Circular No. 43 - Feeding Work Horses

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FEEDING WORK HORSES

By

W. E. CARROLL

CIRCULAR NO. 43

Utah Agricultural College

EXPERIMENT STATION

Logan, Utah  September, 1929
UTAH AGRICULTURAL EXPERIMENT STATION.

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IN CHARGE OF CO-OPERATIVE INVESTIGATIONS WITH
U. S. DEPARTMENT OF AGRICULTURE

M. WINSOR, B. S. ........................ Irrigation Engineer
The intelligent feeding of the work horses of the State of Utah would save each year thousands of dollars in feed and prevent sickness and death of hundreds of horses.

In Circular 32 of this station a brief discussion is given of some of the more theoretical aspects of the feeding of farm animals as they might apply in general to all classes of livestock. Consideration is given to such questions as the composition and digestibility of feeds, the uses to which the digested portions are put in the animal body, the calculation and balancing of rations, how to judge the relative values of feeding stuffs, and the characteristics of a good ration.

It is the purpose of the present circular to adapt the general principles there developed to the question of feeding work horses. To avoid unnecessary duplication the elementary knowledge developed in the previous circular concerning the composition of feeds and the calculation of rations will be assumed.

In the circular mentioned the following were given as characteristics of a good ration: The ration should be adapted to the species; it should be palatable; it should be made up with reference to the quality and quantity of the produce; it should have variety; it should be adapted to the system of farming; it should be economical and liberal.

WHAT THE WORK HORSE DOES WITH HIS FEED

The mature work horse uses his feed chiefly for two general purposes. First, to replace the various tissues of his body as they wear out, and, secondly, to supply the energy necessary for his body functions and for the work he performs. Man is primarily interested in only the last of these, though he must feed for both of them in order to realize the one. The feed supplied must therefore contain the raw materials as it were for all the tissues subject to wear in the body. This will be chiefly protein, to repair the muscles, blood, and other protein tissue, and mineral matter for the bones and the various living cells and fluids of the body.

After the repair is taken care of there must be additional material from which the body can get energy with which to do work. This energy can come either from the proteins, carbohydrates, or fats of the feeds. In practice the carbohydrates
are the principal source of this energy, though the other nutrients can also be used.

**FEED REQUIREMENTS OF THE WORK HORSE**

Considerable experimental work has been done on the feed requirements of the horse under different conditions and for varying degrees of work. As a result of a large amount of personal work on this question and a careful study of the results of other investigators, Armsby of the Pennsylvania Station recommends the following feeding standard for work horses.*

*"The Nutrition of Farm Animals," p. 714.

<table>
<thead>
<tr>
<th>Requirements for Work Production by the Horse</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Per Day and 1000 Pounds Live Weight</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Digestible True Protein &amp; Net Energy</td>
</tr>
<tr>
<td>Pounds &amp; Therms</td>
</tr>
</tbody>
</table>
| Full work—8 hours per day                   | 2.0 & 18.2  
| Half work—4 hours per day                   | 1.4 & 11.1  
| One-fourth work—2 hours per day             | 1.0 & 7.6   

This feeding standard gives the daily requirements of digestible true protein and net energy of an average 1000-pound horse under different degrees of work. It shows, for example, that on the average a 1000-pound horse doing 8 hours' work daily should be fed each day a ration containing 2 pounds of digestible true protein and 18.2 therms of net energy. Rations can be calculated in accordance with this standard by reference to the table of composition of feeds on page 11.

The functions of the various nutrients in the animal body, the digestibility of feeds, and the method of calculating rations in accordance with the feeding standard were discussed in some detail in Circular 32 of the Utah Experiment Station, distributed earlier, and hence will not be repeated here.

It will be remembered in general that digestible true protein in the feeds is used in the mature horse chiefly to repair the muscles and other protein tissue of the body. The surplus protein can be used to produce energy. The carbohydrates and fats of the feeds are used to produce energy, and their net result to the body is indicated by their net energy values.

The therm is a unit of measure for energy just as the pound is a unit by which weight is measured.

