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SOILING CROPS FOR MILK PRODUCTION

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SUMMARY.

1. During a large part of the summer, pasture does not provide sufficient succulence for dairy cows in Iowa.
2. A system of partial soiling may be used with success in this section.
3. Soiling will support more cows on a given area than will any other system of cropping and less concentrated feed will be required.
4. The average of seven years work at this station indicates that 42 cows may be kept during the summer months on 20 acres of pasture and 12 acres of soiling.
5. The increase in wages paid farm labor adds greatly to the cost of producing soiling crops.
6. The yield of soiling varies with the season and crop.
7. Climatic conditions largely determine the best time of harvesting and the length of the period of availability.

SOILING SUGGESTIONS.

1. For Iowa a system of partial soiling, because of the relatively high cost of labor, the general availability of pasture, and the difficulty of maintaining a succession of green crops, is more practicable than a system of complete soiling involving dry lot feeding.
2. Success in soiling depends on obtaining a proper sequence of succulence.
3. Provide at least two or three crops in the soiling system, as this gives variety to the ration.
4. Grow as many legumes as possible.
5. Where silage is not available soiling should be used to supplement scanty summer pastures.

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SOILING CROPS FOR MILK PRODUCTION

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Rapid increase in the price of grains and concentrates, used in feeding dairy cows for milk production, has quickened the interest of dairymen in the feeding problem. The urgent demand for human food has resulted in a more extended use of cereals for that purpose, a practice which has limited quite largely the quantities of grain available for live stock feeding. The curtailment in the use of grain demands that more reliance be placed upon roughages in the ration in order to supply the nutrients required by heavy producing dairy cows. The importance of leguminous hays and corn silage as a basis for any satisfactory winter ration, which has for its purpose the stimulation of the dairy cow to her most economical production and the efficient saving of grain, has been amply demonstrated. However, the practice in so far as summer feeding may be concerned, is more varied.

It has long been realized that the pastures on most Iowa dairy farms do not supply an abundance of feed for the cows during the hot dry summer months. The problem of supplying this extra feed most satisfactorily may be solved through following one or more of the methods here enumerated.

1. Use of larger pastures.
2. Use of larger quantities of concentrates.
3. Use of summer silage.
4. Use of soiling crops.

Larger acreages of pasture land are not always available, though with better care and more thorough management larger quantities of succulent feed may be obtained from the same area. As the land rises in value, however, the cost of feed secured from pastures increases very considerably and this increase is neither sufficient in itself nor always available when needed most and thus dairymen find it a profitable practice to supplement their pastures in the majority of instances. In view of the wide shortage of grain, the heavier feeding of concentrates should be discouraged wherever suitable substitutes may be grown. Experience has indicated that the feeding of grain is usually the most expensive manner by which the deficiencies of pasture may be remedied. It is also essential to use the entire crop rather than merely the grain and thereby save a goodly percentage of the total food value produced on the farm.

Supplying green feed is the most satisfactory method of maintaining the flow of milk during the summer when pastures are short; and the green feed may be in the form either of corn silage or of crops especially adapted for soiling purposes. As agricultural methods became more intensified with the attendant greater importance of dairy farming, larger yields per acre must be secured. Pastures will be more largely supplemented by green feed, since much larger quantities of feed may thereby be grown per acre. This will bring about the growing and cultivation of those crops capable of returning the largest yields of palatable and nutritious feed.

ADVANTAGES OF SOILING.

Soiling for dairy cows may be partial or complete, depending upon the availability of pasture. As a supplemental green feed to be supplied in conjunction with pasture, soiling possesses several distinct advantages. Through the utilization of soiling the production of digestible nutrients per acre is increased from three to five times over that produced by pasturing. This is brought about largely by the maturing of soiling crops which permits of larger production. The tramping of stock on pastures, especially during rainy weather, leaves the soil in poor condition, while with soiling crops if the seed bed is carefully prepared the soil will be in excellent condition. The tramping also directly stamps out considerable grass, while the fouling by manure is another source of waste. The operation of these factors makes it possible through soiling to secure larger yields than is true under pasture conditions.

Soiling tends to increase the average production of the milking herd. By furnishing an abundance of palatable, succulent, and nutritious feed at a time when pastures are short, milk production is stimulated. Thus the serious decline in milk production which usually occurs during midsummer is largely eliminated. The production is favored since the cows have at all times an ample feed supply without which maximum yields are impossible. Soiling also contributes variety to the summer ration as the different green crops mature and are fed to the cows, which is a most important factor with high producing animals. Because of the available feed given, the cows are also kept in better physical tone and in a higher condition of flesh which will augur well for the future production of the herd after the soiling period has closed. The health of the animals is more efficiently safeguarded since the crop is usually mature and not apt to be washy and since weeds are much fewer. The combined operation of these forces will promote the production of the individual cows.

Since the production of the individual cows is increased, it follows that the output of dairy products from the farm will be increased. The larger production of soiling crops per acre as compared with pasturage will enable the dairyman to keep a larger milking herd, which in turn ensures an increase in the amount of dairy products.

The liberal use of soiling crops decreases the necessity of a heavy grain ration to dairy cows in summer. It is a well recognized fact that high producing cows can not subsist on pasture alone and maintain their standard of production. Here, soiling crops fill an important place, for they furnish a large share, if not all, of the digestible nutrients required in a succulent feed relished by the cows, instead of forcing the herdsman to resort to dry feeds. This will render extensive purchase of concentrates unnecessary while the production of leguminous soiling crops effectively limits, if it does not entirely prohibit, the use of costly nitrogenous feeds. Thus soiling crops may be used to furnish part, at least, of the nutrients and most of the protein required even by heavy producing cows.

The use of soiling permits of the production of milk which is free from the flavor of garlic or other weeds. Ofttimes stagnant water in pastures as well as decaying organic matter will bring about undesirable changes in milk. Where the land is well cultivated and soiling crops produced, these difficulties encountered in the production of sanitary milk are eliminated.

The saving of divisional fences occasioned by soiling is a factor of importance under some conditions. This permits of the utilization of the land immediately adjacent to the fence row and removes one of the unsightly scenes afforded by many farms.

Finally, soiling permits of the saving or more complete utilization of manure. The waste of fertility on the average farm is quite large. Through the operation of a soiling system the most effective use of barnyard manure is made possible. The hauling out and spreading of the manure now wasted in the barnyards and lanes of this state, would effect a large increase in the productivity of the soil. The actual value of the excreta passed by a cow in a year for fertilizing purposes averages about \$45 based on pre-war prices, if all is utilized, which condition may be approached where soiling is practiced.

