EXPERIMENT STATION.

KANSAS STATE

AGRICULTURAL COLLEGE.

Bulletin No. 119—September 1903.

ALL DEPARTMENTS.

Press Bulletins Nos. 71 to 124.

MANHATTAN, KAN.
1903.

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EXPERIMENT STATION
OF THE
KANSAS STATE AGRICULTURAL COLLEGE,
MANHATTAN.

BULLETIN No. 119—SEPTEMBER 1903.

ALL DEPARTMENTS—PRESS BULLETINS* Nos. *71 to 124.

Introduction.

THE Station Council presents herewith the third collection of its press bulletins, including Nos. 71 to 124. These were issued during the three years beginning July 1, 1900, and ending June 30, 1903. These have been widely printed in the agricultural papers, and are believed to contain much of value that has not been issued in the bulletins of the Station as yet. For the sake of completeness all are included, though in a few instances their immediate purpose has been fulfilled. The press bulletins, as issued, are sent to the newspapers of the state, to a considerable number of agricultural papers, to certain public officials, and to some other addresses where they will be brought to the attention of the public. The regular bulletins of the Station are sent to all who apply for them. Address Agricultural Experiment Station, Manhattan, Kan.

Press Bulletin No. 71.—Farm Department.
July 14, 1900.

Experience in Soiling and Pasturing Cows, 1899.

On May 10, 1899, twenty-one cows out of the Agricultural College scrub herd were divided into two lots of ten and eleven cows, respectively, one lot to be fed on green soiling crops and the other lot kept on pasture. Lot I was giving an average daily yield of about 207 pounds of milk, and lot II about 206 pounds, the average test being about 3.7 per cent. butter-fat. Each cow was given what grain she

could eat at a profit, the average being a little over three pounds per day per head. The green feeds used were alfalfa, oats, corn, cane, and Kafir-corn. The pasture was composed of both prairie and mixed grasses. It should be noticed that timely rains made 1899 an exceptionally good season for pastures.

The following table gives the amounts of green feeds consumed by ten cows, and the income per acre after deducting the cost of grain eaten. Butter-fat is figured at creamery prices and skim-milk at fifteen cents per 100 pounds:

	Pounds.	Per acre.
Alfalfa, 74 days	77,145	$25 26
Oats, 9 days	12,225	6 81
Corn, 31 days	38,695	22 79
Cane, 15½ day	22,370	15 60
Kafir-corn, 14½ days	17,550	13 83
Average		$18 08

In a similar manner, the pasture cows brought an income of $4.23 per acre.

From these figures we find that it required an average of 116 pounds of green feed per cow per day, including what little was left as waste. It required .71 of an acre to support a cow on soiling crops 144 days, During the same period it required 3.63 acres to keep a cow on pasture. It will be noticed that alfalfa was fed 74 days. This was from May 10 till August 1, except nine days the fore part of June, when the oats were fed. Where alfalfa is properly managed it can be made to produce green feed during the whole summer. The corn was fed during the month of August. Cane was fed the first half of September and Kafir-corn the last half.

The pasture cows yielded the most milk by 6618 pounds and the most butter-fat by 280 pounds, but consumed 1232 pounds more grain. The soiling crops brought an income above the cost of grain of $18.08 per acre, while the pasture brought only $4.23 per acre. Of the soiling crops, alfalfa gave the largest returns per acre, corn next, cane third, Kafir-corn fourth, and oats fifth. The average result shows that it is possible to get over four times as much per acre by soiling as by pasturing. This does not mean that soiling always pays. It will depend largely upon the cost of labor and the amount of pasture land a person may have. Not considering the amount of land used, our cows did the best on pasture.

Nearly every dairyman has experienced the shrinkage that comes in midsummer, when the pastures dry up and grass is scarce. It is at this time that soiling will pay, and pay liberally. In what better way can a person realize from twenty-three to twenty-five dollars per acre for his green corn or green alfalfa? When the cows look over the fence with longing eyes at the corn, the efforts usually spent

in keeping the cows out of the corn had better be spent in throwing the corn over to the cows. The green corn, alfalfa or cane growing alongside of the pasture will pay greater profits if marketed to cows in need of extra feed than if held and sold to the local grain dealer, and not only that, but it will keep up the flow of milk and increase the profits derived from dairying on dry feed next fall or winter.

D. H. OTIS.

Press Bulletin No. 72.—Farm Department.
October 30, 1900.

Fattening Steers without Hogs.

February 13, 1900, the Kansas State Agricultural College began fattening eighty head of steers to test the value of several different methods of preparing feed for steers where, on account of cholera, hogs could not be used to follow and save the droppings. The steers were divided into four lots of twenty each. Lot 1 was fed shelled corn and whole alfalfa hay, lot 2 shelled corn and alfalfa hay cut in inch lengths, lot 3 corn-meal and whole alfalfa hay, and lot 4 corn-meal and alfalfa hay cut in inch lengths. With all lots the hay was thrown in the bottom of the grain boxes, the grain placed upon the hay, and the two carefully mixed. Salt and water were kept before the steers all the time.

The average weight of the eighty head at the beginning of the experiment was 1036 pounds per steer. The steers were fed 116 days and were then ready for market, averaging 1307 pounds each, an average gain of 271 pounds each, or an average daily gain of 2.34 pounds per steer.

The steers required an average of 747 pounds of grain and 385 pounds of hay for each 100 pounds of gain. This is much below the average amount of feed required to make 100 pounds of gain.

The steers ate an average each of 19.4 pounds of grain a day. This is a low amount of feed for the gain made.

The gains for the whole feeding period are as follows:

	Gain per steer.
Shelled corn, whole hay	262 pounds.
Shelled corn, cut hay	257 "
Corn-meal, whole hay	273 "
Corn-meal, cut hay	293 "

Average gain of steers fed shelled corn, 260 pounds each. Average gain of steers fed corn-meal, 283 pounds each. This shows a gain of 8.8 per cent from grinding. The steers fed shelled corn required an average of 780 pounds of grain to make 100 pounds of gain, while those fed corn-meal required an average of 718 pounds of grain for 100 pounds of gain.

But little was saved in cutting the hay, the average gain of the steers fed whole hay being 286 pounds each, and those fed hay cut 275 pounds each, a gain of 2.6 per cent from cutting.

There is a shortage of both grain and roughage in Kansas this year, and every feeder should get the most possible out of his feed. One experiment does not settle any question in feeding, but may indicate what is probable. The results obtained in this experiment seem to indicate that feeders can get considerably more gains from their feed by mixing the grain and hay, as considerably less than the usual amount of grain was required in this feeding to make 100 pounds of gain. Our explanation is that, where grain is fed alone, much of it is not brought back to the mouth again, while if the grain is mixed with hay all of it gets the benefit of thorough mastication in the cud. There is less difficulty from scouring where grain and hay are fed together.

The steers were sent to Armour Packing Company, Kansas City, for slaughter test, and their report is as follows: "The cattle dressed out 59.3 per cent of live weight; the yield of fat 6.7 per cent. The carcasses cut bright, were of good color on the outside, and made good, clean, bright-looking, well-covered beef. Our buyers consider that ground corn and alfalfa is the best feed for cattle."

The eighty head made an average gain of 7.5 pounds for each bushel of food eaten, and ate 28.8 pounds of hay with each bushel of grain.

The gain from the different methods of feeding was as follows:

	Gain per bu. of grain (56 lbs.)
Shelled corn, whole hay	7.1 lbs.
Shelled corn, cut hay	7.3 "
Corn-meal, whole hay	7.4 "
Corn-meal, cut hay	8.2 "

Press Bulletin No. 73.—Botanical Department.
November 6, 1900.

Cultivated Blue-grasses.

There are several different species of grasses offered by seedsmen under the general name of blue-grass. The following notes may prevent confusion:

KENTUCKY BLUE-GRASS *(Poa pratensis).* This is the common blue-grass of Kansas. It is widely used as a lawn grass, and in the eastern counties not infrequently forms a part of permanent pastures. It is a perennial, spreading by underground stems, and forming a compact sod. The flowering stems are a foot or two high, or even taller in moist situations, and bear at the top a spreading, pyramidal flower cluster. For lawns it is recommended to sow three bushels of

seed per acre, and roll in, rather than cover the seed. This grass is called June grass in the Northern states, green grass in Pennsylvania, and Smooth-stalked Meadow grass in England. It is a native of the northern regions in both hemispheres, but is not a native of Kansas.

CANADIAN BLUE-GRASS *(Poa compressa).* This resembles the preceding, but is much less valuable. It differs in having a blue-green color, strongly flattened or two-edged stems, and a small, narrow flower cluster. Under similar conditions, the growth is not so tall. Like common blue-grass, it spreads by creeping stems and forms a strong sod. It will grow on thinner, poorer soil than the preceding. It is what goes under the name of "blue-grass" in the New England and Middle states. Although of considerable value in the East, especially on poor soil, it seems not worthy of recommendation for Kansas. It is offered for sale in some catalogues under the name of English blue-grass, but must not be confused with the grass known in Kansas by that name.

TEXAS BLUE-GRASS *(Poa arachnifera).* A perennial, spreading by creeping underground stems, forming a strong growth one to three feet high. It is a native of Texas, but is cultivated through the South quite extensively. It is highly recommended for permanent pasture, especially during the winter months. It may do well in some parts of southern Kansas, but has not been sufficiently tested. The flower cluster at the top of the stem is dense and narrow, not spreading like Kentucky blue-grass.

MEADOW FESCUE *(Festuca pratensis* or *Festuca elatior).* This grass is not a blue-grass, but is mentioned here because it is commonly known in Kansas by the name of English blue-grass. Most seed catalogues give it the name of Meadow fescue, and this is the name which properly applies. It is a native of Europe and now extensively grown in the United States for meadow and for pasture. It is a valuable grass for eastern Kansas for both hay and pasture. It is recommended to sow it with orchard-grass—Meadow fescue fifteen pounds, orchard-grass twenty pounds per acre. When conditions are favorable, add two or three pounds of Red clover. The field of orchard-grass and Meadow fescue on the College farm has given very satisfactory results. Meadow fescue is also known under the name of Randall grass and evergreen grass.

A. S. HITCHCOCK

Press Bulletin No. 74.—Horticultural Department.
November 13, 1900.

Some Interesting Climbers for the Veranda.

The genus *Clematis* comprises some climbers that recommend themselves both by neat growth and by a profusion of rich and often fragrant bloom. The range in these respects is sufficient to meet most demands for plants suitable for training to veranda pillars, as well as for screens to clothe unsightly walls or to hide other undesirable features in the view. The Kansas Experiment Station has had the more important plants of this group on trial for several years, and the following notes upon the behavior of some of them in this locality are presented as of interest to growers:

Clematis jackmani, a hybrid form, with reasonable care is fairly hardy and satisfactory. Its flowers are four- to six-rayed, of a rich velvety purple, and when well grown measure four to six inches across. They are produced abundantly upon green wood of the season's growth, either from buds on old wood, or from the crown of the plant after the old wood is killed back by the winter. It is best grown with an eastern or northeastern exposure, and, wherever placed, should be given a good bed of rich black loam, with winter protection for the roots in the form of a heavy mulch of well-rotted manure. The wood sometimes lives through the cold weather without serious injury, but it is better to lay down the vines and protect them with a good covering of clean soil, leaves, or hay. Upon replacing the vines in spring, all weakened parts should be cut off, and for the largest flowers, the sound branches should also be cut well back. This is the most satisfactory of the hybrid clematis varieties.