It should be pointed out that feeding standards represent the requirements of the average animal, but may fall far short of meeting the needs of some particular animal. Success in
Feeding Work Horses

feeding cannot therefore be expected to result from a blind though mathematical adherence to these standards. They must rather be looked upon as guides in feeding which should be changed to fit the individual differences of the various animals under observation.

To those who do not desire to go so far as to calculate rations for horses in accordance with the feeding standard given, a much simpler, though less accurate, method is available. On the average work horses should be fed from 1 to 1.25 pounds of hay and from 0.75 to 1 pound of grain daily for each 100 pounds live weight. If a horse weighs 1400 pounds he would therefore be fed from 14 to 17.5 pounds of hay and from 10.5 to 14 pounds of grain daily while at work.

ADAPTING THE RATION TO HORSES

One of the fundamental characteristics of a good ration is that it should be adapted to the species of animals being fed. In order to adapt a ration to horses as a species some consideration must be given their digestive organs which handle the feed they consume. An examination of these organs and a comparison of them with the corresponding organs of the cow indicate very clearly that the ration of the horse should be of different character from that of the cow.

Cattle and horses do not differ greatly in size and yet between corresponding digestive organs of the two striking differences appear. The stomach of the cow is compound and has four distinct compartments, frequently referred to as four separate stomachs. The total capacity of this compound stomach is 266 quarts. The horse on the other hand has only a single stomach with a total capacity of 19 quarts on the average. Then too the cow after she has once eaten her feed returns it to her mouth for more complete chewing, while with the horse feed once swallowed has no chance for such a second preparation.

The small intestine, which receives the food after it leaves the stomach, has a length of about 151 feet in the cow and 74 feet in the horse. The length of the large intestine of the cow is 36 feet and that of the horse 24 feet. The total length of the intestine of the cow is therefore approximately 187 feet, while the horse has a little less than 100 feet of intestine. The capacity of the small intestine of the two animals is not far different. The large intestine of the horse, however, has an average capacity of 137 quarts, while the large intestine of the cow contains on the average but 40 quarts. The large intestine of the horse is therefore much larger for its length than is that of the cow. The horse thus makes up in this organ a little of what was lost in the capacity of the stomach. In spite of this
much larger large intestine in the horse the total capacity of his digestive tract is only about 224 quarts as compared with a capacity of 377 quarts in the cow. The digestive tract of the cow is therefore much longer and has a much larger capacity than that of the horse.

These differences in the organs which handle and digest the feed are similar to the differences between a hay rack and a set of gravel plank. The one is constructed to handle bulky material while the other is made to haul a heavier and more concentrated product and would be unable to contain enough of the bulky material to make a load.

This evidence seems perfectly clear and can lead to but the one verdict—that the ration of the horse should differ from the ration of the cow because the organs which handle the feed are different, and, further, that the differences must be such as to make the horse ration more concentrated—having less bulk, than the ration of the cow.

FEEDS

Horses have a very wide appetite if we can judge from the feeds they eat in widely different countries. All the hays, straws and fodders, the common grains and seeds, various mill feeds, by-products of nearly every sort and description from potato chips to molasses are fed to horses. In some countries “the leaves of limes and grape vines, the tops of acacia, and seeds of the carob-tree” all find a place in the ration of the horse. In some of the far northern countries dried fish and a vegetable mold are the chief feeds available.

This willingness on the part of the horse to utilize a variety of feeds is no doubt largely responsible for his very great usefulness to man under the most variable and trying circumstances. The Arab fleeing from some enemy on the back of his trusted steed was never forced to prepare and carry along the feed for the horse. If a rest was necessary at a place where no natural feed was available the horse was content to share with his trusted master the biscuit and a few lumps of sugar that he had hurriedly tucked in his bag as the flight began.

In spite of this omniverous appetite when horses in general are considered, the rations fed in any one locality are usually rather restricted as to variety. In the northcentral and northeastern United States timothy hay and oats make up the ration of the majority of horses. In the South corn is substituted quite largely for oats and corn leaves and corn stover replace the timothy. On the Pacific Coast barley is the chief grain fed and cereal hays make up a large part of the roughage. In parts of Europe peas and beans with chopped straw for roughage consti-
Feeding Work Horses

tute the ration. This does not mean that horses dislike a variety, for some very successful feeders use a grain mixture composed of six or eight different concentrates and will feed with this two or three different hays.