DISADVANTAGES OF SOILING.

Practical experience has demonstrated that soiling possesses some weaknesses which thus far have inhibited the wide use of this system of summer feeding. Soiling involves a much greater expense for labor than does pasturing. The green feed to be in

the most palatable and appetizing condition must be cut daily, which for a herd of 40 cows requires two men and one team for two hours where a partial system of soiling is practiced. Since the amount fed varies from 30 to 100 lbs. per cow, the labor involved is considerable, and the regularity required of attendants oftentimes proves irksome.

In addition to harvesting the soiling, the extra time and labor involved in seeding the small plots—at least six to eight sowings being needed to keep the supply of green feed regular throughout the season—is considerable. The labor of handling the manure and caring for the animals from day to day is large, a factor which further augments the labor required in a system of soiling. Coming during the summer season when help is scarce and wages high makes this an important item entering into the cost of soiling crops.

A second difficulty encountered is that of providing a suitable series of crops as well as adjusting the amounts of each to the requirements of the herd. The varying climatic conditions and the consequent changes and inequalities in the rates of ripening of the various crops makes the time at which a given crop may be ready to cut, extremely variable. The average yield and therefore the exact acreage of a crop, essential to supplying sufficient green feed, depends upon the weather.

Where there must be a succession of crops furnishing the soiling, it oftentimes occurs that it is not desirable to utilize any surplus for hay production, which is the only alternative presented. The time at which a soiling crop can be used depends on the individual crop, the time at which it is sown, the soil and climatic conditions. Some crops such as alfalfa, are adapted for use as soiling during a comparatively short period after which the forage becomes too mature for feeding while other crops are available for use through quite a long period. Thus to meet the needs of the herd, changing climatic conditions influencing the yield and time of ripening of the crop as well as the length of time it may be fed is a difficult task worthy of serious study on the part of the dairyman.

Soiling crops must be harvested in all kinds of weather. Frequently climatic conditions render it difficult to haul in green feed daily which is quite a disadvantage in the use of a soiling system. Wet weather not only increases the labor of caring for the crop but it also diminishes its usefulness. Indigestion may result from feeding soiling crops harvested during the rainy period as the feed is of a washy nature at this time, and may occasionally induce bloat. Digestive disturbances may be induced by the particles of soil which adhere to some crops, especially during rainy periods.

CORN SILAGE VERSUS SOILING.

The relative merits of corn silage and soiling crops for supplementing corn belt pastures is a disputed question. Every one appreciates the advisability of furnishing additional succulent feed at this period of the year. Undoubtedly there are conditions under which both feeds may be profitably fed. On the average farm corn silage is a cheaper form of succulence, as it can be produced at a less cost than soiling and is therefore generally the more economical feed. The labor in producing silage comes largely after the harvest work so that help is easier and cheaper to secure. Further, the feeding of silage in summer requires less labor than does the growing and feeding of soiling crops. This factor is of greatest importance where labor is scarce or where the largest production per man is sought.

Where silage is used the farmer is independent of the climatic conditions since the supply is grown the previous year. This retention of part of the corn crop until the succeeding year tends to equalize the quantity of feed available during different years, thereby insuring against losses in milk production due to a scarcity of feed. Since silage is usually under cover, it does not require extra work during rainy weather which also insures against digestive troubles emanating from wet feed.

Silage possesses the added advantage of keeping for a relatively long period of time. While some feed is spoiled by age, the vast portion of it remains in a desirable condition. It does not become unpalatable as do soiling crops when maturity is reached. It does not fluctuate in feeding value from that of a light washy nature to a more mature and dry feed.

The principal disadvantage of summer silage is the small size of silo required. Silage to be of good quality and pleasing taste must be removed twice as rapidly in hot weather as during the winter months. The silo must therefore be much smaller in diameter, involving additional expense in saving the crop. Where a large herd is maintained this will necessitate the building of a number of small silos which are difficult to locate conveniently, as well as being costly to erect.

Since the silage must be fed more rapidly there are many small herds which are not large enough to warrant the building of a summer silo. The small silo costs a great deal more in proportion and in addition permits a much larger proportion of the silage to spoil around the edges of the silo. The small silo not only costs more proportionately but also makes the keeping of good silage more difficult. For this reason many of the causes advanced for feeding summer silage do not apply to the small dairyman.

Lack of variety in the succulent portion of the ration may become evident when silage is fed both summer and winter. This

becomes increasingly important as silage tends to become the main part of the succulence during the summer. The deficiency of the corn plant in ash may also prove important unless due attention be paid to the ash content of the other feeds supplied. Furthermore, soiling crops carry a higher percentage of protein which is an important consideration in the corn belt. As dairying intensifies agriculture in a community, it is believed that soiling crops will fit more admirably into the crop rotation as well as the feeding program of the dairy farmer.

PRODUCTION OF SOILING CROPS.

The chief hindrance to the successful production of soiling crops is in keeping a continuous supply of succulent green feed available throughout the summer. The main factor in determining the success of this attempt is the season, but under even favorable conditions, at least four or better still, six individual sowings should be made for a partial soiling system.

Where possible the soiling crops should be put in the regular rotation of the farm, in the place of small grain or corn. If the farm is large or scattered this will not always be practicable and then it will be necessary to grow the green crops continuously on some piece of land located convenient to the barns.

The land for soiling should be well worked and a suitable seed-bed prepared. As large yields are aimed at, liberal use of manure is necessary. This is especially important where continuous growing of soiling is practiced as the production of large yields of green feed year after year tends to impoverish the soil.

Seeding should be liberal—this is most important with crops such as amber cane—for not only will crops be slightly heavier in some cases with heavy seeding, but they will also be much finer in quality. Crops that are seeded thinly tend to produce coarse-stemmed plants which are not relished by stock and result in a large amount of waste. Thick seeding, on the other hand, gives a fine-stemmed succulent forage that is readily cleaned up by the cows with a resultant decrease in waste material.

The harvesting of soiling entails a very considerable amount of labor. The majority of the crops can be cut with a mower and sometimes can be put on the wagon with a hay loader, but where the yield of grain feed is exceptionally heavy the loader will not be suitable. Amber cane can be cut with a small grain binder as it generally stands up well and the bundles are much more convenient to handle than is the loose material. Corn, when used for green feed, should be cut with a binder, if any large amount is used daily.

The green feed, for best results, must be cut and hauled daily as it wilts readily if left cut in the field and if piled up in the barn it heats and spoils quite rapidly in hot weather.