Clematis henryi, another hybrid, bearing six- or seven-rayed flowers, creamy white, and of the largest size, is a free bloomer and a striking plant, but has shown itself much less hardy here than the preceding, under the same treatment. Its general growth and culture requirements are the same. Its showy and abundant bloom renders it worthy to be grown in large pots or tubs for veranda decoration, the plants being removed during winter to a cool cellar, to prevent injury by frost.

Clematis viticella, a species native to southern Europe, is grown with fair success. It is moderately vigorous, with lilac or purple flowers, four-rayed, spreading about two and one-half inches. Where variety is desired, this species may be admitted, but for display it is quite inferior to its hybrid, *jackmani,* and is little superior to it in hardiness.

Clematis viorna, the "leather flower," native to the eastern United

States, varies in the Southwest into the more beautiful red-flowered form, *coccinea.* The form is a slender vine, of neat growth, with solitary, bell-shaped flowers, about an inch in length. When well grown the plant attains a height of eight feet, and by its clean habit is well adapted to the purposes of a pillar plant. It is only of moderate hardiness, demanding a favorable situation and winter covering.

Clematis pitcheri, growing wild in copses throughout eastern Kansas, while somewhat less neat in growth than the preceding, is greatly improved under cultivation, and deserves a place in every collection. Its flowers are single, bell-shaped, about an inch in length, and of a dull purple color, followed by conspicuous silky seed clusters. It is perfectly hardy.

Clematis flammula, the European fragrant virgin's-bower, has shown itself with us a very desirable wall plant. The growth is strong and in protected situations nearly or quite hardy, furnishing, in average seasons, its pure white, star-shaped, fragrant flowers in great profusion throughout late summer. The foliage is of a healthy, rich green, the leaves remaining on the plant until midwinter. After flowering, the plant is still conspicuous by reason of the abundant feathery seed clusters.

Clematis paniculata, a Japanese species, much like the foregoing, is apparently still more vigorous and hardy, and, on account of the flowers, also more beautiful. Since its introduction it has become a great favorite as a veranda or wall climber, and it may be seen in good condition in many city and country places in eastern Kansas. The flowers being produced upon new growth, the best results are produced by close pruning, where the wood survives. This species and the *flammula* do well when fully exposed to the sun, if their roots be in soil rich, deep, and cool. Where but a single clematis can be grown, the *paniculata* will prove the most satisfactory in ordinary treatment.

Clematis virginiana, or native virgin's-bower, grows wild in some of the eastern counties of this state, forming a strong, woody vine of rampant growth, perfectly hardy in good soil. It is useful as a screen plant, though in beauty much inferior to the two preceding. Its abundant flowers are small and creamy white, and are followed by numerous feathery seed clusters. It spreads naturally by layering, and may soon be brought to cover a large space, appearing to greatest advantage in the less formal parts of the lawn, as on a rocky slope or against a rough wall. From such a base it will climb upward into the lower branches of an overhanging tree, when its true use and beauty are fully apparent.

E. A. POPENOE.

Press Bulletin No. 75.—Botanical Department.
December 4, 1900.

The Races of Corn.

Indian corn has been in cultivation by the native races of America for an indefinite period. It probably originated from a wild form somewhere on the Mexican plateau. Botanists usually refer all our forms to one species, *Zea mays*, with several well-marked subspecies or races.

There are five important races of corn grown in the United States on a commercial scale:

I.— DENT CORNS. A part of the starch in the grain is of a close, hard texture. This is called the horny endosperm, and is found along the sides of the kernel, while the softer portion, or starchy endosperm, is found in the center, extending to the summit. In drying the center shrinks more than the rest, and hence leaves a dent at the apex of the grain. Dent corns are the common field varieties grown in the corn belt and are almost the only kinds exported. There are various colors, white, yellow and mottled (calico) being the most common. There are also red and blue varieties. Three hundred twenty-three varieties are described.

II.— SWEET CORNS. These are chiefly found in gardens, but it is grown on a commercial scale for canning purposes, and some of the large sorts are grown for fodder. The first variety cultivated was obtained from the Indians, New England, in 1779. In 1854 there were ten varieties. Now there are sixty-three. Corn as a vegetable is practically unknown outside the United States.

III.— FLINT. The horny endosperm entirely surrounds the starchy, and hence the grain is smooth at maturity. Color various. Many varieties have eight rows, and hence are known as eight-rowed corn. Flint corn can be grown much farther north than the dent corn, since it matures earlier; hence it is the prevailing form in Canada and the northern United States. Since it is the common corn of New England, it is often called Yankee corn.

IV.— POP-CORNS. These resemble the flint corns, but differ in the ability to "pop" when heated. This phenomenon depends upon the fact that the starch is in the form of horny endosperm and the moisture present cannot easily escape, but finally explodes, turning the grain inside out. Pop-corn seems to be the least modified from the original type. There are twenty-five varieties.

V.— SOFT CORNS. In these the starch is all in the form of starchy endosperm. It seems to have been common among the Indians of

the Southwest. Some of the blue squaw corns belong to this race. Brazilian flour-corn sold by seedsmen is a soft corn. There is no dent in these varieties.

Besides the above, there is a pod corn grown as a curiosity, in which each kernel is enclosed in a husk; and some ornamental varieties, derived from the flint corn, grown for the striped or barred leaves. The latter are usually sold under the name of *Zea japonica.*

The varieties of corn are very variable in size, shape, and other qualities. The late Doctor Sturtevant, an authority on corn, said: "The height of the plant in varieties and localities has been reported from eighteen inches for the golden Tom Thumb pop to thirty feet or more for varieties in the West Indies, and single stalks in Tennessee at 22½ feet. I have seen ears one inch long in the pop class and sixteen inches long in the dent class. The rows in varieties may vary from eight to twenty-four or more, and in individual ears are reported from four to forty-eight. A hundred kernels of miniature pop weighed forty-six grains; of Cuzco soft, 1531 grains. A variety that ripens in one month is mentioned, from Paraguay, and seven months is said to be required in some southern countries."

The tables show that the average composition of dent corn is, protein 10.3 per cent., fat 5 per cent.; flint, protein 10.5 per cent., fat 5 per cent.; sweet, protein 11.6 per cent., fat 8.1 per cent. Sweet corn is thus richer in protein and fat, and correspondingly poorer in carbohydrates.

At the Kansas State Agricultural College, experiments are in progress to increase the protein content of field corn by crossing and selection. Any increase in the protein will greatly extend its usefulness as a feed for stock.

A. S. HITCHCOCK.

Press Bulletin No. 76.—Chemical Department.
December 11, 1900.

Sugar Beets in Kansas, 1900.

The Kansas Experiment Station has continued during the past season to assist the citizens of the state who desire to test further its possible adaptation to the profitable production of sugar beets. The chemist of the Station is a special agent of the United States Department of Agriculture, and, as such, authorized to distribute sugar-beet seed, furnished by the department, through the mails free of charge, and to receive samples of beets for analysis in the same way. Previous years experience have shown that no proper test of the capacity of the state to grow good beets for sugar manufacture can be made by the culture of isolated plats, grown in most cases without

proper regard for the conditions essential to the production of a root rich in sugar. The Station has therefore practically discontinued furnishing seed for such isolated trials, but has been and is ready to cooperate with any groups of farmers who wish to experiment with this crop further.

The very considerable growth of the beet-sugar industry in some of our Northern states naturally directs our capitalists to this possible field for investment in this state. The sorghum-sugar experience has not gotten so far into the past that its value as an object-lesson, is entirely lost, and a proper degree of caution is being exercised before large ventures are to be made in the manufacture of sugar from beets here. The Station has cooperated this season in the most-extended and best-conducted series of tests yet made in this state. Gentlemen interested in the matter secured the growing of a considerable number of plats in the eastern part of the Kansas river valley, for the most part under the supervision of an experienced man. Seed was furnished by the Station and the beets analyzed there. The total number of samples taken was eighty-three, grown by sixty-five different men. The average amount of sugar found was 9.93 per cent. The beets analyzed early were the best, and it is possible that at a still earlier date higher results might have been obtained. Those analyzed before September 20 averaged 10.99 per cent of sugar. W. J. White, of De Soto, and N. W. Nobertson, of Lenape, produced the best samples, with 12.81 per cent. of sugar. The average results of analyses made in three preceding years were as follows: 1897, 11.88 per cent.; 1898, 11.56 per cent.; 1899, 10.89 per cent.

A proper view of the prospects for a successful inauguration of this industry in this state must include a comparison of these figures with those yielded by beets grown in regions where beet sugar is being successfully manufactured. The sugar journals report the production of beets this season with percentages of sugar as follows, at the places stated: New York, 10 to 17.65; Nebraska, 13.5; Indiana, 13.7; Michigan, 14 to 15; Washington, 18; California, 17; Colorado, 17 to 22. Comment would seem to be unnecessary.

J. T. WILLARD.

Press Bulletin No. 77.—Horticultural Department.
December 18, 1900.

Honeysuckles at the Kansas Station.

Along with other interesting and useful shrubs grown for trial upon the grounds at the Kansas Experiment Station for some years past, the honeysuckles have attracted much attention, and proven generally well adapted to the conditions of soil and climate here obtained.

The species of this group of plants, though botanically homogeneous, are for ornamental purposes so widely varied as to fit them for several distinct uses in lawn planting. The list of shrubby sorts provides species of dense, rich and persistent foliage, suitable for mass planting in broad effects, as well as those of character so refined as to render them worthy of place as single specimens in choicer situations. Among the twining forms, again, are those admirably suited to cover mounds, walls, or rough terraces, while others, under the care of appreciative growers, are among the most attractive of trellis or pillar plants. They are generally so hardy, and so responsive to culture withal, that they deserve a wider use in Kansas gardens.

The sorts noted in the following commentary are those proving most satisfactory, selected from the more extensive collection under trial.

ERECT SHRUBS.

Lonicera fragrantissima, a Chinese species of spreading habit, the branches curved, with yellowish bark; the leaves numerous, broad oval, thick, rich green, remaining upon the plant until midwinter, the bushes at this date (December 18) being nearly as green as in summer. The small, yellowish flowers appear quite early in spring, before the appearance of the new foliage, and are very fragrant. From its nearly evergreen habit and dense foliage this honeysuckle is a most useful plant for mass planting in large lawns or in parks. Its only disadvantage is found in a less hardy wood than some of the others. Yet this should not cause its rejection, for its finest effects of foliage are exhibited upon plants that are annually close-pruned, though under this treatment the less ornamental bloom is sacrificed.