Horses, however, do dislike frequent or sudden changes in their ration, and in recognition of this it is advisable to use feeds which are available pretty much the year round. Where changes are necessary they should always be made gradually.

Alfalfa.—In the irrigated sections of the West alfalfa should and does form the basis of practically all work-horse rations. Considerable experimental work has been done at the Utah Experiment Station and others on the comparative value of alfalfa and timothy hays for work horses. Almost without exception the results have been very greatly in favor of the alfalfa hay. Frequently where horses eating alfalfa hay and a grain allowance are making small gains in weight their team mates eating the same kind and amount of grain and the same amount of timothy hay will lose weight. Pound for pound, then, alfalfa hay is superior to timothy for work horses.

Horses like alfalfa hay better than timothy, and because of this more care and good judgment are necessary in feeding it. As explained below, this necessitates limiting the allowance of alfalfa hay to prevent over-eating and the development of digestive troubles which may follow.

Clover Hay.—Not much clover hay is grown in the West, so it will not enter into many horse rations. It is comparable to alfalfa hay in actual feeding value, though much more difficulty is experienced in curing the clover free from dust. Because of this, it is much less liked by horsemen.

Timothy.—As mentioned above, timothy is the standard hay throughout the country. It is a safe hay to feed under all conditions, and in many sections its quality is more uniform in regular feed stables or along freight roads. Because of these two things many horsemen prefer it to alfalfa. Unfavorable weather conditions during haying do not injure its quality to as great an extent as is true of alfalfa.

There is a tendency on the part of timothy growers to let it get too old before it is cut. The late-cut hay is very woody and not nearly so valuable as that cut earlier.

There is a greater tendency for horses to become constipated on timothy than on alfalfa hay.

Grain Hays.—Frequently a crop of oats, barley, wheat, rye, or some other such crop is cut as the kernels are forming and cured as hay. This makes a good substitute for timothy and a good quality of it can be considered of nearly equal feeding value to timothy. As a regular practice, raising these cereals
for hay can hardly be looked upon as economical on the average farm.

**Wild Hay.**—A mixture of grasses frequently grown on low or even swampy lands is cut and cured under the name of wild hay. On the better drained areas reedtop, brome grass, orchard grass, blue grass, and a variety of others frequently grow. If cut at the proper time and well cured, such a mixture makes a very desirable hay, fully equal to timothy. On the wetter soils the growth is too often wire grass, broad leaf, and relatives of these which make a very inferior quality of hay.

**Wild Barley or Foxtail.**—Hayfields of different kinds frequently become infested with foxtail. If seeds of this plant are cured in the hay in very large numbers, they render it practically unfit for horse feed. These foxtail seeds may penetrate the tender tissues of the mouth and even of the digestive tract and cause great inconvenience and even death.

**Oats.**—Oats is the standard grain feed for all horses. Because of its straw-like hull it is a light feed which is easy to digest and this also makes it a safe feed. Horses which are at all used to oats will rarely eat enough of them to become foundered. In addition to these qualities, oats are very palatable which contributes in no small way to making them so successful a feed.

At one time it was believed that oats contained some chemical substance which stimulated life and vigor in horses, but this has been found not to be the case. They are, however, possibly the best single grain, all things considered, that can be fed to horses.

**Bran and Shorts.**—“Mill-run” bran and shorts are used very extensively in work-horse rations in many sections. As a substitute for oats there is possibly nothing better when the value, price, ease of getting and comparative safety are all considered.

Feeding tests at the Utah Experiment Station and others as well have fully established that for horses at slow work (not driving horses) bran and shorts are equal, pound for pound, to oats. These tests were run “in the good old days” on “pre-war” bran and shorts, so it may be necessary to make some allowance for the present-day kind. Even with this change in quality, it is a feed which should find very extensive use in the rations of work horses.

**Barley.**—So far as the United States is concerned, barley is distinctly a western feed. Where it is available there is no reason why it should not form a part of the horse ration. In fact, in many cases it will be the only grain fed. Experiments indicate it to be somewhat less valuable than oats, but the difference is very small.
Feeding Work Horses

The hull does not make up as large a part of the weight of barley as oats, and barley is therefore a rather more concentrated feed and will, because of this, require somewhat greater care in feeding.

