

S75  
.E76

Extension Bulletin No. 114

March, 1931

## SUGGESTIONS FOR BETTER PASTURES IN MICHIGAN

---

E. L. ANTHONY, H. C. RATHER, AND  
C. E. MILLAR

---



MICHIGAN STATE COLLEGE

---

EXTENSION DIVISION

---

R. J. Baldwin, Director

Michigan State College and U. S. Department of Agriculture co-operating.  
Printed and distributed in furtherance of the purposes of the cooperative agricultural extension  
work provided for in the Act of Congress, May 8, 1914.

SUGGESTIONS FOR BETTER PASTURES  
IN MICHIGAN

W. J. BOYNTON, JR.  
Michigan State University

MICHIGAN STATE UNIVERSITY

EXTENSION DIVISION

East Lansing, Michigan

## **Suggestions for Better Michigan Pastures**

E. L. ANTHONY, H. C. RATHER, AND C. E. MILLAR

More than one-third of the improved farm land of Michigan is devoted to pasture. Pasture, although occupying a large percentage of the farm land of the State, is the most neglected and ill attended of the farm crops. Pasture has too often been looked upon as just a waste land crop which was of but little value, returned but little income, and deserved but little time or attention in the farm program. There has been a prevailing opinion that lands put to pasture would not yield returns commensurate to the value of the land or to the returns secured from other crops.

While this is undoubtedly true of much of the pasture land of Michigan as it is handled today, yet it need not be true. Pasture land must be considered a part of the farm. Its value must be considered and it should be made to return its true part of the total farm receipts. Pasture land has too long been undervalued, and, for this reason, has been subject to abuse and neglect.

Fortunately, there has been recently a steadily growing return of interest, especially among Michigan dairy farmers, in the possible receipts from good pastures which receive proper attention.

### **THE PLACE OF PASTURE IN THE FARM PROGRAM**

Pasture is the natural feed for most of the livestock kept on Michigan farms today. It is one of the best feeds for our livestock, especially our dairy cows, and it is also one of the most economical sources of feed nutrients. Farmers of Holland, where land is worth better than \$1,000 per acre, have long recognized this fact and much of their high priced land is no longer farmed but is kept in the finest of pastures. The dairymen of Holland are aware of the economy of pastures as a source of feed for their cows and have long since been convinced that not their poorest land but their best land should be kept in pasture. They have found by experience that such high priced land, when used as pasture and given careful intelligent care and handling, yields returns comparable to and often in excess of the returns secured from other farm crops which might be grown on this high priced land.

#### **Pasture a Cheap Feed**

Pastures furnish the cheapest feed. The pasture for one cow for one day costs from 3 to 10 cents. A day's ration of hay and silage costs from 12 to 15 cents. Grain costs from 12 to 15 cents a day.

A survey recently completed in six dairy counties in New York State<sup>1</sup> shows that the average cost of pasture during the grazing season is about 9 cents per day per cow, while for these same cows stable fed the cost is about 38 cents per day. It is safe to say that it costs three or four times as much to feed a milk cow in the barn as to feed her on good pasture. A good pasture during the pasture season will replace all the hay and silage and much of the grain in the dairy ration. Evidently, the most profitable way to keep dairy cows is to have an abundance of good pasture all summer.

### **Lengthening the Pasture Season**

Too frequently, the pasture is just a flush or June grass pasture giving an adequate supply of pasture only a few weeks of the pasture season. After this flush is over, cows are unable to secure an adequate supply of grass for milk production, and must be given supplementary feed most of the summer. Lengthening the pasture season is an important measure for Michigan dairymen. If the same economy of feeding could be secured for the whole pasture season as is supplied by June pasture, it would add much to the profits of milk production. The pasture season can be lengthened both ways by a little properly directed effort.