Lonicera tatarica. The better known Tartarean or bush honeysuckle, of Asiatic origin, is an erect, vigorous shrub, of a neat habit, the branches covered with white bark. The leaves, which appear early in spring and are long retained, are of the softest and clearest color, and the species would well deserve planting for its foliage alone. But in May an added attraction is presented in its abundant bloom, the flowers being conspicuous, graceful in form, white or pink-red, according to the variety, and pleasantly though not decidedly fragrant. Later the twinned berries appear, coral red or amber yellow, and in such profusion that the bush is little less ornamental at this period than during the season of bloom. The best two varieties are the large-flowered white *(alba)* and the large-flowered red *(grandiflora),* though others are not greatly inferior. This shrub should be one of the first in a list for general planting.

Lonicera xylosteum, the European fly honeysuckle, a taller, more straggling and less handsome shrub than the last, has yet characters

that are sure to attract the observer. The leaves are not large, but are smooth and abundant, and of different shades of green, according to their position upon the shoot, this variation giving a most agreeable impression. The flowers are small, yellowish white, fragrant, and produced in great abundance upon the new growth. As in the other species, the amber berries give later beauty to the shrub, in this sort loading the branches until they bend with their burden. As the plant ages it becomes less attractive, unless well-distributed new growth is assured by some attention to pruning.

WOODY TWINERS.

Lonicera japonica. This Japanese species is best represented by the useful Hall's or Halliana honeysuckle, which is a vigorous grower, almost evergreen, the somewhat downy, rich-green foliage even persisting through the winter where protected by blown leaves or snow. The paired flowers are produced in the axil of every leaf in the new growth, They are deeply cleft into two unequal lobes, are creamy white in color, fading yellow, and have a penetrating fragrance, agreeable to most people, though too powerful for some. While this honeysuckle is largely used as a trellis or pillar plant, and, except for a too luxuriant growth is very satisfactory under such use, its greatest beauty is shown when it is planted where it can cover a rough wall or a mound or a terrace with a dense mat of evergreen branches. Under such circumstances it is admirable at all seasons, and is one of the best plants to employ for such a purpose.

Lonicera caprifolium, the European woodbine, is represented most favorably by a variety from Russia of Professor Budd's importation, under the number 138 Voronesh. This honeysuckle has been on trial upon the Kansas Station grounds for ten years, and besides proving perfectly hardy in ordinary situations, it has shown features that should bring it more prominently before flower lovers. Its growth is vigorous, the shoots long and smooth, the foliage clean and handsome, though not as abundant as in the last. Its flowers are cream white with pinkish tubes, and richly fragrant, and are disposed so neatly in their abundance that a vine properly trained upon a piazza screen is a joy to the eye. This species is certainly to be recommended to all planters.

Lonicera sempervirens. The scarlet trumpet honeysuckle, a well-known favorite, is another that deserves better treatment at the hands of the gardener. As ordinarily grown, without pruning or training, it is likely to become disagreeably naked below, and by the dying out of the crowded branches to become unattractive throughout. For its perfection in form and bloom it needs attention in the way of an annual removal of overtaxed wood and the encouragement of strong

young shoots to take its place. A very effective way of displaying its beauty as an everbloomer is to grow it as a standard, supporting it at first upon a low pillar, shortening in, during the period of growth, of the shoots that tend to grow beyond proper limit. This treatment induces the formation of a stout trunk that after a while becomes self-supporting, and of a head of flowering branches that will give their brilliant bloom throughout the entire summer.

All of these twiners are readily propagated by layers of the ripe wood put down in spring, or of the half-ripened shoots in midsummer. The shrubby species are easily grown from ripe-wood cuttings, taken in the fall, protected over winter in cellar or pit, and set deep in nursery rows early in spring. E. A. POPENOE.

Press Bulletin No. 78.—Botanical Department.
January 8, 1901.

Johnson Grass.

This grass is a native of the Mediterranean region. It was introduced into the Southern states about 1830, and for some time was known by the name of Mean's grass, which name it still retains in some localities. About ten years later it was introduced into Alabama from South Carolina by William Johnson, and has since been quite generally known as Johnson grass. Its botanical name is *Andropogon halapensis*, or *Sorghum halapense.* It is sometimes called Guinea grass, but this name properly belongs to *Panicum maximum*, a tropical forage grass sometimes cultivated in southern Florida.

Johnson grass has received considerable attention in Kansas lately. It has been grown in the plats of the Kansas Experiment Station for several seasons, and its behavior in our climate tested. It is a rank-growing perennial, with numerous strong, rather fleshy creeping rootstocks, by which it propagates. The stems and leaves are coarse but quite suculent. It seeds abundantly, and seed can be purchased at all seed houses. If the seed is clean, about one bushel per acre is sufficient for sowing. Johnson grass is chiefly used for hay, for which purpose it should be cut early, before the stems become too old and hard. Usually two or three cuttings can be made. The seed should not be sown until the ground is warm or it will not germinate well. Johnson grass prefers rich, moist soil, though it will grow in quite a variety of soils. It is injured by severe winters, but the cold winter of 1898–99 did not entirely kill out the experimental plat, and it quickly recovered from the effects of the cold. It is not a success as a pasture grass, as it is injured by grazing to such an extent that a pasture soon becomes useless, yet the vitality of the rootstock is such that it is

never entirely killed out in this way, and, after a rest, soon recovers from the effects.

Throughout the South, under proper conditions it is considered an excellent hay grass, and in all parts of Kansas where there is sufficient moisture it will undoubtedly be valuable for the same purpose.

However, it is exceedingly difficult to eradicate the grass on land where it has obtained a foothold, and for this reason it may become a pestiferous weed. Hogs are rather fond of the rootstock and when confined upon a plat of the grass will destroy it. But on soil adapted to its growth it requires great care to eradicate it. If one wishes to grow Johnson grass, the best plan is to devote a field to the purpose without expecting to subsequently put the field in cultivation. With care it can be confined to this field. After a few years the ground becomes so full of rootstocks that the development is hindered. To rejuvenate a field, it should be plowed and harrowed in the spring, or else thoroughly disked.

All these points should be carefully considered before the grass is given a trial. As a forage grass it may prove of great value, and the fact that it is difficult to eradicate may be in its favor in those parts of Kansas where it is not easy to grow forage plants successfully.

But if tried, great care should be taken to keep it under control.

A. S. HITCHCOCK.

Press Bulletin No. 79.—Chemical Department.
January 15, 1901.

A Digestion Experiment with Buffalo-grass Hay.

The high reputation of buffalo-grass as a pasture for stock, even in its winter condition, gives a special interest to an experiment on its digestibility which has been performed by the chemical department of the Kansas Experiment Station. The experiment possesses additional interest because it is the first one of the kind to be recorded in reference to this important resource of the great plains. It being impracticable to investigate the fresh grass in this respect, its conversion into hay presented the first problem for solution. Our sample is probably the only buffalo-grass hay ever made. This was obtained, after some experimentation with other means, by several days of hard work with a lawn-mower. About 300 pounds were prepared near Oakley, Logan county, and shipped to the Station.

Its digestibility was tried with a grade Shorthorn steer. The animal would not eat the hay at first at all, but by mixing alfalfa with it, and reducing its proportion gradually, the steer was gotten upon the pure buffalo-grass hay in about six days. After this he was kept

on the buffalo-grass hay alone for five days as a preliminary feeding, to free his digestive tract from all other feed, and then he was fed for five days more, which constituted the digestion experiment proper. During this time an accurate account was kept of the hay fed and the amount uneaten. The dung was collected by watchers who were with him at all times. The original hay, the uneaten residues and the dung were carefully sampled and analyzed as usual. The following table exhibits the results:

TABLE OF RESULTS IN DIGESTION OF BUFFALO-GRASS HAY, CALCULATED TO A WATER-FREE BASIS.

	Ash.....	Crude protein.	Fiber.....	Nitrogen-free extract....	Fat.....	Totals....
PERCENTAGE COMPOSITION.						
Hay fed.....	13.2	12.3	26.2	46.1	2.2	100
Hay uneaten.....	15.2	12.0	25.3	45.4	2.1	100
Dung.....	25.7	12.4	20.5	38.8	2.6	100
POUNDS — FIVE DAYS' FEEDING.						
In hay fed.....	10.6	9.9	21.0	36.9	1.7	80.1
In hay uneaten.....	3.1	2.4	5.2	9.3	0.4	20.4
In hay eaten.....	7.5	7.4	15.9	27.6	1.3	59.7
In dung.....	7.0	3.4	5.6	10.6	0.5	27.1
In hay digested.....	0.5	4.0	10.2	17.1	0.8	32.6
PERCENTAGE DIGESTIBLE.						
In hay eaten.....	0.8	6.8	17.2	28.5	1.4	54.7
PERCENTAGE OF EACH NUTRIENT DIGESTIBLE, OR COEFFICIENT OF DIGESTIBILITY.						
Each nutrient.....	6.0	54.4	64.7	61.8	62.4	54.7

The most noticeable feature of the above results is the high percentage of digestible proteids which this hay contains. In this respect it is considerably superior to Kentucky blue-grass and very much better than timothy. It has about the same amount of digestible carbohydrates and fat as these grasses, but, because of its higher percent age of protein, furnishes a better-balanced ration. This valuable grass is worthy of most careful protection. J. T. WILLARD.

Press Bulletin No. 80.—Horticultural Department.
January 20, 1901.

Notes on Plums.

The conclusion drawn by the Kansas Experiment Station from their observations on the Japanese plum is that they rank with the peach in hardiness. They head the list for table and market qualities. Their habit of early blooming makes the crop uncertain. Burbank is, perhaps, hardier than Abundance, and they are nearly equal in quality. Ogon is hardier than either, but not nearly so good in quality of fruit.

Of European plums, Communia, Early Red and one called 19 Orel are at the head of the class, but all European varieties have been uncertain bearers. The fruit is of good quality for use fresh and for canning.

The most promising varieties for general planting are those which have been developed from our wild fruits.

All varieties of the species *americana* have proved hardy. While they retain in varying degree the astringency of the wild plum, most of the varieties produce desirable fruit for canning, marmalade, and jelly. Quaker, Wolf, Weaver and Wyant have the best record for regular bearing and general good qualities.

The varieties of the species *angustifolia*, commonly called Chickasaw plums, have been somewhat injured by extreme cold. Robinson has proved most nearly hardy, and a regular and heavy bearer, producing fruit of good quality.

Most of the class known as *hortulana* have proved fairly hardy. Golden Beauty and Moreman have been the heaviest and most regular bearers. Moreman is a rather small, red plum, red flesh, small pit, and especially fine for jelly. Golden Beauty is a medium-sized yellow plum, of fine flavor when fully ripe, and a favorite for marmalade. Wayland, Wild Goose and Clinton are larger plums, of good quality, and fairly regular in bearing.

Eighteen or twenty feet is recommended as a good distance for planting. Clean culture is an important factor in fighting curculio and fungi. Mixed planting increases the chances for pollination. A full discussion of varieties and culture is given in Bulletin No. 100, which, like the other bulletins, may be had by application to the Agricultural Experiment Station, Manhattan, Kan. A. DICKENS.