Because of the hard, flinty nature of the kernel barley should be rolled or chopped.

Corn.—Corn is not grown to a very great extent in the West, but where it is there is no reason why it cannot form a part of the horse ration. It is a very concentrated feed and should be fed carefully. It is improved if it is ground and mixed with a lighter feed such as oats or bran.

Fed with alfalfa hay it can make up a larger portion of the ration than if fed with timothy or grass hays. This is because corn and the grass hays both contain only small amounts of protein and mineral matter, while alfalfa is comparatively rich in these important nutrients.

Wheat.—Wheat is usually too expensive to feed to horses. Occasionally, however, a crop may be frosted or otherwise rendered less marketable and then can be fed. It too is a concentrated grain and should be fed with care and in not too great quantities. It should be rolled or chopped to prevent too much of it from passing through the horse unused. It should be mixed with oats or bran for best results.

Screenings.—A good grade of wheat screenings is frequently available at a very cheap price. Where this is true they can well be utilized in the horse ration. They should be finely ground to destroy the noxious weed seeds they might contain and thus prevent fouling one’s land when the manure is spread.

Beet Molasses.—This is not very extensively fed to horses even though the numerous sugar factories make it rather easily obtained. It is very laxative and because of this cannot be fed in very large amounts. It has been fed successfully in experimental rations up to 4 or 5 pounds to 1000-pound horses. Fed in amounts up to 2 or 3 pounds it has proved equal to that much grain, and where it made up nearly one-third of a heavy grain ration (15 pounds) one pound of molasses replaced 0.78 pound of grain.

Succulent Feeds.—In this group may be considered corn silage, beet pulp, carrots, and other root crops.

Corn Silage is not used very extensively in work-horse rations. Horses do not like it very well and it is also rather too bulky where they are doing heavy work. It can be used in the winter rations and for horses at light work if the silage is of good grade and it is introduced into the ration very gradually. From 6 to 10 pounds per head daily will usually be found sufficient.
Beet pulp is not a desirable feed for working horses. In cases of shortage of feed, if care is used, it may be fed to some extent. Possibly not more than 10 to 12 pounds should be fed daily. Frequently horses will not eat even this much.

Carrots in small quantities (8 to 12 pounds) can be fed to horses with very good results. They are rather expensive, however, though are good "conditioners" and are well liked by horses. As they are rather bulky they should never make up a large part of the ration. In experimental feeding 350 pounds of carrots replaced 100 pounds of good meadow hay.

Other roots, as sugar beets, mangels, etc., and tubers, such as potatoes, are not especially valuable additions to the ration of the working horses.

Salt.—Salt in small amounts is required by the horse at frequent intervals. A convenient method of supplying this is to keep a lump of block or rock salt in the manger before the horse at all times.

The horse is the most sensitive animal on the farm to dusty, moldy, or spoiled feeds of any kind. Should it ever be necessary to feed these on the farm they should be given to some other class of animals as they are positively dangerous to the health and life of the horse.

PRACTICAL HORSE RATIONS

The following rations are given as examples of rations that have been fed successfully in different sections of the country and should prove about ample for 1400-pound horses doing moderate work.

<table>
<thead>
<tr>
<th>Ration</th>
<th>Alfalfa Hay</th>
<th>Oats</th>
<th>Bran and Shorts</th>
<th>Chopped Barley</th>
<th>Chopped Corn</th>
<th>Oats</th>
<th>Bran and Shorts</th>
<th>Chopped Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18 pounds</td>
<td>11 pounds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>18 pounds</td>
<td></td>
<td>11 pounds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>14 pounds</td>
<td></td>
<td></td>
<td>10 pounds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>18 pounds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>18 pounds</td>
<td>5 pounds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>18 pounds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>12 pounds</td>
<td></td>
<td></td>
<td>5 pounds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>18 pounds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>14 pounds</td>
<td></td>
<td>6 pounds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>18 pounds</td>
<td></td>
<td>5 pounds</td>
<td>5 pounds</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
COMPOSITION OF FEEDS