### **Early Spring Pastures**

When the supply of stored feed runs low in the spring, cattle are often turned on pasture when the pasture has too little growth. This is repeatedly done in every section of the State even by dairymen who use good methods except for this one fault. It is poor management. As the result of this practice, the grass is eaten off as fast as it grows, it has but small value as a food, and the yield of pasture for the entire year is reduced. The land, pasture, and cattle suffer. A solution to this problem is to have some special early pasture on which to turn the dairy cows for a few weeks. For such early pastures, in Michigan, sweet clover or rye and vetch are to be recommended. The seeding of a few acres of rye and vetch in the fall will provide early pasture for several weeks before the regular native or permanent pasture is ready to use. If early supplementary pastures cannot be provided, it is better to continue to stable feed a few weeks longer and give the pastures a good chance to be well started. The extra feed used will more than be returned in better grazing after the pasture is ready.

### **Late Summer and Fall Pastures**

If the greatest amount of feed is to be secured during the summer season, it is necessary that thought be given to providing adequate pasture from the time the flush is gone from the June pasture until the grass starts again after the fall rains.

The use of temporary pastures to supplement regular pastures at this season of the year is rapidly gaining favor in Michigan. Sudan grass makes a very satisfactory supplement for this season. It is a

<sup>1</sup>Farm Economics Cir. 43, Cornell University.

very quick growing crop, especially resistant to dry weather, recovers quickly when eaten off, and is not easily uprooted or injured by tramping. If planted at the proper time, it is available about the middle of July and furnishes a very fine heavy pasture throughout the last of July, August, and early September. It is being used by many dairymen in the state and has been tried by the dairy department of Michigan State College with very satisfactory results. Sweet clover also makes a satisfactory supplementary pasture for summer and fall use. Sweet clover has assisted in improving the efficient production of dairy products on many Michigan dairy farms. Records reported through the Dairy Herd Improvement Associations show many instances of the value of this new pasture crop. A herd of 10 cows on which records were kept in 1926 when these cows were on common bluegrass pasture with a little grain being fed showed a production of \$87.75 less butterfat than the following year when they were kept on sweet clover pasture during a prolonged drought in the summer.



### Pasture Must Be Abundant

A milking cow must have plenty of feed if she is to continue to keep up the milk flow. It has been estimated that the maximum amount of pasture grass the average dairy cow will consume in a day is about 80 to 100 pounds. This is sufficient to maintain the body and produce about 20 to 25 pounds of milk per day. The following table shows how many pounds of the different green feeds are necessary for a thousand pound cow to maintain her body and give 40 pounds of 3.5 per cent milk or 30 pounds of 5 per cent milk.

160 pounds alfalfa before bloom
103 pounds clover in bloom
131 pounds sweet clover
90 pounds Kentucky bluegrass.

Pasture must be heavy, luscious, and readily available to make it possible for a cow to gather this much grass. A dairy cow should be able to gather her maximum capacity in not more than two or three hours grazing. To do this, pasture must be so heavy and abundant that the cow can actually bury her muzzle all the way to her eyes in fine succulent grass all the time. Unless a cow can get her requirements in a few hours grazing she will not produce economically or hold up her milk flow. The dairy cows that are in milk must also be kept on pasture near to the barns, as a heavy milking cow should not be expected to have to travel far to pasture or cover much territory while grazing. This means of course more abundant pasture on less ground which is near at hand.

### **Rotational Grazing**

The advantages of the system of rotational grazing are as yet but little appreciated by American dairymen. This idea was first used in Germany and has come to be known generally as the Hohenheim System. Under this system, the available pasture is divided into paddocks or small lots by temporary fencing and the livestock is moved from one lot to another to give each lot a chance to rest and recuperate between periods of grazing. Grazing is started when the grass has a growth of three or four inches. This system is very popular in Europe, in fact is but an adaptation of the old tethering practice which has been in use in northern Europe, in Holland, and Denmark for many years. It is now gaining favor in America. There is much evidence from sections where rotational grazing has been tried to indicate maximum carrying capacity when pastures are so handled and for the dairymen short of pasture land such a system should be very desirable.

On a real intensive scale, the procedure on each lot would be as follows:

1. Pasture plot heavily with milking cows for three or four days.
2. Turn in dry stock to clean up rough feed.
3. Mow off rank growth not consumed.
4. Run chain harrow over lot to spread droppings.
5. Let lot rest for two or three weeks until grass has regained growth.