Press Bulletin No. 81.—Farm Department.
February 5, 1901.

Soy-beans in Kansas in 1900.

Last year the Kansas Experiment Station sold soy-beans for seed to farmers in sixty-five counties of Kansas. Seedsmen and many farmers also sold soy-beans in different parts of the state. This was the first general trial of this new crop through the state. The season was generally unfavorable to the growth of the beans.

The Kansas Experiment Station wishes to collect all the information possible in regard to the growth of soy-beans in the state during the past year, and we ask that every Kansas farmer who planted soy-beans last spring write us IMMEDIATELY, giving the following information:

Your name.
Post-office.
County.
Kind of soil.
Method of preparing the land.
Variety of soy-beans planted.
How planted.
Time planted.
How cultivated.
Did anything injure the soy-beans; and if so, what was it; and how were the beans injured ?
How were the beans gathered ?
Yield per acre.
What do you think of soy-beans for your section of Kansas ?

Please send your answers to these questions immediately, and address all letters to H. M. Cottrell, Kansas Experiment Station, Manhattan, Kan.

Please send us the name, post-office and county of every other farmer in the state who you know raised soy-beans last year.

We have already received many letters asking where soy-beans for seed may be purchased. We have none for sale. If you have soy-beans for sale, write us, giving the number of bushels offered, so that we may refer buyers to you.

Press Bulletin No. 82.—Farm Department.
February 5, 1901.

Disking Alfalfa.

Our first experience in disking alfalfa was in 1898. A field had been seeded to alfalfa in the dry year of 1894 and a poor stand secured. In 1897 this alfalfa was heavily pastured by hogs. The hogs were

taken off early in the fall and a heavy growth of crab-grass came up. The crab-grass was so thick and the stand of alfalfa so thin that it was not worth keeping.

Late in March, 1898, this field was harrowed with a disk-harrow, the disks sharp and set at as great an angle as possible. It was immediately cross-disked with the disks set the same way. The ground was thoroughly pulverized and the alfalfa apparently destroyed. It soon started, branched out thickly, and we made three good cuttings from that field that summer.

In 1900 we went a step further in disking alfalfa. The season was very dry at Manhattan, the rainfall in June being 1.19 inches, in July 4.51 inches, and in August 2.84 inches. Two fields of alfalfa, two years old, were disked.

One field was disked March 28, the first cutting for hay made May 31; disked June 6, the second cutting for hay made June 25; disked June 27, the third cutting of alfalfa made August 13, and the alfalfa disked for the fourth time August 20. The last cutting of alfalfa was made September 13. This shows four diskings and four cuttings of alfalfa on upland in a dry year.

Another field of alfalfa was disked and cross-disked March 27. The first cutting of alfalfa was made June 4 and the second disking June 6. Through July and the early part of August the alfalfa was cut from day to day, and fed green to dairy cows, to help out dried-up pastures. August 20 the field was disked, and October 3 the last cutting of alfalfa made.

The alfalfa in both fields made fine late fall growth and went into the winter in good condition.

The stand of alfalfa on both fields disked in 1900 was good. A harrow with sharp 16-inch disks was used, the disks being set at a slight angle, just sufficient to turn the soil over, and the harrow was weighted to make the disks split the alfalfa crowns to a depth of two inches. The disking split the alfalfa roots and this made them throw out many new shoots. The disking made an earth mulch over the field and prevented the evaporation of water, so rapid in a dry time from an alfalfa field just after being cut. The disks were set so that they barely turned the soil over, and, running at a depth of two inches, they turned the roots of the crab-grass and weeds up to the sun, which killed them. These disked fields were clean and free from crab-grass in the fall.

We have not disked one-year-old alfalfa. From these experiments, we feel safe in recommending disking all alfalfa of two years standing or more. Make the first disking early in the spring and then disk immediately after each cutting. If the stand of alfalfa is fair to good,

set the disks as we did in the experiments made in 1900. If the stand is poor and the growth of crab-grass thick, set the disks to cut deeply. Disking is of as much value to alfalfa as motivation is to corn.

H. M. COTTRELL.

Press Bulletin No. 83.—Botanical Department.
February 12, 1901.

Clovers.

The clovers are among our most valuable forage plants, though the species usually grown are not able to withstand the extremes of drought and heat prevailing over much of Kansas. Belonging to the group of plants known as legumes, they have the power to utilize the free nitrogen of the air by means of the nodules upon their roots. Consequently they serve as soil renovators, and are valuable to grow in rotation with other crops. On account of the large amount of protein which they contain, they have a high feeding value.

The clovers are characterized by having the flowers in spherical or oblong heads, and the leaves divided into three stalkless leaflets.

The following are more or less grown in Kansas:

RED CLOVER *(Trifolium pratense).* This is the commonest species in Kansas, but can be grown successfully only through the eastern fourth of the state. As far west as Riley county it is uncertain. It is a short-lived perennial, or often scarcely more than a biennial, with red flowers, and dark spots upon the leaflets. It is a common practice to sow clover with timothy for both meadow and pasture; the timothy tends to hold the clover upright, and the mixture is considered to make better feed. The timothy is usually sown in the fall, often with wheat, by a special attachment to the drill, and the clover sown in the following spring, or the timothy is sown early in the spring and the clover in April, or after danger from frost is passed. There should be about six to eight quarts of timothy to eight or ten pounds of clover per acre.

MAMMOTH CLOVER *(Trifolium medium).* This resembles Red clover, but has no spots upon the leaves. It is adapted to more moist land than is Red clover, and under favorable conditions is said to give a larger yield than that species.

ALSIKE CLOVER *(Trifolium hybridum).* A perennial clover whose appearance suggests a hybrid between Red and White clovers, but it is not a hybrid. It will thrive on soil too wet for Red clover, but on ordinary soil is probably not to be so highly recommended. It should be sown with grasses to give the best results.

WHITE CLOVER *(Trifolium repens).* A low-growing perennial,

spreading by creeping stems. Flowers white, the older ones more or less purplish-tinged. It is of no value as a hay crop but is quite useful in pastures through the eastern part of the state. It is usually associated with Kentucky blue-grass for this purpose. It endures drought fairly well and will grow on soil too poor to support other tame-pasture constituents. It is the shamrock of Ireland.

CRIMSON CLOVER *(Trifolium incarnatum.)* An erect annual, a foot or two high. Flowers scarlet, in oblong heads. It is much used in the Southern states as a soiling crop. It is susceptible to drought, but may do well in the southeastern part of the state. It seems not to have been grown much in Kansas.

SO-CALLED CLOVERS. — There are several other legumes which go under the name of clover, but are not true clovers, though they may be allied to them. Of these may be mentioned Sweet or Bokhara clover *(Melilotus albus)* and Japan clover *(Lespedeza striata).*

A. S. HITCHCOCK.

Press Bulletin No. 84.—Farm Department.
March 1, 1901.

Tests of Soy-beans by Kansas Farmers in 1900.

The Kansas Experiment Station has received reports from 276 Kansas farmers who raised soy-beans in 1900. These reports came from 72 counties. One hundred and forty-nine farmers write that the soy-bean is a profitable crop, 44 have a favorable opinion but need further trial, 34 report unfavorably, and 35 think the crop a total failure. The others did not express an opinion.

Most of the successful farmers plowed and harrowed their ground as for surface-planting of corn, a few listed or double-listed, either listing shallow or else harrowing the furrows nearly full. The Early Yellow soy gave the best yield, only a few farmers having success with the late varieties.

The favorite method of planting was with a grain-drill, stopping up all the holes but those that put the rows 32 inches apart, and dropping single beans 2 or 3 inches apart in the row. Corn-planters with drill attachments and one-horse corn-drills were frequently used. Objections were made that corn-planters put the rows too far apart for best yield. The best yields were usually secured by planting as soon as corn planting was finished. Several farmers in eastern Kansas report that with them beans may be planted any time before July 1. The same cultivation as for corn was usually given. Eagle-claw attachments and five-toothed cultivators were frequently used.

The season was exceptionally unfavorable. Hot winds and drought from the time of blossoming to maturing cut the crop short and

shriveled the beans. This was immediately followed by heavy and long-continued rains that injured the beans in shock and stack. The worst pest was rabbits, the injury from them varying from slight to the destruction of every stalk on eleven acres. In some places soy-beans cannot be profitably grown as long as rabbits are so numerous. Some injury is reported by grasshoppers and other insects.

The yields were from nothing to 31 bushels of grain per acre and up to 2 tons of hay per acre, the hay being reported as nearly equal to alfalfa in value, and superior to clover. Most of the yields were from 12 to 20 bushels per acre. On the College farm, soy-beans yielded 7.4 bushels per acre alongside of Kafir-corn yielding 20 bushels, and corn a total failure.

Many reports show a failure of seed to grow. Soy-beans for seed must be kept in cool, well-ventilated bins, in thin layers. In buying seed, empty the sacks as soon as received, and keep the beans spread out in a dry, cool place in a thin layer. A grower may send the best of seed, and yet if it is kept in the sacks until planting-time it will usually heat sufficiently to destroy its growing powers.

Satisfactory results are reported in feeding soy-beans to horses, mules, dairy cows, young stock, sheep, lambs, hogs, and poultry, Many farmers report that they have never fed anything equal to it; a few write that their stock could not be induced to eat either beans or hay.

The season was the most unfavorable for growing soy-beans, but one, that we have had in twelve years. The crop was a new one to most of the farmers raising it, and many mistakes were made. Good results were secured in this poor season, and with a new crop, by a majority of the farmers who reported, indicating that in an ordinary year most Kansas stock-raisers will find this crop profitable. We believe it will pay nearly every farmer in the state to plant five to ten acres of soy-beans in 1901, and many farmers report that they will plant much larger areas.

The reports in detail as made by 276 farmers will be given in a large bulletin now in press. H. M. COTTRELL.

Press Bulletin No. 85,—Farm Department.
March 5, 1901.

Roots for Kansas Farmers.

A horse, a cow or a sheep will thrive and do well on good pasture alone. Cut this grass, carefully cure it, and feed the animal on hay alone. It will lose its appetite in a few weeks, become thinner, and it will not have a thrifty appearance. The hay is a dry feed, the grass a succulent feed. If the best results are to be secured from

feeding in winter, some succulent feed should be provided to take the place of the green feed of summer.

The cheapest and most convenient way of providing succulent feed is by corn silage; the next best way is with roots; and when a farmer does not have a silo he should raise roots. We recommend the growing by Kansas farmers of mangel-wurzels as the root crop best adapted to Kansas conditions. Sugar beets are worth more, pound for pound, as feed, but the greater yield of the mangel overbalances this. The mangel is a coarse stock beet.

Mangels need a good, rich soil. Creek or river bottom is good, and the writer has seen 1200 bushels per acre grown in a small, rich ravine on an upland farm. On most farms there is some rich, moist spot that is suitable for mangels. The ground should be prepared just as for a garden, deeply plowed, and thoroughly pulverized just before planting.

Plant ten days before you plant corn. This is very important. A later planting often results in a total failure of the seed to grow. The mangel grows fairly well in dry weather after it gets started, but the seed will not germinate unless the soil is thoroughly moist.