FEEDING OF SOILING CROPS.

Soilage can be fed either on the pasture or in the barn. The feeding of it on the pasture is the much more convenient method, entailing less labor and being cheaper. It has its disadvantages, however. There is a great waste as a rule when the green feed is put out on the pasture, due to the fact that the cows trample and foul it. In addition it dries out rapidly and becomes unpalatable. Where it is spread out the cows are also apt to injure each other in their efforts at feeding. When it is put on the pasture perhaps the best method is to haul it out just before the cows are turned out. Otherwise the cows hang around the gate instead of feeding and when the green feed is taken out the danger of cows being injured is increased.

Feeding in the barn is laborious but on the whole advantageous. The wastage of feed is cut down and in addition the cows are more comfortable in the barn during the hot hours in the middle of the day. When they are kept in at this time they are protected from the heat to some extent and in addition they can be sprayed as a protection against flies.

All of the common soiling crops, with the possible exception of corn, can be conveniently fed in the barn. Owing to its coarse nature it is difficult to feed corn in the mangers unless labor is available to cut the bundles and so it can frequently be most easily fed on the pasture, though this does induce a considerable amount of waste.

Where the soiling is given on the pasture it is usually fed only once a day but when fed indoors from one to three feeds may be given, depending on the amount of labor available and the extent to which soiling replaces pasture in the maintaining of the herd. Generally, however, feeding more than twice a day will not be advisable where some pasture is available.

The amount of soiling used daily depends on the crops grown and the quality and extent of the pasture. With a partial soiling system, such as is most generally used, from forty to seventy pounds of green feed per cow a day will commonly be consumed in addition to pasture.

In the feeding of soilage care should be taken to avoid the inclusion of large amounts of soil with the green feed. Attention to this point is especially necessary where such sparse growing crops as soybeans are raked into windrows after cutting. Soil particles, adhering to or mixed with the green feed, render it un-

palatable and tend to cause digestive disturbances. The feeding of soilage that is wet or fermented is another cause of digestive troubles. Care in handling will prevent the heating or fermenting of the green feed but owing to weather conditions, which cannot be forecast, it is not always possible to get feed that is not wet. Where the soiling has been cut when wet it is advisable to limit the amount fed as the wet feed will often produce scours.

CROPS SUITABLE FOR SOILING PURPOSES.

Crops most desirable for soiling purposes will be determined largely by the climatic conditions prevailing in the given community. This factor also affects the yield of forage supplied by the various crops, which is a most important point. Where the yields of different crops are approximately the same, a choice is usually indicated by the relative amount of protein furnished. The palatability of different forages varies widely as does the effect upon the flow and flavor of milk as well as upon the physical health of the cow. It is difficult to secure green forage at some periods of the year and this renders some crops capable of supplying green feed at this time well-nigh indispensable. The time which is required to mature a crop is worthy of study since some of the early crops may be followed by later sowings making it possible to secure two crops from the same acreage in one season. While the ease of harvesting may seem to be a minor point it should be given consideration since the green feed is very heavy and in the case of some crops quite difficult to handle.

A wide variety of crops may be used for soiling purposes in this section. These may be conveniently grouped as leguminous, non-leguminous, and mixed. Owing to the higher content of protein which leguminous crops carry as well as to their value as soil improvers, they are advisable in many instances. Their use tends to decrease the purchase of nitrogenous concentrates which are usually the most expensive feeds and may thereby lessen the cost of the grain ration. Leguminous crops do not thrive on acid soils and frequently the application of ground limestone greatly increases the yield as well as the ease of securing a stand. Those legumes not common to the locality or farm also require inoculation. Where these two precautions are observed there are few Iowa soils, indeed, upon which legumes will fail to respond to careful cultural methods.

A representative number of the crops that might prove suitable for soiling in this section have been tried out on the Iowa State College dairy farm during the years 1911 to 1917 with interesting results. A larger variety might have been tried but the aim has been to keep the number of crops grown in any one year within the limits of practicability.

In determining the costs of the various crops all items entering into their production have been taken into account, including rent of land, labor, manure, and seed. All operations, from the preparing of the land to the harvesting and hauling of the crop to the barn have been included in the labor cost. Owing to rapidly changing labor conditions it has been deemed advisable to adhere to the uniform rates from which the data were originally calculated rather than to recalculate them. Throughout the work man labor has been charged at \$55 per month, horse labor at \$2 per team per day, and rent of land at \$6 per acre.

LEGUMINOUS CROPS.

Not many of the leguminous crops are specially adapted for soiling purposes under Iowa conditions and so the number tried out here has been limited.

ALFALFA.

This is undoubtedly the most valuable soiling crop among the legumes, since the various cuttings may all be utilized as soiling. Alfalfa may be said to owe its importance as a forage crop to its high nutritive value, being especially rich in ash and protein; to its palatability; to its large total yield where successfully grown; to its drought resistance; and to its long life, and consequent small cost of seeding. The various cuttings may be timed to keep a continuous supply of green feed available. Alfalfa may be used to furnish green feed during the entire season if a sufficient acreage is available. The period during which it is suitable, however, is limited, since where the cutting is made too early the yield will be decreased, while in the later cuttings the stems may become woody and fibrous, and in addition the succeeding crop may suffer.

The precaution should be taken not to cut the same field more often than it would be cut for hay as otherwise the plant may be seriously weakened and the stand permanently injured. In this section alfalfa frequently proves valuable in the early part of the soiling season. The yields secured are usually large, varying from 10 to 18 tons per acre. Cows do not consume large quantities of alfalfa in the green state as the green feed does not seem to be relished proportionately as much as is the well cured hay. Where alfalfa is grown successfully it may be included in any rational scheme of soiling.

During the seven years in which soiling has been practiced at this station, alfalfa has been used to some extent each year. The first and second cuttings were used. The alfalfa cut for soiling was generally of the previous spring's seeding, having been sown at the rate of 18 pounds per acre along with 1½ to 2 bushels of oats. The first crop was generally obtained about June 10 to 20, while the second cutting came about July 5 to 15. The yield

varied with the seasons but was generally satisfactory, the average being 8 tons of green feed per acre for the first cutting and 4 tons for the second.

The costs per ton of this feed were comparatively high, being \$3 per ton for the first cutting and \$4.50 for the second. The cows seemed to relish it fairly well but did not consume as large quantities of it per head daily as they did of some of the other feeds.

The main disadvantage of alfalfa as a soiling crop was found to be its short season of availability. If it was cut too early the maximum yield was not obtained and if the cutting was delayed the subsequent crop was decreased. In other respects it was fairly satisfactory.