The carrying capacity will of course depend upon the fertility of the soil and the type of sod or turf. It should take a herd of 10 cows three or four days to clean up an acre of good grass with a four inch start. Where rotational grazing is practiced the first grazing should be a light one. Grass plants must have a chance to develop leaf and root. The advantages of this system are that it provides a luxuriant heavy growth of grass rich in protein, confines the cows to heavy grazing on a small area, and allows the grazed land a chance to recuperate after each grazing. Some extra lots should always be set aside against unfavorable weather or growth. These may be used for hay if not needed for pasture.

## PASTURE PLANTS AND MIXTURES FOR MICHIGAN

To furnish abundant and nutritious pastures, the plants or mixtures used should conform to as many of the following qualifications as possible:

1. Plants must be palatable and appetizing to livestock.
2. They should be high in feeding value.
3. They should stand tramping and should recover quickly from the affect of close grazing.
4. They should yield well.
5. Drought resistant plants for summer pasturage are highly desirable.

### Alfalfa

It has become increasingly common for Michigan farmers to pasture old alfalfa stands and no crop furnishes a more nutritious pasture than alfalfa. This crop is being used for pasture at the Michigan State College for all classes of livestock. As a hog pasture it has no superior, while cattle, horses, sheep, and poultry all use it to good advantage.

In the case of cattle and sheep, precautions should be followed which will minimize the danger of bloat. Avoiding alfalfa pasture when wet with dew or rain, especially when the livestock are unaccustomed to it, is the most important of these precautions. Most farmers who have been successful in pasturing alfalfa see that the cattle have a good feeding of dry hay before they are first turned into the alfalfa. For a time, the animals are only permitted on the alfalfa two or three hours a day. When they are thoroughly accustomed to the alfalfa, they may be permitted to graze it continuously.

From the standpoint of the alfalfa, it is important to avoid over grazing. If the plants are kept closely grazed, they have no opportunity to build up root reserves and consequently the stand will be thinned out severely and the plants will be much more subject to winter injury. It is particularly important that grazing be light during the late summer and fall so the alfalfa may go into the winter with a six to ten inch growth which tends to hold snow and to fortify the stand against winter killing.

Where alfalfa is being sown with a view to pasturing it with sheep or cattle, it may be well to add five pounds per acre of orchard grass or timothy to the usual alfalfa seeding. It has been the experience that such a mixture is less likely to cause bloat.

### Sweet Clover

Sweet clover has justly come into wide favor as a pasture crop for cattle and sheep. It has great carrying capacity, especially during the early months of its second year, and, because of its high protein content, it is an excellent milk producer and a splendid feed for young growing stock.

Sweet clover is apparently less likely to cause bloat than is alfalfa or red clover. Its principle objection lies in its distastefulness to live-

stock unaccustomed to grazing on it. This usually can be overcome with but little difficulty if the animals are confined to it and forced to eat it for a few days. Once an appetite for sweet clover is acquired stock eat it readily.

Most sweet clover seedings are made in early spring with wheat, oats, or barley. On very fertile soil, seedings made directly with oats or barley are likely to get as high as the grain and cause difficulty in curing the grain at harvest time. Under such conditions, it is better to sow the sweet clover just as the oats or barley is coming up. The rate of seeding is 15 pounds per acre.

Sweet clover requires plenty of lime in the soil and this is also true of alfalfa. If there is plenty of rainfall following the removal of the nurse or companion crop, the sweet clover will furnish a moderate amount of late summer and fall pasture in its first season. During its second season, which is also its last, sweet clover makes a very rapid growth during the spring months and should be pastured as nearly to capacity as possible. Blossoming starts in June and if the plants are too large at this time they become woody and less palatable.

Early blossoming dwarf sweet clovers such as the Grundy county and Essex dwarf varieties have a shorter period of time when they are most desirable for pasture than the common biennial white variety, consequently the latter strain is to be preferred.