Table I.—Value per 100 Pounds for the Horse*

<table>
<thead>
<tr>
<th>Dry Matter</th>
<th>Digestible</th>
<th>Net Energy Values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crude Protein</td>
<td>True Protein</td>
</tr>
<tr>
<td>pounds</td>
<td>pounds</td>
<td>pounds</td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td>91.4</td>
<td>10.9</td>
</tr>
<tr>
<td>Red clover hay</td>
<td>87.1</td>
<td>7.2</td>
</tr>
<tr>
<td>Timothy hay</td>
<td>88.4</td>
<td>1.3(?)</td>
</tr>
<tr>
<td>Wheat straw</td>
<td>91.6</td>
<td>0.8</td>
</tr>
<tr>
<td>Oats</td>
<td>90.8</td>
<td>9.9</td>
</tr>
<tr>
<td>Cornmeal</td>
<td>88.7</td>
<td>7.1</td>
</tr>
<tr>
<td>Carrots</td>
<td>11.7</td>
<td>1.2</td>
</tr>
<tr>
<td>Potatoes</td>
<td>21.2</td>
<td>1.9</td>
</tr>
</tbody>
</table>


It is recognized that this list of feeds is short. It, however, includes all the Western feeds whose energy value for horses has been determined.

FEEDING PRACTICE

Regularity.—Regularity is one of the absolute essentials to success in horse feeding. The horse comes to expect his feed at certain times and any variation from this schedule is resented and results in lowered efficiency of the ration.

Common Faults with Horse Rations.—The two most common faults in feeding work horses are the feeding of a ration composed entirely of roughage and over-feeding of certain kinds of roughages when the grain allowance is adequate.

As an example of feeding a too bulky ration might be cited a practice that is fairly common in many sections of the West, especially on farms and ranches—that of feeding horses doing rather heavy work during rush seasons a ration composed entirely of alfalfa hay. A 1400-pound horse doing heavy work should be supplied approximately 19 or 20 pounds of digestible material in his feed each day. To get this from average alfalfa hay would necessitate a consumption of approximately 40 pounds. This amount of hay has a bulk altogether greater than the horse can comfortably carry in his small stomach and do his work at the same time, so it is necessary to give him this amount of food material in a smaller bulk in a form which contains less undigestible waste matter. This can be done of course by restricting the amount of hay and introducing grain into the ration.

The second fault, that of allowing too much hay when grain is being fed, is probably more common and more wasteful than feeding hay alone. This is apt to occur only when alfalfa hay
of good quality is being fed. Good alfalfa hay is very palatable
to horses and when receiving grain they will, if allowed free
access to the hay, eat more than they need and more than is
actually good for them. It is a mistake to keep idle horses or
horses doing only part-time work tied to a manger which is
constantly filled with good alfalfa hay. This practice results in
lazy, dull horses when they are at work and may bring on con-
siderable trouble from colic and other such ailments. Probably
worse still, is the thoughtless and unnecessary waste of hay.

Experiment Station Points the Way.—Some years ago some
work was done at the Utah Experiment Station which throws
interesting light on this question. Horses weighing in the
neighborhood of 1400 pounds were being fed what alfalfa hay
they would eat in addition to 12 to 15 pounds of grain. By
weighing this hay it was found that they were actually eating
from 35 to 40 pounds. Two or three of the horses were subject
to attacks of colic and other digestive troubles under this system
of feeding. The hay was gradually reduced from 35 to 40
pounds down in most cases to less than 20 pounds each daily.
At first the horses did not appear satisfied with this smaller
amount of feed, as might be expected, at least in the beginning.
They did their work, however, even more willingly than when
they were eating more hay. They also maintained their weight
and presented a good appearance, so they apparently got all
the feed they actually required.

One of the very pleasing and beneficial results of the new
system of feeding was that colic and other digestive disturbances
disappeared entirely from the barns. The teamsters all noticed
a greater willingness on the part of the horses and driving
whips also came to be an unnecessary part of the equipment.