The seed should be planted in rows thirty inches apart, dropping the seed about as thickly in the row as for garden beets. At the Kansas Experiment Station we have found it most convenient to plant with a two-horse grain-drill having press wheels. We stop up all the holes in the drill but those from which we want seed to drop. About six pounds of good seed are required for an acre. Test the seed before planting, as much of it on the market is poor. Last spring we bought seed of two varieties of a leading seedsman; only ten per cent of one variety grew, while the seed of the other sort was all right.

The Long Red mangel yields the most but it is not a good keeper. We plant it for feeding up to New Year's. The Golden Tankard, if properly handled, will keep until June, and we plant this variety to furnish the supply of roots needed from New Year's until spring.

Cultivate as for corn. We use a two-horse spring-tooth cultivator, taking off the outside shovels. After the first cultivation, thin with a hoe to one plant every six inches in the row.

Mangels are a valuable feed to give brood sows during the winter. Fed in connection with grain, they keep the animal healthy, the hair glossy, and the system cool. Fattening hogs like them as a change from corn and they keep the appetite up well. It is difficult to maintain a full yield of milk in winter without succulent feed, and mangels supply this to the dairy cow in a palatable form. Mangels help push the calves along through the winter. Plant an acre this spring.

H. M. COTTRELL.

Press Bulletin No. 86.—Farm Department.
April 23, 1901.

Kafir-corn versus Good Butter.

The Kansas Experiment Station has received numerous letters from farmers and dairymen asking if Kafir-corn will produce a poor quality of butter. The cause of these inquiries has been the reading of the following dispatch in our daily papers:

"LYNDON, KAN., March 26. — It has cost the Overbrook creamery, of this place, $400 to learn that the milk from cows fed on Kafir-corn will not produce good butter. For the past three months the manager of the creamery has been unable to make high grade butter, and has lost about $400 on a reduction in the price. He had experts at work to locate the trouble, but they failed. Finally one of the common laborers at the creamery did some experimenting on his own account. He kept the milk separate and churned some of each, He soon found out that the milk from the cows fed on Kafir-corn was what brought down the grade of butter."

If Kafir-corn, which has been such a good yielder and drought-resister, should be excluded from the ration of the dairy cow, many farmers in central and western Kansas would be obliged to quit the dairy business. This would result in a loss of thousands of dollars annually. Fortunately other experiences do not tally with the report. The Kansas Experiment Station has fed the grain and fodder of Kafir-corn for months at a time and has never experienced a particle of trouble from its producing a poor quality of butter. During the months of February and March, 1898, the Station herd was fed almost exclusively on Kafir-corn meal for the grain ration. At that time the dairy school was in session, and we were making butter from the milk of this herd without the addition of any milk from outside sources. The butter was tested by competent judges and pronounced excellent in quality. Since this time both the grain and the fodder of Kafir-corn have been used as the whole or part of the ration, the milk being sent to the Manhattan creamery, where it has been saved to use in the making of starters. The milk has also been used each year at the dairy school, both with and without milk from other sources; it has been specially sought for by our cheese boys in their effort to make a first-class quality of cheese, and in no instance have we heard a single complaint from the use of the College milk on account of the cows being fed on Kafir-corn.

When the season is a poor one for the curing of the crop and the grain has been left on the fodder, considerable penetrating dust arises from the crop where handled at feeding time. If the feeding is done just before or at milking-time, particles of this dust, with all the germs that they carry with them, will undoubtedly find their way

to the milk-pail and may cause a poor quality of butter. In the instance of the Overbrook creamery, the manager states that the Kafir-corn in that part of the country had all been damaged by rains, and where the feed was the poorest the milk from that farm made the poorest butter. Indications point to a slight decomposition of the feed. Hay and fodders of any kind contain large number of offensive germs, which, if allowed an entrance into the milk-pail and permitted to multiply rapidly, will cause a very undesirable quality of butter.

This experience, together with others with which we are familiar, points to the necessity of feeding after rather than before milking. In this way, Kafir-corn, properly balanced, is one of our best feeds for a dairy cow and should be grown extensively where corn is uncertain.

D. H. OTIS.

Press Bulletin No. 87.—Farm Department
May 20, 1901.

When to Cut Alfalfa.

Alfalfa should be cut when not more than one-tenth of the plants have come in bloom. Cut at this early stage, the yield of hay for the season will be much greater than if the alfalfa is cut near maturity, and every pound of hay secured will be worth more for feed.

At the Kansas Experiment Station, a strip through a field of alfalfa was cut when one-tenth was in bloom, another strip was cut after full bloom had past. The strip cut early was nearly ready to cut the second time when that cut after full bloom was being harvested the first time. The strip cut early grew vigorously through the season and made three cuttings and a good aftermath. The strip cut after full bloom gave a low yield the first cutting and did not grow sufficiently to yield a good second cutting. Early cuttings seem to invigorate the plant.

The late cutting of the first crop seems to injure the plant more than at any other time, and we have found it profitable to cut alfalfa the first time as soon as one-tenth was in bloom, even though the weather was bad and we knew that the crop would spoil in curing. The increased yield from succeeding cuttings over that cut late much more than makes up for the loss of the first crop.

Successful clover-growers, the first time they try alfalfa, often ruin the stand, so that it has to be plowed up, by waiting to cut until it reaches the stage at which clover is usually cut.

The great value of alfalfa is the large amount of protein it contains—that material in feed that is absolutely necessary for the formation of blood, lean meat and milk. The higher the protein in alfalfa

the more valuable the crop. The chemical department of this Station found the effect of cutting alfalfa at different stages as follows:

	Protein.
One-tenth in bloom	18.5 per cent.
One-half in bloom	17.2 "
In full bloom	14.4 "

The Colorado Experiment Station found the effect of cutting alfalfa as follows:

	Protein.
Coming in bloom	18.5 per cent.
Half in bloom	14.6 "
In full bloom	12.9 "

The Utah Experiment Station for five years cut alfalfa at different stages of maturity and fed the crop in producing beef. The average production per year per acre was as follows:

	Hay, tons.	Beef, pounds.
In first bloom	5.35	706
In full bloom	4.90	562
Half blooms fallen	4.55	490

These, experiments, made in three states — Kansas, Colorado, and Utah — prove that alfalfa cut in the first bloom will give the greatest yield and feeding value. The leaves of alfalfa contain more than three times as much protein as the stems, a ton of alfalfa leaves containing as much protein as 2800 pounds of bran. Every care should be taken in curing alfalfa to save the leaves. H. M. COTTRELL.

Press Bulletin No. 88.—Farm Department.
May 21, 1901.

Condimental Stock Food for Dairy Cows.

EXPERIENCE WITH ACME STOCK FOOD.—On November 1, 1900, sixteen cows from the herd of the Kansas Agricultural College were divided into two lots as nearly equal as possible, on the basis of the yields of milk and butter-fat for the month of October. One lot (cows fed Acme food) had the advantage by 212 pounds of milk and 17.4 pounds of butter-fat for the month. Both lots were fed on alfalfa hay, with a grain ration of equal parts of corn chop and bran. In addition to this feed, one lot received Acme stock food fed according to directions. On December 1 oats took the place of bran in the grain ration of both lots. The results for the three months (ninety-two days) under experiment are as follows:

Eight cows receiving Acme food.		Eight cows without Acme food.	
Milk produced, pounds.	14,271	Milk produced, pounds	14,395
Test, per cent	4.39	Test, per cent	4.13
Butter fat produced, pounds,	626.7	Butter-fat produced, pounds,	595.9
Cost per pound of fat, cents,	14.6	Cost per pound of fat, cents,	12.3

The Acme-food lot consumed 136 pounds of Acme food, which, at

eleven cents (wholesale price), amounts to $14.96. Deduct this from the feed cost and the expense for feed in producing a pound of butter-fat is reduced to 11.68 cents. The difference in the total production of butter-fat can readily be accounted for by the difference in the lots at the commencement of the experiment; but granting that it is due to the effects of the Acme food, it would make the extra butter-fat cost forty-eight cents per pound.

EXPERIENCE WITH GLOBE STOCK FOOD. — Taking the record for the month of January as the basis, a herd of twenty cows was divided into two lots as nearly equal as possible, there being only a difference of 1.4 pounds of butter-fat in the total yield for the month. All the cows received alfalfa hay for roughness and equal quantities of corn-and-cob meal and oats for the grain ration. One lot received the Globe stock food in addition. The results for two months (59 days) are as follows:

Ten cows with Globe food.		Ten cows without Globe food.	
Milk produced, pounds	12,784	Milk produced, pounds.	12,896
Test, per cent	4.05	Test, per cent	3.96
Butter-fat produced, pounds,	518.1	Butter-fat produced, pounds,	511.3
Cost per pound of fat, cents,	11.7	Cost per pound of fat. cents,	11

If the Globe food be eliminated from this experiment, the cost of producing a pound of butter-fat is the same in both lots. The totals for two months show that the cows receiving the Globe food produced 6.8 pounds the most butter-fat. Globe food sells for nine cents per pound (wholesale rates). The ten cows consumed 43.3 pounds, worth $3.89, or a cost of 57 cents for each extra pound of butter-fat produced.

The tests of these two stock foods indicate that they are worthless for dairy cows accustomed to a good balanced ration. The experience of the Kansas Experiment Station coincides with the experience of other stations where a still larger number of these stock foods have been tested. When financial gain is the object, it will pay the farmer to confine himself to those feeds that have been thoroughly tested, whose merits are known, and which can be raised or purchased at reasonable prices, rather than to pay exorbitant sums for so-called stock foods whose merits, to say the least, are very doubtful.

D. H. OTIS.

Press Bulletin No. 89.—Farm Department.
May 28, 1901.

Shelled Corn Compared with Corn Chop for Young Calves.

In the fall of 1900, the Kansas Experiment Station purchased twenty head of young calves, composed mostly of Shorthorn and Hereford grades. On November 28, these calves were divided into

two lots as nearly equal as possible, the average weight being 127 pounds. Both lots were fed and treated alike, with the exception that one received its grain as shelled corn and the other as corn chop. All the calves were fed mixed hay (Red clover, orchard-grass, and English blue-grass) for the first nine weeks, prairie hay for the next four weeks, and a mixture of prairie hay and alfalfa for the last six weeks. Each lot was given all the milk, grain and hay the calves would eat without scouring. Salt was accessible at all times. For nine days previous to the division into lots the grain for all the calves consisted of a mixture of shelled corn and corn chop. It was noticed that the calves would begin to eat the shelled corn when three to four weeks old, and in a few cases when two to three weeks old. At the commencement of the experiment each lot was consuming ten pounds of grain daily. As the experiment advanced it was found that the corn-chop calves could not eat as much grain as the shelled-corn calves without causing considerable trouble from scours. This accounts for the difference of 325 pounds in the grain consumed by the two lots.