Many growers are finding it desirable to supplement sweet clover with a more carbonaceous pasture such as Kentucky bluegrass, timothy, or Orchard grass either in mixture with sweet clover or in separate accessible fields. Livestock which are pastured exclusively on sweet clover crave dry feed and it is a good plan to let the stock have free access to an old hay or straw stack when being so pastured.

### **Sudan Grass**

One of the most desirable emergency or one-season pasture crops is Sudan grass. Sown the latter part of May or the first of June, Sudan grass should be ready for pasture the first of July. It will then furnish pasture until it is killed by frost in the fall. When severely frosted, Sudan grass should no longer be pastured as the injured plants may contain sufficient prussic acid to be poisonous.

Sudan grass is drought resistant and was used to great advantage for both sheep and dairy cows on the W. K. Kellogg Farm of Michigan State College at Augusta during the very dry summers of 1929 and 1930. During these dry seasons and on the sandy soil on which it was grown at this sub-station, Sudan grass furnished considerably more pasture for sheep than did rape.

Sudan grass may be seeded with an ordinary grain drill set to sow two pecks of wheat per acre. The drill will then sow 20 to 25 pounds per acre of Sudan grass seed.

### **Rye and Vetch**

Rye or rye and vetch are particularly desirable for late fall and early spring pasture. When thus used, the rye and vetch relieve other pastures from severe grazing in the late fall and early spring. It is particularly important that heavy early spring grazing be avoided on



regular pastures until the grasses have a start of several inches growth. Thus rye and vetch relieve permanent pastures when that relief is most needed and they may still be used for a fair grain crop or for green manure. When rye is sown alone for pasture, it should be seeded at two bushels per acre. The mixture consists of one bushel of rye and 20 to 30 pounds of vetch. Seeding should be in late August or early September.

### Reed Canary Grass

Experiments in Oregon and Minnesota have indicated that reed canary grass makes one of the most desirable marsh land pastures. Preliminary work with this grass is under way in Michigan and it looks promising. It is a coarse stemmed, broad leaved perennial which grows in marsh lands and will stand wet conditions and moving overflow even in the growing season. Old stands of the grass form a dense turf which will carry livestock. It is said that this grass also yields well on upland soils if supplied with plenty of moisture for spring and early summer growth.



The analysis of reed canary grass is comparable to that of timothy though the hay is somewhat inferior to timothy in feeding value.<sup>1</sup> However, it is quite palatable and under Oregon conditions one acre of good reed canary grass will furnish fresh feed for four dairy cows for seven months.<sup>1</sup> Similar experiments have not yet been tried in Michigan.

The principle objection to reed canary grass at present is its high seed cost. With this in view farmers who wish to try it out may well start with an acre or two using five to eight pounds of seed per acre. Thin stands will gradually improve under good conditions.

<sup>1</sup>U. S. D. A. Farmers Bulletin No. 1602.

### Pasture Mixtures

In many instances, the seeding of a mixture of pasture grasses and legumes is desirable, particularly where the field is to be left for permanent pasture. Established sods can better and more quickly be improved by proper fertilization than by breaking the land up and reseeding. The fertilizers to be used will be discussed in another part of this bulletin. However, where land is not already in sod and it is desired to establish a permanent pasture several mixtures of crops adapted to pasture purposes may be used.

### Moist Meadows

Where the land intended for permanent pasture is moist, such crops as red top and alsike clover are especially well suited. Red top is as winter hardy as timothy and stands hot weather even better. Both red top and alsike clover will grow vigorously on very wet soil. When the price of seed is not prohibitive, meadow fescue may well be added to this mixture. Meadow fescue is more palatable than red top. It begins its growth real early in the spring and continues until late fall. It will endure well for five or six years in a pasture mixture but does best the second and third years.

When the land is only moderately moist, timothy may well be employed in the mixture. Its quick start is valuable in making the meadow available for pasture early but, eventually, particularly when pastured in early spring, the timothy will be supplanted by other grasses.