Prevention of a Great Waste.—If this great saving in hay
were possible with all the alfalfa fed horses in the West it would
run into millions of dollars each year. Assuming that only one
half of the horses of Utah are being wastefully fed and that it
is possible to effect the same saving that was accomplished at
the Station it would mean a saving of from 150,000 to 275,000
tons of hay each year. With hay at the price it has been the
past winter this represents a money value of almost staggering
proportions—from $4,500,000 to $7,250,000. If a saving of this
size could be effected in the feed of one horse in each ten in the
state with hay at this year’s price the money thus saved would
more than pay the expense of our entire school system.

Necessity of Economy in Horse Rations.—What may be ac-
complished by each farmer in this line may seem small and not
worth the effort. Horse work, however, on the average farm in
very expensive because of the large number of idle days spent
during the year. It is true that these idle days do not require as much feed as the work days, but on many farms horses when not at work will eat more hay than when they spend 8 to 10 hours in the harness. This is of course not true of the winter feeding, but is in many cases of the idle days of summer. A saving of 30 or 40 per cent in horse feeding is an item no farmer can afford to overlook.

Proper Distribution of Daily Ration.—It is not enough that the hay allowance be reduced to the lowest amount necessary, but care is also needed that the total daily allowance be divided properly among the three feeds. Horses that are doing a full day’s work cannot be expected to accomplish this as effectively with their stomachs so full as to prevent deep and vigorous breathing when increased exertion brings the demand. In order to prevent the difficulty mentioned the horse should never be put to hard work just after a bulky meal. This will necessitate feeding most of the hay at night when the horse will be at rest in the stall. A ration composed of 20 pounds of alfalfa hay and 12 pounds of grain should be fed about as follows: An early morning feed of hay—about 5 pounds; after the hay is eaten, 3 pounds of grain; at noon 7 to 8 pounds of grain (no hay); and at night the balance of the hay—15 pounds, and grain—2 to 3 pounds. If a system similar to this is followed the horse will at no time be forced to work on an over-full stomach, and as a result will do his work easier and keep in better condition.

Men frequently wonder why their teams sweat so easily the first hour after noon. The cause too frequently is to be found in the noon meal. A contented horse standing munching hay while he rests is music to the ears of most men and the thought of him standing there with nothing but his feed of grain would not be especially pleasing. On the contrary, however, this is the best preparation that he can be given for the afternoon work. A full stomach makes deep breathing difficult, and when his breathing is thus cut short a horse soon warms up and loses efficiency. On the other hand, the feed of grain will usually supply enough energy in small bulk for the afternoon work and the horse renews his work with no handicap.

Proper Time to Water Horses.—When to, and when not to water horses is a disturbing question to many teamsters. It is a question that is just as important as when or when should not the teamster have a drink. If each driver of horses would look at the question from this point of view less inhumanity would be done the horses. It is true that horses have been trained into certain drinking habits. When the camel (famous for going “a long time between drinks”) is kept for some time where water is readily available, it is necessary in preparing
him for desert travel to withhold water from him a few days to get him to take on the required amount for a long dry journey. Horses may be similarly trained no doubt to take water only at certain intervals, but they probably would enjoy a chance to moisten their lips at other times during the heat of the day.

It is not an uncommon sight to see a man get down from the seat of his plow or mower and go to a keg or spring several times during the half day without even a thought of bringing a bucketful of water to his horses, and he has been riding while they have been doing the work.

Some men strongly recommend watering horses before feeding, others after, while still others will water between the hay and grain feeds. This no doubt is largely a matter of habit. A horse can easily become accustomed to receiving his water and feed in a certain order and he may not even want water at other times during his meal. After a system is once worked out it should be followed closely for farm animals are creatures of very regular habits when conditions will permit.

Some men object to watering after feeding grain for fear the water will wash the grain out of the stomach. Under normal conditions this probably is not likely to occur. And even if it does happen to some extent, it will not be especially detrimental as a small amount of grain will be fully digested without any lengthy stay in the stomach. The humane thing to do seems to be to give the horse an opportunity to drink both before and after eating.

Watering Horses When Warm.—Some caution is necessary in allowing horses access to much water when they are extremely warm. So long as they continue working after the drink there seems to be little danger. Even when going into the stall if they are accustomed to their drink as they come out of the harness very little difficulty will be experienced. At the Station here our horses go directly out of their harnesses to the watering trough and then into their stalls. This is true both at noon and night during all seasons of the year. They very frequently are good and wet too, and we have never had the least trouble, altho our horses as mentioned have become accustomed to this method of treatment.