SHELLED CORN LOT. — For nineteen weeks under experiment these ten calves consumed 18,561 pounds of skim-milk, 2611 pounds of shelled corn, and 7088 pounds of hay, The total gain during the experiment was 2322 pounds, or 1.74 pounds daily per head. Valuing skim-milk at 15 cents per 100 pounds, grain at 50 cents per 100 pounds, and hay at $4 per ton, the feed cost of raising these calves amounts to $55.06, or $5.50 per head. The cost for each 100 pounds of gain is as follows: Skim-milk, $1.20; grain, 56 cents; roughness, 61 cents; total, $2.37.

CORN- CHOP LOT.— The ten calves consumed 18,666 pounds of skim-milk, 2286 pounds of corn chop, and 7088 pounds of hay. The gain of this lot was 2123 pounds, or 1.59 pounds daily per head, At prices given above, the feed cost amounts to $53.60, or $5.36 per head. The cost of each 100 pounds of gain is as follows: Skim-milk, $1.31; grain, 54 cents; roughness, 67 cents; total, $2.52. If we raise the cost of grain 5 cents per 100 pounds (about 3 cents per bushel) to pay for the grinding, the grain cost per 100 pounds of gain would be increased to 59 cents, and the total to $2.57.

Comparing the two lots, we find those on shelled corn made the best gains by 199 pounds, and at a cost of 20 cents less per 100 pounds of gain. Since calves relish shelled corn and will begin eating it when three or four weeks old, and make better and cheaper gains on it, and are less subject to scours than on corn chop, there is certainly no object in going to the expense of grinding the corn. This experiment shows that it is possible to raise good, thrifty calves, that will gain

1.75 pounds daily per head, on feeds produced entirely from the farm and in a form that requires no preparation of the feed, outside of harvesting, except the shelling of the corn. D. H. OTIS.

Press Bulletin No. 90.—Farm Department.
June 4, 1901.

Dried Blood as a Tonic for Young Calves.

For two years the Kansas Experiment Station has used dried blood in connection with its experiments in feeding calves. In March, 1889, one of our cows gave birth to a calf weighing eighty-six pounds. This calf was allowed to suck for several weeks, to assist in reducing the inflammation in the dam's udder. On account of poor quality and quantity of milk, the calf did very poorly, and to save its life it became necessary to remove him from his dam. With the ordinary treatment accorded our calves he grew worse and worse, and when seventy-nine days old weighed only ninety pounds, or four pounds heavier than at birth, Although no one would have given ten cents for the calf at this time, an effort was made to bring him out. He was given castor-oil, laudanum, fresh eggs, calf meal, and, as a last resort, dried blood. With the blood the calf commenced to improve, and in a short time was gaining at the rate of nearly fourteen pounds per week, and not infrequently as high as seventeen to eighteen pounds per week. When a year old he weighed 578 pounds—a pretty good record for a calf that gained only four pounds for the first seventy-nine days of its existence. The dried blood consumed during parts of three months amounted to seven and one-half pounds. At two cents per pound, the cost was fifteen cents.

In October, 1900, a heifer belonging to the Agricultural College dropped her first calf. The calf was small and sickly, and for the first few weeks did very poorly, as is shown by the fact that on December 1 it weighed two pounds less than on November 1. For a few weeks its life was in a very critical condition, but when induced to eat a little dried blood with its milk it began to improve and has been making fair gains ever since.

Dried blood is not only good for a weak calf, but is an excellent remedy for any calf subject to scours. The Kansas Experiment Station has just purchased twenty young calves. Frequently these calves arrive at the Station badly affected with scours. A little dried blood always brings about a cure. Recently a test was made with five calves that happened to be scouring at the same time. With two of these dried blood was fed, after reducing the regular feed of milk. With the other three the dried blood was fed without changing the

supply of milk. In the former ease the calves recovered from the scours after two feeds; in the latter after three feeds. With the seventy head of young calves under experiment at the Kansas Station during the past year, there has not been a single case of scours that dried blood has failed to check.

In feeding dried blood, a teaspoonful at a feed is a great plenty. This should be continued until the scours disappear. In case of a weak calf, the allowance may be gradually increased to a tablespoonful at a feed. To prevent the dried blood from settling to the bottom of the pail where the calf will be unable to get it, it may be stirred in the milk while the calf is drinking, or the milk and blood may be fed immediately after being thoroughly mixed. Since dried blood is such a cheap and effective remedy, it will pay any one who raises young calves by hand to have a little available whenever a calf shows signs of disorder in its digestive tract. It can be obtained from any of the large packers. When ordering state that the blood is wanted for feeding purposes. D. H. OTIS.

Press Bulletin No. 91.—Entomological Department.
June 11, 1901.

The Clover-hay Worm.

From specimens and inquiries reaching the entomological department of the Kansas State Experiment Station regarding the clover-hay worm *(Pyralis costalis)*, it seems that this insect is more abundant than formerly in Kansas. It has been recognized as a member of our fauna, but until recently has attracted little attention. With the extension of alfalfa growing, however, this species finds a new and entirely suitable food, and its abundance in stacks of this valuable hay, as evidenced through communications received at this office, may well mark it as a pest of importance.

This worm attacks clover and alfalfa hay, both in the mow and in the stack, cutting up the leaves into chaffy pieces and webbing the mass together by abundant cases of silken threads, which it is the habit of the worm to spin at all times. Hay so infested looks moldy and matted, and the abundance of the silken threads, mingled with the excrement of the worms, renders the hay distasteful to cattle.

When young the worms are of a dirty white color, darkening as they grow older, until they become a livid brown. When mature they measure about three-quarters of an inch in length. The pupal stage is passed in a thin silken cocoon spun near where the larval life is passed, and the adult moth is soon given forth, a trim little insect, with wings spreading about four-fifths of an inch, in color a lilac

brown or purple, with two bands of a lighter shade, each starting from a yellow spot on the front of the wing.

The moths may frequently be seen resting on walls and timbers within barns where clover hay has been stored, and their appearance in such places should warn the owner to clean out the mows thoroughly before storing the new crop. The insect is always more abundant where old hay remains over summer and in stack bottoms, rebuilt in the same places year after year, of the waste hay remaining over. Much less danger of attack will result if such waste hay be fed clean; or, if badly infested, it should be burned. The amusing suggestion of a writer in a recent number of a Kansas paper, that the worms may be destroyed by placing on the top of the stack a vessel containing carbon bisulphide, will hardly commend itself to practice with those having any experience with this liquid. E. A. POPENOE.

Press Bulletin No, 92.—Farm Department.
June 25, 1901.

Cow-peas as a Second Crop.

Cow-pea hay is nearly equal to alfalfa in feeding value and contains nearly one-half more flesh- and milk-making material than clover hay. It is rich in the mineral matter that is needed in forming bone, blood, flesh, and milk. These qualities make it especially valuable for feeding growing cattle and pigs, dairy cows, and fattening steers and hogs. The cow-pea enriches the land on which it grows, the same as alfalfa, clover, and soy-beans. It makes hard soils mellow and aids in holding loose soils together, and stands drought well. In Kansas, cow-peas can often be grown as a second crop, after wheat and oats.

July 16, 1900, F. A. and F. C. Abbott, Manhattan, Kan., planted fifteen acres of cow-peas on oat stubble on sandy river bottom. A crop of oats was grown on the land and harvested. After the oats were stacked the ground was listed, the lister opening the furrows in the oat stubble just as it was left at harvest. The furrows were run about three feet apart, and the cow-peas were drilled in the bottom of the furrows with an ordinary one-horse corn-drill, four bushels of seed being used to plant fifteen acres. The drill did not cover the seed well and the ground was harrowed to get more dirt in the furrows. The Whipoorwill variety was used.

The beans were cultivated twice with an ordinary two-horse cultivator. This left the ground nearly level at the last cultivation. The season was very dry, but the beans made a heavy growth, and at the time of cutting, October 4, stood two feet high and covered the space between the rows.

The Abbotts tried to out the crop with a mower, but found this unsatisfactory, as the mower could not reach the vines that were on the ground, and with part of the vines cut and part uncut it was difficult to gather the tangled mass. Finally, after consultation at the Kansas Experiment Station, the Miller bean harvester was tried, and found to do the work just right. This machine is made by the Le Roy Plow Company, Le Roy, N.Y., and was designed for harvesting navy beans, but it was found just as successful in harvesting soy-beans and cow-peas.

With the Miller harvester two rows were cut at a time, the knives cutting off the plants just below the surface of the ground, and the wings above the knives throwing the vines from the two rows together into a windrow. The vines were put up in small cocks, where they were left to cure until dry enough to stack. The yield of hay was estimated to be one ton per acre, possibly a little more.

June 23, 1900, the Kansas Experiment Station plowed ground from which wheat had been harvested and planted it to Whipoorwill cow-peas, using an ordinary press-wheel grain-drill and letting the seed run from every hole. The ground was dry and no rain fell for some time. Many of the cow-peas sprouted and died, and not over one-third of a stand was secured.

When the soil is sufficiently moist we recommend surface-planting; when dry we advise listing. The College has no seed for sale.

H. M. COTTRELL.

Press Bulletin No. 93.—Farm Department.
July 2, 1901.

Baby Beef.

In the latter part of October, 1900, the Kansas Experiment Station put into the feed-lots 130 head of calves that had just been weaned. They were divided into lots, to test the value of alfalfa hay, prairie hay, corn, Kafir-corn and soy-beans in the production of baby beef.

Sixty head of heifer calves were purchased in the Kansas City stock-yards, weighed an average of 418 pounds each, cost $4.25 per cwt. at the yards, and cost an average of $18.25 per head delivered in the College feed-lots. These were range calves, grade Shorthorn, Hereford, and Angus. Fifty head were purchased of farmers near Manhattan, and had been kept with their dams through the summer in small pastures. Twenty head were mixed-bred calves that had been purchased around Manhattan when born, and had been raised at the College by hand, ten being raised on creamery skim-milk and ten on whole milk. The calves were vaccinated to prevent blackleg. Without this safeguard we should not have dared to undertake the experiment.

All lots were fed twice daily all they would eat, water and salt were always before them, and they were sheltered in common board sheds opened to the south. The yards were fenced with woven wire.

The calves were fed seven months, with the following results:

Feed.	Average gain per head.	Grain per 100 pounds gain.	Hay per 100 pounds gain.
Alfalfa hay and corn ..... lbs.	407	470	544
Alfalfa hay and Kafir-corn..... "	379	524	626
Prairie hay, corn, two-thirds; and soy beans, one-third..... "	378	520	486
Prairie hay, Kafir-corn, two-thirds; soy beans, one-third..... "	342	594	539
Skim milk calves, alfalfa hay and corn..... "	440	439	436
Whole-milk calves, alfalfa hay and corn..... "	404	470	420

At the close of the experiment, May 27, the entire lot averaged 800 pounds per head in the College feed-lots. The shrinkage in shipping to Kansas City was three per cent. Thirty-two steers averaged 838 pounds, and sold at $5.40 per 100 pounds; seventy-four heifers averaged 758 pounds, and sold at $5.35; and eighteen heifers averaged 741 pounds, and sold at $5.15. Six head of heifers went as springers.