Recommended mixtures are:

#### For Moist Meadows

Alsike clover .....	4 lbs. per acre
Red top .....	8 lbs. per acre
Meadow fescue .....	10 lbs. per acre

#### For Moderately Moist Meadows

Alsike clover .....	4 lbs. per acre
Red top .....	8 lbs. per acre
Timothy .....	8 lbs. per acre

### Upland Soils

On well drained, fertile upland soils, crops of which plenty of the cheaper native grown seed is available may be relied upon to give satisfactory results. These will start quickly and last for several years after which, if the fertility is properly maintained, such volunteer crops as Kentucky bluegrass, frequently called June grass, and white clover will come in and form a dense turf without the expense of seeding. Thus on a well drained fertile loam not acid in reaction a mixture for seeding might well be:

Timothy .....	6 lbs. per acre
Red or Mammoth clover .....	3 lbs. per acre
Sweet clover .....	3 lbs. per acre
Alfalfa .....	5 lbs. per acre

Soils which are less fertile and which are acid in reaction will never yield as much pasture as they should until the acidity has been corrected with lime and proper fertilizers have been added. However, until these adverse conditions have been corrected a mixture such as the following might be used:

Red top .....	4 lbs. per acre
Timothy .....	6 lbs. per acre
Alsike clover .....	4 lbs. per acre
Red or Mammoth clover .....	3 lbs. per acre

In case the seed of Kentucky bluegrass or white clover is low priced, four or five pounds per acre of the former and one pound per acre of the latter may well be added to the above mixture.

On sandy soils inclined to be droughty, brome grass at five to ten pounds per acre would make a good addition to the pasture mixtures given above. While brome grass prefers fertile loams it does better on lighter soils than many other grasses and in drought resistance it compares favorably to alfalfa. It is well liked by livestock and is slightly higher in protein than Kentucky bluegrass.



Where there is considerable shade in the pasture, orchard grass may be included in the mixture at five pounds per acre. Alone it is usually seeded at about 20 pounds per acre. Orchard grass thrives in shade and, due to its habit of growing in large tussocks, it prevents washing on sloping ground. By analysis, orchard grass appears more nutritious than timothy. However, it is quite coarse and not so palatable as brome grass or Kentucky bluegrass. Since it is a bunch-grass its best place is in a mixture.

### Reseeding in Old Meadows

Old pastures can be improved by proper liming and fertilization and by a certain amount of reseeded. On soil containing enough lime for sweet clover, the grass may be burned off or the land disced so seed will come in contact with the soil; then sweet clover seed may be sown during the alternate freezing and thawing period of the spring. The sweet clover not only furnishes pasture itself but adds nitrogen to the soil and stimulates the growth of other grasses. Graber<sup>1</sup> reports that in Wisconsin sweet clover, thus handled, more than doubled the yield of the bluegrass in the pasture. Wherever reseeded of old meadows with any crop is practiced, it is important to see that the seed makes soil contact.

### Maintaining a Good Pasture

After a good pasture has been secured, either as a permanent native pasture or as a rotated pasture, the problem of maintaining it is an important one. Aside from the difficulties due to improper handling such as over grazing, too early and late grazing, or other causes which have already been mentioned, many pastures produce but little return because of lack of adequate supplies of available plant food. It is often not realized that the soils of most pastures are not new. Land that has been grazed continuously for several years has had much of the available fertility removed in the sale of meat and milk produced upon it. This constant drain, though slow, is one of the reasons that pastures which have received no attention are not producing as in former years. It is not often appreciated that a herd of 20 milking cows of average production will in 30 grazing seasons remove better than 11,000 pounds of phosphoric acid from the soil. Other fertilizing elements are removed in like proportions. The supplying of proper food for the pastures is a fundamental thing in good pasture management.

## FERTILIZATION AND LIMING OF PASTURES

Experience has taught the error of the idea, sometimes advanced, that land which is heavily pastured is resting and that its fertility is increasing. On the contrary, the gradual thinning of the sod and the resulting decrease in yield of forage on land which is in permanent pasture and the equally serious decrease in nutritive value of the grass is a matter of record.

Many experiments have demonstrated that depleted pastures may be rejuvenated by proper fertilization; very decided improvement is obtained during the first season and further desirable changes occur in following years. Some of the most pronounced results arising from the use of fertilizer and lime on pastures are:

1. Grazing from one to two weeks earlier in the spring.
2. Grazing later in the fall.
3. A much increased carrying power.