RED CLOVER.

While this clover is more widely grown in the United States than is any other legume it does not fill an important place in soiling systems. It can be fed for only a very short period as the stems quickly become woody. It does not compare favorably cured. Red clover should be cut for soiling shortly before the with alfalfa in yield although from 8 to 12 tons are usually se-blossoms appear as at this time it yields more protein and less fiber per acre than during any other period. Bloating seldom results although it is desirable that the clover be neither wet nor badly wilted when fed. Grown without other crops red clover sometimes goes down, thus making it difficult to harvest. While the second crop may also be utilized for soiling in this section, it is better adapted for hay or pasture, or even, in favorable seasons, seed production purposes.

ALSIKE CLOVER.

Alsike is one of the finer leafy clovers that makes an excellent quality of feed. It is adapted primarily to low wet land, which is insufficiently drained, although it makes a good growth on any average soil. Under low land conditions alsike grows most luxuriantly and is a very satisfactory legume. It is widely used in this state although seldom grown alone for soiling purposes because the yield may be somewhat below that of red clover and the plant tends to lodge. Alsike soiling is quite palatable, it may be fed in large quantities and it exerts a favorable influence on the milk yield, while the plant is hardy throughout the state.

SWEET CLOVER.

The relative value of this plant for soiling is in dispute, many reporting that it was not entirely satisfactory for soiling purposes, while others have lavished praise on it. The stems rapidly become woody and the feeding period is relatively short. Yields

secured may vary from 8 to 15 tons but as a soiling crop it does not have a large place in this section, unless the cattle become accustomed to and eat it with apparent relish.

Sweet clover was used as soilage at this station in but one season with fairly satisfactory results. It was sown with oats in the spring of the previous year at the rate of 15 pounds per acre along with $1\frac{1}{2}$ to 2 bushels of oats. The first cutting was obtained from June 7 to 17 and the second from July 24 to 27. The yields were 5 tons per acre for the first cutting and 2 tons for the second. The costs were respectively \$2.80 and \$3.60 per ton for the first and second cuttings laid down in the barn. The amounts eaten by the cows were practically the same as of alfalfa; 35 pounds per head daily for the first cutting and 39 pounds for the second. In feeding value it was similar to alfalfa. At first it was unpalatable though not so much so as might have been expected.

CANADIAN FIELD PEAS.

This annual legume is not valuable as a single crop because the yield is usually less than 7 tons per acre. The stems are of slight and slender growth and do not support the plant. It is hardy, however, under Iowa conditions, and is often used in mixtures with good results, as the green pea forage is very palatable and is consumed in large quantities.

COWPEAS.

Cowpeas are better suited to the more southern states than to Iowa. They are matured successfully in Iowa only when the small early varieties are sown and then the yield is small. The crop furnishes palatable forage during the latter part of the season.

SOYBEANS.

This crop is well adapted to Iowa conditions. In feeding value soybean forage compares favorably with alfalfa and the plant is more resistant to heat and drouth. Where clover kills out, soybeans may be used as a catch crop, altho where the ground is foul, cultivation is necessary to keep down the weeds. The crop, which is becoming more widely used in this state, matures for soiling during the latter part of the summer and will ordinarily yield from 3 to 10 tons of green feed. For best quality of soiling, the seeding should be heavy, $1\frac{1}{2}$ bushels being recommended.

Trials with soybeans at this station as soiling have been made in two seasons with but fair success. In the first year in which they were used part were drilled in rows $3\frac{1}{2}$ feet apart at the rate of 25 pounds per acre and cultivated, while part were drilled in rows 1 foot 9 inches apart at the rate of

50 pounds per acre and left uncultivated. The yields obtained were respectively 3 tons and 6 tons of green feed per acre and the respective costs per ton were \$4.60 and \$2.70 which was decidedly in favor of the plot heavily seeded without subsequent cultivation. The date of seeding was June 1 and of harvesting August 25 to 30.

In the second trial they were drilled on June 21 at the rate of 45 pounds per acre and were harvested August 24 to 31, when a yield of $5\frac{1}{2}$ tons of green feed per acre was obtained at a cost of \$3.00 per ton.

As a feed soybeans were satisfactory as the initial unpalatability soon disappeared and cows would consume about 70 pounds of them per day. There were drawbacks to their general use. The most profitable yields were obtained when they were closely sown and uncultivated, but this, along with their lack of height, led to a heavy growth of weeds—a condition that is not at all desirable. In addition they are difficult to cut and collect without becoming mixed with a large amount of soil and this is disagreeable especially in wet weather and may even induce digestive disturbances among the cows.

LEGUMINOUS SOILING CROPS UNSUITED TO IOWA.

In addition to the crops already mentioned a large number of other legumes have at times been proposed for soiling purposes. Some of these which are not suited to Iowa conditions are mammoth red and crimson clovers, sainfoin, flat peas, and the common and hairy vetches.

NON-LEGUMINOUS CROPS.

The non-leguminous forage crops provide an even greater variety of soilage than do the leguminous. Under the majority of conditions they will produce larger and more economical yields of green feed than do the legumes though they do not provide as much protein or ash. Like the legumes these crops vary widely in palatability and in the ease of harvesting. Some of them are essential to a complete system of soiling in this latitude.

DENT CORN.

This is used as soiling to some extent in this locality as it returns rather a large yield and is quite palatable. It is, however, rather difficult to handle and feed, and is not cleaned up very well by the cows. In this locality green corn can not be safely fed until rather late in the summer, from which time it may be fed until ready to cut for silage. It should be borne in mind that by feeding green corn the cow is not given much of a variety as compared to her winter ration.

Part of the corn crop was used for soiling on several occasions in the latter part of the season. Yields of 9 to 12 tons of green feed per acre were obtained at an average production cost of \$2.70 per ton. It gave good and economical yields and was palatable and successful as a feed.

SWEET CORN.

Sweet corn is perhaps the most palatable of the corns and is used more for soiling than the other kinds. In yield it ranks close to that secured from dent corn, where the larger varieties are used, and is more satisfactory, since it stays green longer, and the leaves do not fall so quickly. Neither does it become so coarse nor is it so difficult to feed as is dent corn. It furnishes good soilage even when the ears have been removed previous to feeding, a practice followed near canning factories. The length of the feeding period will depend upon the number of varieties grown and may extend throughout a considerable part of the late summer.

OATS.