Winter Feeding

Many farm horses are worked very little during the winter, but they of course must be fed if they are to be available the next summer. It is the necessity of feeding during this idle period that makes horse labor so expensive. Any method therefore that will carry the idle farm horse over the winter at less expense is actually reducing the cost of each hour the horse works during the summer.
Feeds.—Unfortunately the amount of unmarketable feed and by-products that can be fed at little expense to horses on the average farm is limited.

Straw is probably the most generally available of all such feeds. If used intelligently it can be made to go a long way toward keeping mature idle horses over winter. In fact many horses are wintered each year with a straw stack as the sole source of both feed and shelter. Straw from headed grain has a higher feeding value than long straw. Oat straw is more desirable than straw from the other grains. Straws from bearded grains sometimes set up an irritation in the mouth and other tissues which gives trouble.

Straw alone is not a satisfactory feed for horses because it does not move through the digestive tract very rapidly and this constipating effect results in impaction of the large intestine and death in many cases. The danger from this and other digestive disturbances is so great that one can hardly afford the risk involved in feeding valuable horses on straw alone. A small addition of some feed having laxative properties overcomes this danger.

Wheat bran is as widely available as straw. It is mildly laxative and would help to overcome the dangers resulting from feeding straw alone. In addition to the laxative properties the bran supplies protein which is present in straw in only small amounts. The two feeds therefore supplement each other very well. Four or 5 pounds of bran in addition to the straw will be a good insurance against digestive troubles and will keep the animals in better condition than straw alone.

Beet molasses has been fed very successfully with straw as a maintenance ration for wintering mature horses. It is much more laxative than bran and is therefore very effective in overcoming the constipating effects of the straw.

The molasses is best fed by sprinkling it on the straw. It may need diluting with water before this can be done. Three or four pounds of the undiluted molasses can be fed in this way. Molasses contains practically no protein so the straw-molasses ration would be very deficient in this nutrient, though mature horses will survive the winter with no other feeds.

Beet pulp as it comes from the factory wet can be used to overcome the constipating effects of straw. It is not usually very palatable to horses, but they will eat enough of it to improve the straw ration. Fifteen to 25 pounds have been fed to horses, though they usually do not care for more than 10 to 15 pounds. Beet pulp also contains very little protein.

Rough hay, which is otherwise unmarketable, is a cheap feed for wintering mature idle horses. They should be fed only
enough of it to keep them from losing flesh. Bran, beet molasses, or wet pulp should be fed with such hay.

**Hay and grain** must sometimes be fed when no cheap substitute can be had. Under such conditions it is advisable to feed only as much as is absolutely necessary to keep the horses up. Whether grain is to be fed at all and the proportion of grain to hay will depend upon the prices of the two. If grain is relatively cheap it will be profitable to feed it; if not, hay alone should be used.

**Salt** should be kept before the horses at all times.

**Water.**—While on such dry, coarse rations as suggested above it is necessary that horses have access to all the palatable water they will drink, as this will help to prevent digestive troubles. If the water can be directly from a flowing well so it is not uncomfortably cold the horses will drink more. If flowing water is not available and there are many horses being wintered a tank warmer of some sort to keep the water from freezing will be a good investment.

**DETAILS THAT NEED ATTENTION**

"**Bolting**".—Horses as well as people acquire bad eating habits. One which is common to both is the habit of eating too fast. Hay is seldom "bolted" by horses, but grain sometimes is. Horses that have developed this habit are more subject to colic and belly ache because of improper digestion of their feed. A considerable amount of grain under these conditions is lost in the droppings.

The amount that passes thru of course is wasted for it can be of no use to the horse until it has been broken up and made to dissolve in the digestive juices. It may be impossible to break a horse completely of this habit, but he can be pretty well prevented from practising it if a little care is taken. There are two methods about equally effective whereby a horse can be prevented from "bolting" his grain. One is to put several clean, smooth pebbles a little larger than an egg in his feed box and then spread the grain out well. Nosing the rocks around while hunting for the grain prevents him from taking the grain too hurriedly. The other method is to spread the grain rather thinly on a large, smooth clean surface such as a barn floor. This is not so easy as the other, but it is just as effective because considerable time is required to get much into the mouth and the chewing process continues all the time.