<sup>1</sup>L. F. Graber—"Evidence and Observations on Establishing Sweet Clover in Permanent Bluegrass Pasture." Jour. Am. Soc. Agron. Vol. 20, No. 11, p. 1203, 1928.

4. A more nutritious feed due to increased protein and mineral content.
5. Cattle enter the fall in a much better condition.
6. A considerable saving in feed costs.

### **Pastures Which Should Be and Those Which Should Not Be Improved**

Pasture improvement by means of fertilizer and lime should be restricted to pastures on good soil. The recommendations which follow are made from this point of view and are not applicable to pastures on soils such as: 1, Thin rolling land; 2, poorly drained areas; 3, very sandy or droughty soil, and 4, heavily wooded land where shade inhibits a good sod.

Fertile soils which are too stony to plow may be fertilized for pasture purposes and this is also true of cut over land from which the stumps have not been removed if there is not too heavy growth of brush. One of the greatest opportunities for pasture improvement is in the case of fields, used in the regular rotation, which have been seeded and set aside for pasture for a period of two or more years. Muck land which is sufficiently well drained to serve for pasture purposes for a considerable portion of the growing season offers an unusual opportunity for pasture improvement. It is assumed in all cases that the land carries a fair to good sod. If it does not, reseeding is advisable.

### **Analyses of Fertilizers to Use On Mineral Soils**

As mineral soils are almost universally deficient in available phosphoric acid this plant food element should be the predominating one in the fertilizer mixture. The fact that phosphoric acid is a constituent of each cell in the animal body and is especially important in bone formation indicates its significance in growth, reproduction, and milk formation and also shows the importance of phosphorous-rich feed.

An early spring and late fall growth, giving early and late grazing, is an important consideration. Nitrogen is the element which is especially effective in stimulating growth but its rate of availability from the soil supply is slow when the soil is cold, as is the case in early spring and late fall. It is advisable, therefore, to include a reasonable percentage of readily available nitrogen in the pasture fertilizer.

The formation, in the grass, of starch, sugar, and similar compounds is influenced by potash. Potash also tends to give a well-balanced growth of disease-resistant, palatable grass. Fertilization with potash, especially when accompanied with phosphate, encourages the growth of white clover in pastures. Experiments have demonstrated that additional potash is needed for an improved pasturage on practically all types of soil, with a somewhat higher percentage on soils of a sandy nature.

Experimental work shows that fertilizers of approximately a 5-10-5 analysis are quite well balanced for pastures on many Michigan soil types. A somewhat earlier spring growth, resulting in the pasture being available for use somewhat sooner, may be obtained by increas-

ing the nitrogen percentage. Under a very intensive grazing system where early pasturage is of considerable importance, a 10-10-5 fertilizer is advisable. This is especially true where the pasture is divided into paddocks which are grazed in succession as suggested earlier in this bulletin.

### **How Much Fertilizer to Apply and When\***

Considering the reduced feeding costs resulting from an improved pasture and the fact that a heavily grazed pasture is an intensive type of farming from the standpoint of plant food removed from the soil, heavy fertilization is both advisable and economical. Experimental results suggest that not less than 300 pounds and preferably 500 to 1,000 pounds per acre of the complete fertilizer should be applied from four to five weeks before it is desired to turn the stock on the pasture in the spring. In case the larger quantities are used, the application need be repeated only every second or third year. In the years when the complete fertilizer is not applied, an early spring top-dressing of 80 to 100 pounds of sulphate of ammonia or an equivalent quantity of other carrier of available nitrogen should be made. If the smaller application is used, it should be repeated annually or every second year at least. For pastures handled in an intensive grazing system, the larger applications are recommended.

Provision should be made to permit the removal of stock from a pasture when the grass is grazed down to within one or two inches of the crown. Overgrazing is one of the surest and quickest ways of thinning the sod, of bringing in weeds, and of causing the pasture to deteriorate. When the animals are taken from the pasture, an application of from 80 to 100 pounds of sulphate of ammonia or an equivalent quantity of other equally available and economical nitrogen fertilizer should be made.