The remarkable feature of this experiment is the small amount of feed required to make 100 pounds of gain. Last year the Kansas Experiment Station reported making 100 pounds gain on 1000-pound steers with 718 and 780 pounds of corn. Many old feeders wrote us that they could not make such gains with so little feed. Professor Henry reports that he finds the average in a large number of feeding experiments with steers to be 100 pounds of gain for 1000 pounds of grain and 500 pounds of roughage.

These calves averaged 100 pounds gain for from 439 to 594 pounds of grain and 420 to 626 pounds of hay, about one-half the amount required for mature cattle. H. M. COTTRELL.

Press Bulletin No. 94.—Farm Department, July 9, 1901.

Three Ways of Feeding Milk to Calves.

Twenty head of grade Shorthorn and Hereford calves were purchased by the Kansas Experiment Station in the spring of 1900, and divided into two lots. One lot was fed on sterilized creamery skim-milk, with a grain ration composed of equal parts of corn and Kafir-corn meal, with all the alfalfa hay they would eat. The second lot was fed the same as the first, except that fresh whole milk was used instead of skim-milk. In addition to these two lots, the Station secured the privilege of weighing twenty-two head of high-grade Hereford calves

which were running with their dams in a pasture near the Experiment Station.

RESULTS WITH SKIM-MILK.—For the twenty-two weeks under experiment, the ten calves consumed 24,736 pounds of skim-milk, 1430 pounds of corn chop, 1430 pounds of Kafir-corn meal, and 641 pounds of alfalfa hay. The total gain was 2331 pounds, or a daily average of 1.51 pounds per head. Figuring skim-milk at 15 cents per 100, grain at 50 cents per 100 pounds, and hay at $4 per ton, the total feed cost of raising these calves was $52.68, or $5.27 per head. The feed cost for each 100 pounds of gain was $2.26.

Cows that are milked will produce larger yields than when suckling calves. According to the average yield at this Station, ten cows (one for each calf) produced 55,540 pounds of milk, testing 3.93 per cent. butter-fat. With butter-fat at 15½ cents per pound, this would amount to $338.52. The value of the skim-milk not needed by the calves would raise this to $374.24. Deduct from this the value of the feed consumed by the calves, and there remains $321.56, or $32.15 per calf, to pay for the expense of milking, feeding the calves, and hauling the milk to the creamery. At 12½ cents per hour, this expense need not be one-half of the above sum, leaving $15 to $16 clear profit for each calf raised on skim-milk.

RESULTS WITH WHOLE MILK—During twenty-two weeks these ten calves consumed 23,287 pounds of fresh milk, 835 pounds of corn chop, 835 pounds of Kafir-corn meal, and 835 pounds of alfalfa hay. The total gain was 2878 pounds, or a daily average of 1.95 pounds per head. Charging butter-fat at creamery prices, the feed cost of raising these calves amounts to $159.19, or $15.72 per head. The feed cost for each 100 pounds of gain amounts to $5.46.

RESULTS WITH CALVES NURSED BY THE COWS. —On May 28, 1900, twenty-two calves that were running with their dams averaged 174 pounds. On October 15, these same calves averaged 422 pounds, or an average daily gain per head of 1.77 pounds. The only expense attached to raising these calves was the keep of the cows, which was estimated by the owner to be $12 per head. Multiplying the average daily gain of these calves by 154, the number of days in previous experiment, gives a total gain of 272 pounds per head. With $12 as the cost of raising the calf, each 100 pounds of gain cost $4.41.

RESULTS IN FEED-LOT AFTER WEANING.—In the fall all these calves were placed in the feed-lot, where they were pushed for baby beef. During the seven months under experiment, the skim-milk calves gained 440 pounds per head, the whole-milk calves 405 pounds per head, and the calves nursed by the cows 422 pounds per head.

This experiment shows that the feed cost of raising a good skim-milk calf need not exceed $5.25, in contrast to $15.75 for a whole-milk calf, and $8 for one nursed by the dam. The skim-milk calf becomes accustomed to eating both grain and roughness early in life, is handled enough to be gentle, and when transferred to the feed-lot is ready to make rapid and economical gains. D. H. OTIS.

Press Bulletin No. 95.—Farm Department.
July 16, 1901.

Skim-milk Calves in the Feed-lot.

Feeders find that the average skim-milk calf does not make profitable gains in the feed-lot and will not buy him. Farmers find that the difference in price between an ordinary skim-milk calf and one that has run with the cow is frequently greater than the profits made from milking, and they drop dairy work.

The Kansas Experiment Station during the past winter fattened 130 head of calves far baby beef. These were divided into nine lots—one lot of ten had been raised by hand with skim-milk, and another lot of ten had run with their dams in small pastures until weaning. Both lots were put in fattening yards at weaning and were fed for seven months on alfalfa hay and corn. The results are as follows:

	Average gain per head, pounds.	Feed for 100 pounds gain.	
		Corn.	Alfalfa.
Calves raised with dam	435	475	472
Skim-milk calves.	440	439	436

Corn cost 40 cents a bushel and alfalfa hay $8 a ton, making the cost of each 100 pounds gain $5.28 for calves raised with their dams and $4.88 for the skim-milk calves. The calves when fattened were shipped to Kansas City, the steers in each lot bringing $5.40 per hundred and the heifers $5.15. The packers paid the same price for the fattened skim-milk calves that they did for the others. In this trial, the skim-milk calves made the greater gain, gains at the least cost, and made the most profit.

We attribute the good showing made by the skim-milk calves to fact that at weaning-time they were already on grain feed, they did not worry at loss of their dams as did the other calves, and they were perfectly tame.

The skim-milk calves were fed until weaning on sterilized skim-milk, with a grain ration composed of equal parts of corn and Kafir-

corn, with all the alfalfa hay they would eat. They were fed in this way twenty-two weeks, and made an average daily gain of one and a half pounds per calf. The feed to raise these calves to weaning cost $5.27 per head. As the results show, they were in good condition for feeding when weaned, and the experiment shows strongly the good feeding qualities of the skim-milk calf and the profits that can be made from it when the calf is properly handled from birth to weaning and then pushed for baby beef.

The College herd of scrub cows, bought without regard to their value for the dairy, produced in a year, at creamery prices, milk worth $37.75 per cow. The skim-milk calves which were fattened in this experiment were of mixed breeding, and were selected without regard to their value for the production of baby beef. They brought an average of forty dollars each when marketed at about a year old. This shows a gross income in a year from a scrub cow and a scrub calf of $77.75, when both cow and calf are pushed, the cow's milk sold, and the calf raised on skim-milk.

The best cow in the scrub herd produced milk in a year worth, at creamery prices, $60.88, The best calf in the skim-milk lot brought $47. This shows that a good scrub cow with a good calf could be made to bring over $100 gross income in a year. With large grade Shorthorn or Hereford cows of the dairy type crossed with a short-legged, thick-meated, blocky bull, the returns from both cow and calf would undoubtedly be much greater, making the combination of dairying and baby beef very profitable. H. M. COTTRELL.

Press Bulletin No. 96.—General Department.
July 23, 1901.

Feeding Wheat.

The almost unprecedented drought of the present season, which bids fair to cut the corn crop down to next to nothing, but which began late enough to allow the production of a large crop of wheat, is turning the attention of farmers to the possibility of feeding wheat in the place of corn. In previous years of similar conditions thousands of bushels of wheat were profitably fed. Secretary Coburn, in his report for the quarter ending September 30, 1894, included statements from a large number of farmers upon feeding wheat. These varied greatly in tenor, some regarding corn as better than wheat, others wheat as much better than corn. These views were necessarily based upon general impressions rather than exact comparisons. Experiments in feeding wheat to swine were performed at the Kansas Experiment Station and at the experiment stations of some other states. Experiments in feeding other stock have not been made at

the Kansas Station, and but few at others, but hundreds of farmers have fed it to all kinds of farm animals. The following table, taken from Henry's "Feeds and Feeding," presents a compilation of the results obtained with swine at certain stations:

Station.	Average weight at beginning.		Number of days fed.	Feed eaten.		Feed for 100 pounds gain.	
	Fed corn-meal.	Fed wheat-meal.		Corn-meal.	Wheat-meal.	Corn-meal.	Wheat meal.
	Lbs.	*Lbs.*		*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Kansas	152	163	77	2,294	2,257	439	411
Ohio	136	137	70	1,228	1,273	453	438
South Dakota	96	103	90	1,159	1,144	458	481
Wisconsin	243	247	63	1,212	1,206	499	522
Wisconsin	247	247	126	6,014	6,054	496	465
Averages	.....	.....	.....	.....	.....	469	463

It will be seen that the results obtained were, on the average, practically identical. In other words, the wheat and corn fed in the form of meal are of equal value for feeding. The Kansas results are given in Bulletin No. 53, which contains some others in addition to the one included in the table. A limited number of copies of this bulletin are still available for distribution.

In feeding wheat satisfactorily, a number of considerations must be kept in view. The kernels being much smaller than those of corn, there is much more danger of their escaping mastication and passing out undigested. Many farmers who regarded it as unprofitable to feed wheat whole found, on crushing or grinding it, that all difficulty disappeared. It is especially necessary when fed to steers or milch cows. In animals with smaller mouths there is less waste than with cattle, and some have observed a positive advantage with sheep in feeding it whole. This was due, however, to the greater consumption of whole grain than ground. Ground wheat has an important disadvantage in feeding, in that it is apt to form a gummy mass, which adheres to the teeth, making it difficult and disagreeable to handle by the animal. This fault has been the source of some of the poor results in feeding it, and is best obviated by feeding it mixed with some other grain, as corn, oats, or Kafir-corn. Animals fed upon a mixture are also less liable to become cloyed than when fed on wheat alone.

In brief, the nutritive value of wheat, as shown by its composition, is greater than that of corn; it can be utilized by feeding it ground or crushed, and mixed to a certain extent with oats, corn, or Kafir-corn; it may be fed advantageously to horses, cattle, hogs, sheep, or poultry.

In discussing the feeding value of wheat, the grain only has thus

far been in mind. In this year of extreme scarcity of roughage it may not be amiss to inject a word of suggestion that wheat straw is much better than nothing, and that in all probability the farmers of the wheat belt can contribute to the needs of their less fortunate fellow citizens and add to their own profits by preserving, baling and marketing their straw, instead of burning it as usual.

J. T. WILLARD.

Press Bulletin No, 97.—General Department.
July 30, 1901.

Inquiries Concerning Prairie-dogs and Gophers.

The Kansas legislature at its last session provided for experiments to determine the most effective and economical means of destroying prairie-dogs and pocket-gophers in the state. (See chapter 273, Session Laws of 1901.) An appropriation was made for the purpose, and the work placed in charge of the Board of Regents of the State Agricultural College. The Board have employed a field-agent who will work under the direction of the Council of the Experiment Station.

In order intelligently to carry on these experiments, it is desirable to know the magnitude of the work before us. The actual distribution of the two pests named in the act, with the extent of the damages due to each, should be determined. The experience of the farmers of the state in their efforts at repressing these evils is also desirable. With the object of securing such information, the present circular is sent out to township trustees and other citizens of the state.