Oats alone were used for soiling on but one occasion. This was a patch of oats sown for grain but beginning to lodge. The yield of 7 tons of green feed per acre was obtained at a cost of \$2.90 per ton. However it was not very palatable and the cows refused to eat large quantities of it. It also ripened too rapidly to be a good soiling crop.

WINTER RYE.

Rye has been used more for soilage purposes than any other of the lesser cereals. It gives fair yields, averaging perhaps 6 tons per acre: is only fair in palatability and can be used very early in the season for soilage purposes. Under some conditions rye has been known to impart a peculiar and disagreeable flavor to the milk. It is perhaps more valuable for early pasture than for soiling purposes.

FOX-TAIL MILLET.

The various varieties of fox-tail millet include Common, German, and Hungarian, as well as many others. These varieties have been used successfully by many stations to furnish soiling crops for cows, inasmuch as they may be matured rather late in the fall and may be used until frost. Yields vary, but on the average where a thick seeding of millet prevails, from 10 to 14 tons of green forage are not uncommon. The value of the millet forage depends largely upon the variety. For example, the common millet is fine stemmed and leafy, and makes a very good quality of forage, while the German variety is coarser than the common and not relished

as much by the milch cows. Millet matures rather rapidly and under the most favorable circumstances is ready for harvesting forty to fifty days after seeding. In order to secure the best quality of forage, heavy seedings are advisable as two to four pecks have given the best results.

AMBER CANE.

Amber cane is one of the most valuable soiling crops for this section. The yield is quite large and under average conditions 10 to 16 tons per acre may be secured. It is succulent and palatable and cows will consume large quantities of it. It may be used over a long period of time without becoming coarse or woody. It can also be produced at a lower cost per ton than any other crop grown for soilage purposes in this section. Seeding should be fairly heavy to insure fine growth of cane, as the finer and less fibrous the crop grows, the higher will be the palatability and the smaller the waste. Experience indicates that at least 70 pounds of seed should be sown per acre, and 90 pounds will produce finer forage.

The main drawback which has been found in the use of cane for soiling is the difficulty of handling the crop. Where it is thickly sown so that the crop does not become too coarse it may be cut with a small grain binder with little difficulty. It should be mentioned that the second crop is apt to be poisonous after it has been frosted or markedly checked by dry weather. In this part of the state, however, there is but little second crop produced.

Amber cane has been grown alone at this station for the last three years and has given excellent results. From two to three sowings per season were made from about May 20 to July 10 at the rate of 70 pounds per acre. The season of harvesting covered the period from about July 20 to the end of October. The yields obtained were larger than those of any other crop—averaging 12 tons of green feed per acre—and the cost of production was also low, being between \$2.00 and \$2.25 per ton.

The cows relished it and ate on the average of about 70 pounds of cane per day. It proved to be the most successful soiling for the latter part of the season and could be used until the time of frost.

SUDAN GRASS.

This crop is especially suited to the arid and semi-arid regions altho it is being grown to some extent in this state. It gives rather large yields of feed but dries out very rapidly while growing and is apt to become fibrous when mature, a fact which decreases its palatability and detracts from its value as a soiling crop. Under some conditions Sudan grass

may be profitably used altho usually other crops can be more successfully grown for soiling purposes in this state.

It has been grown at this station on a few occasions and given good yields, the average being 11 tons of green feed per acre at a production cost of \$4.00 per ton. It was sown in the latter part of May and used from August 25 to September 10. It was a palatable and useful feed when not too ripe but dried out very rapidly and so did not have a very long period of usefulness.

NON-LEGUMINOUS SOILING CROPS UNSUITED TO IOWA.

The wide range of non-leguminous crops makes it impossible to treat all of them individually. Many forages not heretofore mentioned have direct value for soiling purposes, altho they are not primarily suited to Iowa conditions. The more common of these are flint corn, oats, barley, wheat, Japanese and pearl millets, orange cane, milo maize, feterita, kafir-corn, timothy, red top, brome, and orchard grass.

MIXED CROPS.

Mixtures of leguminous and non-leguminous forage crops have been widely grown for soiling purposes. Many of these mixtures have much to recommend them since they possess many good characteristics of each of the other two classes. Their value depends upon the suitability of the crops for the locality in which they may be grown and upon their adaptability for growth in mixtures. While a great many mixed forages have been grown the number which are really suited to farm conditions in this section is quite limited.

OATS AND CANADIAN FIELD PEAS.

This is one of the most valuable of the early soiling crops. Both are well adapted for this locality and when grown together give moderately large yields of very palatable feed. When the oats are in the milk and the peas have filled the pods, the crop is most desirable and it should be utilized as fast as possible at this stage as the crop ripens rapidly with the feed becoming less palatable. By making two or three sowings of this crop it is usually possible to secure a plentiful supply of green feed for a period of about 30 to 40 days. One of the difficulties which is experienced in growing this crop is that the oats have a tendency to ripen before the peas. This can be overcome to some extent by using a late variety of oats, and if necessary, sowing them a week or ten days after the peas have been drilled. Oats and peas are of sufficient value for soiling purposes to warrant the statement that they should be included in soiling crop systems for this state.

This crop has proved to be of the greatest service in the early part of the season. Two or three sowings were usually made between April 5 and May 10 at the rate of $1\frac{1}{2}$ bushels oats and $1\frac{1}{2}$ bushels peas per acre. The season of availability lasted from about June 20 to the end of July. The yields obtained varied from 5 to 10 tons per acre, the highest yields of green feed being from the early or medium early sowings, and the production cost per ton varied from \$2.50 to \$5.00 according to the season and the yield obtained.

This feed was very palatable in the early stages but was usually fed in limited quantities as pastures were then fairly good. From 40 to 60 pounds per head per day was the average consumption of oats and peas. Owing to its early ripening tendencies it was suitable for use in the early part of the soiling season only.

OATS AND COMMON VETCH.

This mixture has been recommended in some cases in place of oats and field peas but as the yield is usually not as large as with the peas and owing to the extremely high price of vetch seed at the present time, its use in this connection can hardly be considered practical.

BARLEY AND CANADIAN FIELD PEAS.

This crop is quite similar in value to the oats and peas but possesses the disadvantage of the barley ripening even earlier than does the oats. In some sections it is possible to use this crop for fall feeding by sowing the barley and peas after one of the early forage crops have been harvested. In this way it is possible to utilize the ground for two crops during the same season and thus barley and field peas may be used to give a liberal supply of forage during the autumn.

WINTER RYE AND HAIRY VETCH.

