protein content high when the hay was raked at any point above 55% moisture content. Raking below that point caused progressively greater damage, except for periods of high relative humidity.

Maximum yield was obtained by raking just before leaf shatter begins, usually about 55% moisture content. Raking when the hay was damp or tough as a result of high humidity was equally effective in the retention of leaves.

Raking immediately after mowing—which is effective on light, mature hay and in areas of exceptionally low relative humidity—may, however, under less favorable conditions reduce yield as much as 3% and prolong the curing period one to three days.

For the least leaf shatter, the greatest carotene and nearly maximum protein retention, plus faster curing, it is recommended from the results of these tests that alfalfa hay be raked between 55% and 65% moisture content.

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The Feed Laboratory Bureau of Field Crops of the California State Department of Agriculture co-operated in the study reported above.

ACARICIDE

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Ovotran has shown a comparatively long residual value and ovicidal—egg-killing—properties against all three species of mites. As it is relatively slow in its kill of adult mites it should be used early—before the adult population is high—or in conjunction with another compound such as TEPP or parathion if used later. It will cause injury in combination with lime sulfur.

Aramite has shown a comparatively long residual value on two-spot and Pacific species of mites but not on European red or Bryobia. It has good ovicidal properties and a rapid kill of adult forms. It is incompatible with lime sulphur, Bordeaux mixture and other strong alkaloids. Its compatibility with sulphur, at first questioned, has now been confirmed.

Sulphenone has been erratic in control in past seasons, but has shown improvement recently probably due to change in formulation. It has only a fair residual value—two or more applications generally being required. High deposits on the foliage and fruit are apparently a necessity.

Genite 923 shows only a fair residual value but has good ovicidal properties though it will cause injury in combination with TEPP. It is not registered for use on apples due to spray injury.

Dimite has shown a long residual value except on European red mite. It has good ovicidal properties and shows a rapid knock-down of adult spider mite. Apparently it is nonphytotoxic at dosages required.

Parathion has shown a short residual and weak ovicidal value though the knock-down of adults is rapid. Several applications a season are usually required. It is highly toxic to humans but residual deposits disappear rapidly which makes it possible to use parathion within 21 days of harvest. Its efficiency is apparently better in the cool period of early season than in the warm days of early summer.

TEPP has shown no residual or ovicidal values. The knock-down of adults is rapid but inadequate without repeated applications. It is often used just prior to harvest in emergencies. TEPP is readily destroyed by alkaline materials and like parathion its human toxicity is high.

Malathon shows a fair residual value generally requiring two or more applications. It is effective against the egg and adult but has had only limited study in California. Its low toxicity to humans makes it much safer to use than other organic.

EPN shows a fair residual value, is a weak ovicide and rather specific as to species controlled. It has shown the most promise on European red mites but requires several applications per season. It is highly toxic to humans.

DN-111 has a short residual value, is weak as an ovicide and has a rapid knock-down of adults. It is not compatible with oil. Its efficiency is best in the early season while temperatures are cool.

Metacide has a short residual and a low ovicidal value and resembles parathion, in toxicity. Control with metacide may require several applications.

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NEMATODE

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75% and class four had 76%–100%. To arrive at the root index each class was weighted by the factor of 0, 1, 3, 5, or 7 for the classes 0 to 4 respectively, then the total divided by seven.

The results of these tests show that the flat treatment was much more effective than any of the row treatments in reducing the root-knot nematode population. Also it is apparent from the root gall examinations that it is not necessary to kill all of the root-knot nematodes in the area to obtain satisfactory growth of plants in fumigated soil.

One difficulty encountered in the row treatments resulted from the undecomposed roots and plant parts which caught on the chisels and disturbed the beds excessively, loosening the soil where the seeds were planted. This could possibly dry out the soil too rapidly and have an adverse effect on germination. In some cases the loose soil resulted in seeds being planted too deep.

Excessive disturbance of the soil probably can be avoided by fumigating at the same time the beds are formed. This would offer the additional safety factor of treatment well before planting time. Further investigations concerning the possibility of phytotoxicity—plant injury—in different soil types and under varying weather conditions are being continued. Fumigation at the time of planting can not be recommended for general use until more information on phytotoxicity is obtained.

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