**Bad Teeth.**—Bad teeth may be the cause of a horse not properly chewing his feed. If this is the case, grain will appear in the droppings just as when he bolts his feed. A sore or decayed or aching tooth may be so uncomfortable that the horse
will not properly chew his feed. Another frequent cause, especially in older horses, is the way the teeth wear. In the process of wear sharp corners which cut either the tongue or the cheek are frequently produced, and these make eating very unpleasant. If the teeth are suspected a competent veterinarian should be called to examine them and be allowed to apply the needed remedy.

Sundays and Holidays.—Work horses that are laid off Sundays and holidays should be given a feed of bran in place of their regular grain feed the night before the layoff. One or two of the feeds of grain should be omitted on the days of rest and no more than the regular hay ration should be given. The bran mash can be fed either dry or moistened with warm water. It is mildly laxative and gives the horses a little more than the regular clean-out, thus removing any accumulation of waste material that may be in the digestive tract. It is also cooling to the digestive tract, and when fed at intervals, as suggested, is both a feed and a tonic.

One large concern that feeds a number of horses makes a hot bran mash each Saturday night a part of the feeding system. It reports that on Sunday morning there are six loads of manure to haul away, while on every other morning three loads cleans it up. This puts the horse in good condition for his coming week's work.

Azoturia.—If the ration is not reduced on occasional idle days the horse is very apt to develop azoturia or "Monday morning disease" as he resumes work. This is especially true if he starts to work at a trot the first thing in the morning after an idle day on full feed. This disease seems to be a food poisoning brought on by an accumulation of unutilized food nutrients and of waste products in the tissues and blood. If the practice suggested in the paragraph above is followed, this rather common ailment will be completely eliminated.

Changes.—All changes in the ration or the manner of feeding it should be made gradually. Horses are very sensitive to sudden changes and new conditions and digestive troubles are apt to develop if care is not taken in this regard. If a change is necessary in the hay or grain being fed, gradually introduce the new feed while some of the old is still available. The new feed should gradually replace the old in increasing amounts until at the end of a week or 10 days the change has been completed.

New oats should be fed with care and in small quantities or they will scour the horses. They should be introduced gradually at first as recommended above. After they have cured for a certain length of time after threshing this property leaves them.
SUMMARY

1. A tremendous money loss to the farmers of the State results each year from the method of feeding horses now practiced.

2. The mature work horse uses his feed chiefly for two purposes: to repair his body and supply energy with which his body can do work.

3. The feed requirements of the mature work horse per 1,000 pounds live weight vary from 1 pound of digestible true protein and 7.6 therms of net energy to 2 pounds of digestible true protein and 18.2 therms of energy according to the severity of the work he performs. Idle horses require even smaller amounts of feed.

4. The average Western horse doing moderate work receives approximately 1-1.25 pounds of hay and 0.75-1 pound of grain for each 100 pounds live weight.

5. The horse’s digestive organs do not handle bulky rations economically.

6. The horse has a wide appetite, tho for practical reasons the ration of any one horse seldom contains a great variety of feeds.

7. Alfalfa if fed intelligently is the best hay for work horses. Timothy hay is somewhat safer for a careless feeder, tho it has a lower nutritive value. Oats is the standard grain for horses, tho bran and shorts have been found equal in value pound for pound when fed to work horses.

8. When feeding alfalfa hay it is necessary as a safeguard to the health of the horse to limit the amount fed.

9. Most of the hay should be fed at night and most of the grain at the noon feed.

10. Horses should be watered frequently, tho care should be exercises in watering them when they are very warm and tired, especially if they are thru work.

11. So long as horses are at work winter feeding will not differ from feeding during the summer. Horses that are idle during the winter, however, should be fed on cheap rough feeds.

12. Horses should be prevented from “bolting” their grain.

13. Give a bran mash the night before holidays and cut down the feed when the horses are at rest.

14. Regularity is important to success. Sudden changes in ration should be avoided.