This mixture has given good results, as the vetch increases the yield, and the protein content of the forage. Owing to the high price of vetch seed, it may not be extensively used as the cost of seeding is too great. The rye also serves to help support the vetch and makes the crop easier to harvest. This mixture will furnish green feed earlier in the spring than any legume or other mixed crop. On farms where no pasture is available, it may be wisely used.

COWPEAS AND CORN.

This crop has been used for soiling purposes in some sections, and particularly in the south, where it will give heavy yields. Where the corn is drilled thickly, however, as is practical for soilage purposes, cowpeas oftentimes do not

make a large growth, especially during dry seasons. On the average, therefore, while cowpeas may increase the protein content of the feed it does not greatly increase the yield and since corn is not widely used for soilage the crop has not come into general use.

COWPEAS AND CANE.

As has been previously mentioned, fodder cane makes an excellent crop for soiling purposes. From actual experience some men have stated that it can be improved by sowing in mixture with cowpeas since the protein content will be increased. However, where the amber cane is sown thickly so that the stalks do not become too coarse the cowpeas usually do not make much growth. Larger and more economical yields of forage can usually be obtained by sowing the cane alone rather than by adding cowpeas. The mixture is palatable and eaten readily by the cows with but little waste where fed in a manger.

This mixture has been tried on several occasions at this station, and though it was a good feed the sowing of the cowpeas proved to be simply an additional expenditure. Though the cowpeas were valuable for increasing the nitrogen content of the soil and adding protein to the feed, they were readily crowded out by the cane. The time of sowing and of harvesting was the same for the cane and cowpeas as for the cane alone. The yields obtained were slightly lower in the case of the cane and cowpeas and the cost per ton slightly higher.

SOYBEAN MIXTURES.

Soybeans have been grown in various combinations in much the same way as have the cowpeas. They are more desirable for use in mixtures than the cowpeas as the plants are better adapted to Iowa conditions, and are equally palatable. Soybeans have also been grown in mixtures with cowpeas but for this locality other forages will give more satisfactory results.

CLOVER AND TIMOTHY.

Red clover and timothy have been used for soiling purposes. The value of the crop is usually enriched by adding alsike to the mixture. Under the majority of conditions, however, it will be found more satisfactory to mature this crop for hay rather than to attempt to feed it green. It is not as palatable as some of the other crops and does not yield heavily, which renders it less suitable for soilage purpose.

SUMMARY OF RESULTS SECURED.

The results secured are summarized in Table I, where the average yield, cost per ton, and other production data for the crops used are given.

In connection with the summary of the soiling system practiced at the Iowa State College dairy farm it will be convenient also to discuss the pasture which was available for the milking herd. The pasture land is rolling and gravelly and was at one time poor but by liberal manuring and supplementing with soiling crops it has been converted into a comparatively good pasture. On this twenty acre pasture, supplemented with soiling, have been supported an average of more than 40 cows each season.

TABLE II—AREAS USED FOR PASTURE AND SOILING.

Year	No. of cows	Pasture acres	Soiling acres	Pasture days	Soiling days	Soiling per cow tons
1911	40	20	9	165	127	1.47
1912	41	20	6	170	98	1.42
1913	42	20	10	167	168	1.26
1914	42	20	10	165	198	1.85
1915	40	20	10	177	116	2.14
1916	40	20	20	173	97	1.87
1917	47	20	22	152	126	3.50
Average	42	20	12	167	111	1.93

The amount of soiling used depended to a considerable extent on the season and the amount of land available for this purpose, but on the average it amounted to about 12 acres. These factors along with the lengths of the pasturing and soiling seasons determined the cost of keeping the herd during the summer. The average acreage of soiling and pasture combined required to support a cow for the summer months was eight-tenths of an acre per season. The average cost of this was \$8.60 per cow per season, of which \$5.30 was due to soiling and \$3.30 to pasture. If the cows had been supported on pasture alone, from two to three acres per cow would have been required with a subsequent cost of \$12 to \$18 per cow per year. This is a saving which is decidedly in favor of soiling, and in addition to this, increased milk production results from its use.

POSSIBLE OUTLINES OF SUITABLE SYSTEMS OF SOILING.

A few possibilities of crop combinations may be suggested and they can easily be modified to meet individual conditions.

TABLE I—SUMMARY OF SOILING CROPS GROWN ON IOWA STATE COLLEGE DAIRY FARM, 1911-1917.

CROP	Approximate date of sowing	Rate of seeding per acre	Approximate date of harvesting	Yield per acre tons	Cost per ton	Feed per cow per day lbs.
Alfalfa.....	Previous year	18 lbs.	June 10-20	8	\$ 3.00	35
Alfalfa.....	Previous year	18 lbs.	July 5-15	4	4.50	40
Alfalfa.....	Previous year	18 lbs.	Aug. 20-25	2	5.00	30
Sweet Clover.....	Previous year	15 lbs.	June 5-15	5	2.80	35
Sweet Clover.....	Previous year	15 lbs.	July 25-30	2	3.60	40
Soybeans.....	June 1	50 lbs.	Aug. 25-Sept. 15	6	3.00	55
Amber Cane.....	May 20	70 lbs.	July 20-Aug. 20	12	2.25	70
Amber Cane.....	June 20	70 lbs.	Aug. 15-Sept. 20	12	2.00	70
Amber Cane.....	July 10	70 lbs.	Sept. 10-Oct. 30	12	2.00	70
Oats.....	April 5	1½ bus.	July 5-15	7	2.90	45
Dent Corn.....	May 10	9 lbs.	Oct. 1-10	10	2.70	40
Sudan Grass.....	May 25	20 lbs.	Aug. 25-Sept. 10	11	4.00	40
Oats and Canadian Field Peas.....	April 5	1¼ bus. oats and ¼ bus. peas	June 15-July 5	6	5.00	40
Oats and Canadian Field Peas.....	April 20	1½ bus. oats and ¼ bus. peas	June 30-July 10	5	4.50	50
Oats and Canadian Field Peas.....	May 5	1¼ bus. oats and ¼ bus. peas	July 10-25	5	4.00	60
Amber Cane and Cowpeas.....	May 25	35 lbs. cane 1 bu. cowpeas	Aug. 1-30	9	2.50	45
Amber Cane and Cowpeas.....	June 25	35 lbs. cane 1 bu. cowpeas	Aug. 15-Sept. 5	13	2.00	45
Amber Cane and Cowpeas.....	July 5	35 lbs. cane 1 bu. cowpeas	Sept. 1-20	9	2.00	45

The areas given are those that should prove suitable with a herd of about 15 cows provided that ten acres of pasture were also available.