### **Liming**

In the case of mineral soils which are very strongly acid, an application of from one-half to one ton of lime per acre is recommended. Heavier applications are not advisable since lime applied to the sod penetrates the soil slowly and only to shallow depths. If the soil is only slightly to moderately acid, liming is not recommended.

### **Analyses of Fertilizers to Use on Muck Soils**

Medium and deep mucks which do not show a very strongly acid reaction and hence are classed as high-lime mucks, are more in need of potash than of any other plant-food element. In some cases, experiments in fertilizing various crops on muck have shown that potash is the only fertilizer needed. On such fields, an application of from 75 to 150 pounds of muriate of potash in the spring is all the fertilization the pasture will need. In many instances, however, mucks of this type

\*Pastures should not be fertilized while stock have access to them as some fertilizers are poisonous when eaten in considerable quantity. Rains wash the fertilizer from the herbage and into the soil.

require some phosphate in addition to potash, and a 0-8-32 fertilizer gives better results than potash alone. In case there is no definite evidence that the muck does not need phosphate, it will be better to use the 0-8-32 or similar fertilizer, at the rate of from 100 to 200 pounds per acre.

Shallow mucks of the high-lime type require somewhat more phosphate in proportion to the potash and hence a 0-8-24 or similar mixture at the rate specified above is recommended.

Low-lime mucks, or those which are very strongly acid, will carry, in most cases, a light sod and little can be done to improve the growth of grass. To obtain a good pasture, it is advisable to lime heavily and to produce one or two crops before seeding grass on the muck. A fertilizer containing both phosphate and potash, and for immediate results, nitrogen, is advisable. A 3-9-18 is satisfactory. As the lime takes effect, making the nitrogen in the muck more available, it will be possible to omit the nitrogen from the fertilizer, using a 0-8-24. From 100 to 200 pounds of fertilizer per acre is a reasonable application.

In fertilizing pastures on muck soils, it is necessary that the fertilizer be applied each year in place of once in two or three years as is recommended for mineral soils.

#### **Fertilizing Meadows for August Pasturage**

One method of obtaining mid and late summer grazing is to fertilize, in early spring, at least a portion of the meadow with complete fertilizer, as recommended for pastures on mineral soils. The hay should then be cut very early and an application of available nitrogen made at once. Unless very severe drought conditions prevail, the new growth should provide much valuable grazing during the latter part of the summer.

#### **Fertilizing Alfalfa**

Established stands of alfalfa which are to be pastured, or cut for hay, on the heavier sandy loams, silt loams, and clay loams will make a profitable response to an application of a fertilizer containing abundant phosphate with lesser quantities of potash such as a 0-14-6. Not less than 300 pounds to the acre and preferably more should be applied early in the spring before growth starts. On the sandier soils, the same quantity of fertilizer containing equal parts of phosphoric acid and potash, as a 0-14-14, is advisable.

#### **Fertilizers For Sweet Clover**

Sweet clover requires the same fertilization as alfalfa. In case the clover is seeded in a small grain, the fertilizer should be worked thoroughly into the soil before sowing the grain. When the sweet clover is seeded alone, the fertilizer may be applied shortly before seeding and worked into the soil. It is important in applying fertilizer for new seedings of either alfalfa or sweet clover to work the plant food into the soil to a depth of several inches. When the soil is acid, lime should be applied and worked well into the soil as far in advance of seeding as possible.

### **Fertilizers For Annual Pastures**

When Sudan grass, rye and vetch, rape, and other annuals are seeded for pasture purposes, an application of fertilizer will result in a more vigorous growth and in the production of a more nutritious forage.

### **Conclusion**

The facts that more than 5,700,000 acres are devoted to pastures of some kind in Michigan today, that pastures furnish us with the most economical source of feed nutrients for milk production, and that pastures, when properly handled can make returns comparable with other farm crops, should be sufficient to cause a very careful study to be made by livestock and dairy farmers of the possibilities of better pastures for Michigan.