SYSTEM A.

Crop	Area acres	Approximate date of sowing	Approximate date of harvesting
Alfalfa, 1st cutting.....	½	Previous year	June 10-20
Oats and Canadian Field Peas.....	1	April 5	June 15-July 5
Oats and Canadian Field Peas.....	½	April 20	June 30-July 10
Alfalfa, 2d cutting.....	½	Previous year	July 5-15
Oats and Canadian Field Peas.....	½	May 5	July 10-25
Amber Cane.....	1	May 20	July 20-Aug. 20
Amber Cane.....	1	June 20	Aug. 15-Sept. 20
Amber Cane.....	1	July 5	Sept. 10-Oct. 15

This is a simple and convenient system but it is adaptable to further simplification and modification. Where alfalfa is not available, the other two crops, amber cane and oats and Canadian field peas, can be made to last throughout the season. In some cases it will also be possible to cut down the number of sowings of these crops and make larger plots. Four is the smallest number of sowings that can be expected to give good results and five or six are better as they ensure a more uniform supply of green feed throughout the season. This is due to the minimizing of the risk of too early maturing of the crops with subsequent unsuitability of the feed for soiling. Sweet clover can also be used in place of the alfalfa where it is available.

SYSTEM B.

Crop	Area acres	Approximate date of sowing	Approximate date of harvesting
Winter Rye.....	1	Previous fall	June 1-20
Barley and Canadian Field Peas.....	1	April 5	June 15-July 5
Barley and Canadian Field Peas.....	1	April 20	July 1-20
Amber Cane.....	1	May 20	July 15-Aug. 20
Amber Cane.....	1	June 25	Aug. 15-Sept. 20
Millet.....	1	July 1	Sept. 15-Oct. 15

In this system winter rye is depended on for the earliest soiling, while barley replaces oats in the mixture with Canadian field peas and the millet takes the place of the last sowing of amber cane used in the previous system. For the reasons pointed out in the section on individual crops this is not quite so suitable as the first system and it is also less easily varied and adapted to individual conditions.

SYSTEM C.

Crop	Area acres	Approximate date of sowing	Approximate date of harvesting
Oats and Canadian Field Peas.....	1	April 5	June 10-July 5
Oats and Canadian Field Peas.....	1	April 25	July 1-25
Amber Cane.....	1½	May 20	July 20-Aug. 25
Amber Cane.....	1½	June 25	Aug. 15-Sept. 15
Green Sweet Corn Stover.....	1	June 10	Sept. 10-Oct. 15

This system would not provide feed as early or late in the season as would some of the others, but it would be quite simply and suitable where sweet corn was being raised. Dent corn could also be used in the late part of the season.

These are merely outlines and can be altered or interchanged as is necessary. The approximate yields to be expected can be seen from the table already provided.

RESUME OF PREVIOUS WORK.

The value of soiling crops in inducing milk production has been amply demonstrated. In experiments conducted by Carlyle, Danks and Morton⁵, it was shown that the cows of the experimental herd which received soiling crops maintained the milk flow at a higher level than did those cows kept by dairy farmers and allowed pasture only. Goessman¹¹ also found that the yield was well maintained through the summer months by using soiling crops. Their use is advocated by Moore²³ to furnish feed during the dry period which comes in the fall under Mississippi conditions. Wilson³² reported that the production of milk increased with the use of soiling crops.

The evidence on the relative efficiency of pastures compared to soiling crops in promoting the yields of milk and fat is conflicting. Wilson³¹ and his co-workers compared the yield of six cows by the reversal system. They concluded that cows fed oats, peas, clover and corn as soilage gave more milk than when allowed to graze on a good blue grass pasture. Linfield¹⁸ reported that the yield of cows on pasture increased as compared to those fed soiling crops. Lyon and Haecker¹⁹ concluded that pasture induced 117% greater milk production than did soiling. Doane⁸ in a very limited test at Maryland reports in favor of pasture, while Otis²⁵ states that cows on pasture produced more but also consumed more grain. Lindsay¹⁷ states that the open air, sunlight, and exercise afforded by pasture is more desirable and further that pasturage contains relatively more protein and less fibre than do the cereal fodders.

The advisability of using soiling crops rather than hay in summer feeding has been pointed out by Goessman¹¹. After three years experience he reported, "A smaller amount of dry matter sufficed for the production of one quart of milk where a part of the hay was substituted by the green fodders than where the full ration of hay was fed, indicating a superior nutritive value of the former as compared with the latter. The milk was in every instance increased by changing from a hay ration to a green fodder ration." The quality of the milk was not influenced by the change. "The net cost of food for the production of milk was in every instance less in the case of green fodder rations than with the hay rations."

Moore²⁴ compared cottonseed meal with alfalfa, sorghums, and Johnson grass for supplementing pastures. Where cows received 41 lbs. green feed additional to pasture, the average milk flow was 14.9 lbs. daily, while 3.4 lbs. cottonseed meal induced 14.2 lbs. daily, showing a slight difference in favor of soiling.

A summary of eight years' work conducted at the New Jersey Experiment Station by Lane and Billings² is given by the latter. For six months, from May 1 to November 1, the station herd was maintained on soiling, while silage furnished the succulence during the remainder of the year. The cows freshening uniformly through the year showed an average yield of 3,322 lbs. milk containing 167.0 lbs. fat, while on soiling, compared to 2,997 lbs. and 152.5 lbs. milk and fat respectively on silage. This denoted a slight advantage in yield for the soiling crops, which were also produced at a less cost than was the silage. Later Billings³ states that silage maintained the yield of milk obtained with wheat forage at an equal cost and again⁴, that the results indicate that corn silage may be fed safely and economically during the summer months.

Daniels⁶ reported that growing clover and either oats, rye, or wheat for ensiling in June was a more economical and satisfactory method in addition to requiring less labor than did summer soiling. Watson and Mairs²⁸ report that a "slight increase of milk was noticed when the change in feeding was made from clover silage to cowpeas and milo maize," which was accounted for, perhaps, by the larger consumption of the forage crop. Lindsay¹⁷ reported against the use of summer silage where it also forms the basis of the ration for winter feeding.

Through feeding one lot of cows in the station herd soiling crops, and another corn silage for three successive summers, Woll³⁴ et alii found that corn silage was superior in

practice to soiling crops. The yield of corn silage per acre was larger, the seed cost less, the percentage of feed wasted, smaller; while the labor item was greatly reduced by feeding silage. A smaller amount of silage was also found essential to the maintenance of economical production, an average of 30 lbs. of silage as compared to 35 lbs. soiling crops being fed to maintain production. Frandsen¹⁰ also reported favorably on the use of silage as compared to soiling crops for supplemental feeding.

Phelps²⁶ has pointed out the relatively higher feeding value of soiling crops high in protein, even where smaller yields were secured. He found the protein feeds to be from 5 to 10% more valuable in increasing fat and milk production. Von Feilitzen⁹ warned against cutting leguminous soiling crops when too mature, advocating cutting at the period when full bloom appears. Mair²¹ reported that, "The milk produced bore a much closer relationship to total green forage than to dry matter or protein consumed."

Otis²⁵ found .71 acres of soiling crops would support a cow for 144 days, while 3.63 acres of pasture were required. Kildee¹³ maintained 37 cows on 19½ acres of pasture and 8 acres of soiling crops in 1911. This season happened to be one of scant rainfall near Ames; farmers generally allowing 2 to 3 acres pasture per cow. Voorhees and Lane²⁷ reported one acre of soiling crops to furnish sufficient green feed for three or four cows, while Linfield¹⁸ found two cows were maintained on an acre of soiling crops for 108 days, while an acre of pasture sufficed for two cows for 102 days. Carlyle⁵ stated that the acreage required per cow may be reduced at least one half through soiling rather than pasture. Zavitz³⁵ was able to keep one cow on .78 acres of soiling crops. Armsby¹ reported the growing of 3 to 5 times as much digestible nutrients with soiling crops as on pasture.

Linfield¹⁸ is the only investigator to report larger returns per acre from pasture, the difference being \$6.50 per acre against soiling. Lyon¹⁹ secured the largest yields of milk and fat per acre from cowpea soiling. Otis²⁵ reported the income, less cost of grain, for pasture to be \$4.23 per acre, while that of soiling proved to be \$18.08, a difference of 325% in favor of the latter system.

The yield of soiling crops depends upon the kind of crop grown as well as the environmental conditions prevailing. Billings² stated that for 8 years the average of soiling crops secured was 11.99 tons per acre. Later Minkler²² of the same station reported a yield of 2.75 tons per acre from cowpeas and kafir corn, while Frandsen¹⁰ secured 3.50 tons from oats

and peas and 12.00 tons from alfalfa. Lane¹⁴ gave 19.32 tons as a five-year average for alfalfa; McConnell²⁰ secured a yield of 22.00 tons from Japanese millet. Watson and Mairs²⁹ reported yields of nearly 15.00 tons from sorghum and cowpeas and only 3.50 tons from clover and timothy.

Three or four crops are recommended for soiling by nearly all the stations, though wide variation occurs. Alfalfa, oats, and peas, and sorghum are standard soiling crops. Cowpeas are preferred over soybeans by many authorities. Carlyle⁵ recommended thick seeding not only because of heavier yields but also since the finer stems produced are more palatable. Lane¹⁵ recommended crimson clover very highly, as it caused a daily increase per cow of 1.8 lbs. milk or 8%. Millet serves an important place in soiling systems since it furnishes green feed in the fall for a comparatively long period.

Wilson³² and Watson³⁰ discouraged the use of rape since the flavor is noticeable in both milk and butter. The use of flat peas is also discouraged by Watson³⁰ since they are unpalatable and taint the milk. Lane¹⁶ stated pearl millet to be rather coarse and watery though palatable, succulent and a heavy yielder. He did not favor broom corn, since only about half of it is consumed, while neither kafir, durra, milo maize nor teosinte was entirely satisfactory. Day⁷ rated rye as less valuable, and more unpalatable than alfalfa. No second growth was secured. Bhuda kale and thousand headed kale and rape gave unpleasant flavor to milk and butter, according to McConnell²⁰.

The use of some soiling as a catch crop when a regular crop has failed or between two regular crops in the rotation is advocated in some foreign countries. This supply of green fodder can be used to supplement pastures thus allowing more land to be brought under cultivation, which permits of more intensive farming with resulting larger production.

Outlines of soiling systems based on more or less experience in producing them have been issued by a number of stations. The systems indicated will furnish green feed from early spring until corn silage is available in the fall. For early spring, rye and wheat are chosen, the latter yielding less but being somewhat more palatable. Following this, alfalfa is usually available, this being followed by oats and peas which in turn are succeeded by the second crop of alfalfa. Cowpeas, usually considered preferable to soybeans, supersede the cane fodder or oftentimes the two are grown together. This crop may be used to furnish feed for over two months while millet closes the soiling season.

Mairs²¹ reported the average amount consumed per cow daily to vary from 39 lbs. to over 100 lbs. of soiling crops. Otis²⁵ fed 116 lbs. daily, while Wilson³³ found 65 to 90 lbs. to be sufficient. Carlyle⁵ recommended 75 to 100 lbs. where the cows are not on pasture and 45 lbs. where the soiling is merely supplementary. Moore²⁴ fed 41 lbs. to cows when on pasture. In this connection it is pertinent to note that Hills⁴² stated that cows shrink much less in milk yield when fed entirely on grain and soiling crops than when partially soiled, a point which does not seem to be substantiated by other investigators.

Voorhees²⁷ believed a partial soiling scheme to be desirable while Lindsay¹⁷ did not favor summer silage. Later investigators however, are not all willing to concede that soiling is necessarily advisable, though emphasizing that some supplementary green feed should be fed at a time when pastures are short. Frandsen¹⁰ reported the feed cost per pound butterfat to be 24.5c with soiling, while with the silage ration it was only 21.5c. Kildee¹³ stated that the specific conditions of the dairyman will determine the practicability of using soiling crops and he said:

“However, the man who has a large herd of dairy cattle and wishes to secure the best possible returns from his acreage will find it to his advantage to grow some soiling crops. There is nothing better than fresh, palatable, nutritious green feed to stimulate milk production. Then, too, by having in each mixture a leguminous plant, soiling crops can be grown that are superior to corn silage in balance of nutrients.

“Another class of farmers who would profit by the use of soiling crops is the renters who can not persuade their landlords that silos are necessary fixtures upon farms. To these classes must be added the men who have not put up silos yet and who wish to grow crops to feed in addition to their pastures during the summer. All of them may adopt the common practice of cutting green oats, sweet corn and field corn to tide the cattle through the short pasture period, but that is not as satisfactory or profitable as to grow crops that are adapted for this purpose and can be cut at the proper state of maturity.”

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1890. Rpt. Ont. Agr. Coll. and Expt. Farm.

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