It is believed that but one species of prairie-dog, *Cynomys ludovicianus,* is found in the state. Two species of pocket-gophers occur. The prairie gopher, *Geomys bursarius,* is found in eastern Kansas. The plains gopher, *Geomys lutescens,* is found in sandy parts of western Kansas. The specific characters which separate these species need not be given, but in general they may be distinguished by the smaller size of the plains species and the smaller size of the hills of soil which it throws up.

Two species of the prairie-squirrels *(Spermophili)* are found in Kansas, and are popularly called gophers. The act of the legislature under consideration does not refer to these; but in order to prevent errors in answering this circular their distribution is made a part of the inquiry. The work of the *Spermophili* may be easily distinguished from that of the true gopher, from the fact their burrows are always open. The small, striped squirrel, *Spermophilus tridecemlineatus,* does not heap up the soil at the opening of its burrow, but

carries it away. The larger species, the gray ground-squirrel, *Spermophilus franklini*, often allows the soil to accumulate in heaps near its burrow, but the mouth of the latter is never closed, as in the case of the pocket-gophers.

It is earnestly hoped that every one who receives this circular will make an effort to furnish the desired information by filling out carefully the accompanying blank and returning it to the Station. Township trustees are especially interested in section 1 of the act, which permits townships to make cooperative efforts to destroy the prairie-dog and gopher. The field-agent of this Experiment Station will assist individuals and communities to the extent of his ability in making war upon these pests of the farm. D. E. LANTZ, *agent.*

COPY OF BLANK SENT OUT.

Give county, township, name of person reporting, and post-office address.

1. Are prairie-dogs found in your township ?
2. Are they abundant, common, or rare ?
3. Approximately, how many acres in the township are occupied by their villages ?
4. What means have been used for their destruction ?
5. If successful, give particulars, or refer to persons who can give definite information.
6. Is the pocket-gopher present in your township ?
7. Are they abundant, common, or rare ?
8. Approximately, what is the extent in acres of injury done by them ?
9. What means have been tried for their repression ?
10. If successful, can you give particulars, or give address of some one who can give us useful information on the subject ?
11. Is the striped gopher or ground-squirrel *(Spermophilus tridecemlineatus)* present in your township ?
12. Does it injure crops, and to what extent ?
13. Is the gray gopher or ground-squirrel *(Spermophilus franklini)* present in your township ?
14. Does it injure farm crops ? To what extent ?
15. Remarks.

Press Bulletin No. 98.—Farm Department.
July 31, 1901.

What Shall we Feed?

The first thing to do in arranging to get stock through the coming fall and winter is to use to the best advantage the crops now growing. The stalks of corn, sorghum, Kafir-corn and other plants used for roughness are worth more for feed green than they will be if fed as day fodder next winter. If the stockman does not have the necessary pasture, and is obliged to feed now, it will pay him to feed his corn and other green crops and save the hay for winter.

A great deal of corn is in tassel and drying up, with no prospect

for ears. Corn in such condition is not worth much, but if it is fed green cattle will get all there is in it, while, if it is cut, shocked and left in the field until winter, there will be only a pile of poor manure where the shocks have rotted down. If it is not necessary to feed the corn now, leave it as long as it stays green, then cut with a binder, and when dry, stack. Let the corn stand in the field before cutting as long as can be done without waste. While any of the leaves are green the corn will increase in feed value, and the later the corn is cut the better it will keep in winter.

On the College farm, July 13, twenty-six head of dairy cows were put on five acres of sorghum. The sorghum stood waist high and was not headed. Later we will turn these cows on another field of sorghum when it heads out. Our tame pastures are bare and furnish no feed whatever, and we have the choice of either feeding hay now and saving the sorghum to be cut for winter, or pasturing the sorghum and saving the hay for winter. The hay will be just as good for next winter as it is to-day. The sorghum fed green is worth much more than it will be if cut and fed dry.

The College has some high-priced, pure-bred cattle, and we are pasturing them on cow-peas and second-growth alfalfa. Both these crops make good pasture in dry weather. We would not dare to pasture them when damp. If we needed it, we would pasture our soy-beans and Kafir-corn, feeling sure that more can be gotten out of these feeds green than dry. We are pasturing fifteen hogs on half an acre of rape, and this will probably give all the pasture they will need until frost, even though no rain should fall.

Where it is possible to keep the stock off dried-up pastures and put them on sorghum or other pasture, it should be done. If the stock are kept entirely off the grass it will make a slight growth, no matter how dry and hot the weather may be, and then when we get fall rains the pastures kept free from stock now will furnish much more feed and feed later in the season than if tramped while dry.

Sorghum, Kafir-corn, cow-peas and alfalfa make safe pasture after cattle become accustomed to them, but great care must be used in starting stock on such pastures. At the College we fill the cattle with straw or hay in the morning and then turn them on the sorghum or other green crops only fifteen minutes the first day, the next day thirty minutes, and then increase the time fifteen minutes each day until we reach an hour and a half, when it is safe to let them stay on all the time and not give them other feed. Cattle turned on such pastures at first, if hungry, will often eat a few mouthfuls and die in a few minutes or hours.

CROPS TO SOW.

Cow-peas may be sown as late as August 1, with a prospect of a fair crop if we do not have early frosts. List shallow and drill in the furrows one-half bushel per acre, sowing the Whippoorwill variety.

If the season is favorable, Early Amber sorghum or Kafir-corn, sown broadcast, one bushel per acre, will furnish pasture if sown as late as August 1.

Rape sown as late as September 1 will furnish pasture for hogs. Sow Dwarf Essex rape, five pounds per acre broadcast, or three pounds per acre drilled. It will do to feed in six weeks after seeding. An acre will pasture ten to twenty hogs, and as seed costs only ten to fifteen cents per pound, the cost is light. Rape is a fair pasture for cattle, but some dry feed must be given with it to prevent scouring. It takes a heavy frost to kill rape, so that it furnishes late pasture, and Kansas farmers should sow a large acreage to this crop.

Turnips should also be sown largely, as the seed is cheap, and if a crop is secured the turnips will save a great deal of other feed needed for the cattle, young stock, and hogs.

We have not had success with late-sown millet, but if the fall should be damp and cool, millet would make a fair crop.

Wheat, oats and rye will furnish a large amount of pasture if the season is favorable, and while these crops are in good condition cattle will do well on them without any other food than straw. A farmer pastured his dairy cows on oats, and sold during the fall seven dollars' worth of milk for each acre of oats pastured, the cows having no other feed.

WINTER FEED.

It is too early to decide what will be the cheapest combination of feeds for winter. The shortage will be in roughness. There is enough straw in Kansas to supply roughness for every animal in the state, and with many stockmen straw will be the feed to use. Farmers usually feed from twenty to thirty pounds of hay or fodder a head per day to stock cattle. Very much less may be fed if a proper grain ration is used. In 1888 a milkman in Manhattan wintered his entire herd of dairy cows without a pound of roughness, and he sold milk all winter. The cows were fed all the grain they wanted, and in the spring were strong, but they looked gaunt and rough. It always pays to feed a little roughness. The writer has brought cattle through the winter in good condition on three to five pounds of hay per head a day, feeding grain.

Bran or wheat will take the place of nearly all the roughness, and can be mixed with cottonseed-, gluten-, germ-, oil- or linseed-meals, oats, corn, or Kafir-corn, whichever is cheapest, and make a good ration at

a reasonable cost. Wheat is worth about as much, pound for pound, as corn, and middlings are worth more as a hog feed.

Fattening hogs fed all the alfalfa or clover hay they will eat will fatten on much less grain than without hay. Sorghum hay is good for hogs. A few winters ago some farmers in northwestern Kansas carried their stock hogs through the winter on alfalfa hay alone. Stock hogs fed twice daily all the alfalfa, clover or sorghum hay they will eat will require much less than the usual amount of grain. Hogs should be fed sufficient rough feed, so that they will need to eat the leaves only.

H. M. COTTRELL.

Press Bulletin No. 99.—Farm Department.
August 1, 1901.

Fall Seeding of Alfalfa.

In some sections this summer tame-grass pastures were eaten to the roots, and then the cattle were turned on the meadows and these were grazed as closely as the pastures. Where this is the case, it is probable that, with usual conditions during the coming fall and winter, a large part of these pastures and meadows will, next spring, be either dead or so badly killed that they will have to be plowed up. This means a severe shortage next year in hay, and farmers should prepare to meet this shortage now. It can be met by sowing alfalfa between August 15 and September 15. Alfalfa sowed at this time, under favorable conditions will furnish a good cutting of hay next May, and with ordinary conditions will yield three to four cuttings of hay next summer.

The ground for alfalfa should be well settled before seeding, and only the surface made loose. Alfalfa will usually fail if seeded in the fall on freshly plowed ground. Well-cultivated corn-fields, with the stalks cut and drawn off, give ideal conditions. Such fields should not be plowed, but harrowed only before seeding. Wheat-, oats-, flax- and millet-stubble ground plowed shallow, harrowed thoroughly, and allowed to settle before seeding, furnishes good conditions for alfalfa. If such ground is mellow, plowing may not be necessary, as the land will only need to be disked and cross-disked.

The best time to sow is in the last half of August. It is safe to sow as late as September 15, if conditions are good. The ground must be well settled, with a loose mulch on top, and well saturated with moisture, so as to bring up the seed quickly and force the fall growth. If either of these conditions is lacking it will not pay to sow.

The best way to sow is with a press-drill, using twenty pounds of seed per acre. Mix the seed with equal parts, by measure, of coarse corn chop or bran. Drill half the seed one way, and cross-drill the

other half. If necessary to sow broadcast, use twenty-five to thirty pounds of seed per acre, cover with a harrow, and roll, unless there is danger from blowing. It is much better to seed with a drill. Alfalfa should be sown alone.

The best quality of seed will give the best stand and the most vigorous growth, and is always the most profitable to use, although it costs the most.

Alfalfa will grow on any well-drained soil that will produce corn. It does best on well-drained bottom lands that do not overflow, but in the eastern half of Kansas, when properly handled, is a profitable crop on upland. Alfalfa seeded last fall on upland in Shawnee and Riley counties gave two good cuttings this summer before July 5, while tame meadows and prairie-grass on adjoining lands yielded only half a ton of hay per acre. H. M. COTTRELL.

Press Bulletin No. 100.—Department of Dairy Husbandry.
August 13, 1901.

Sorghum Pasture for Dairy Cows.

During the month of July, the Kansas Experiment Station realized $8.20 per acre from pasturing sorghum, besides having the field left to produce a second crop. On July 1, twenty-seven milch cows were given all the alfalfa hay they would eat and then turned into a sorghum field of 6.7 acres for fifteen minutes. The sorghum was from eighteen to twenty-four inches high. The next day they remained thirty minutes, the third day forty-five minutes, and so on, increasing fifteen minutes daily, until they reached an hour and thirty minutes, when they were left to run at will. During this transition period the cows were given all the alfalfa hay needed to keep up the normal flow of milk. For the first nine days this amounted to nearly twenty-four pounds daily per head. After twelve days the cows were allowed to pasture the sorghum at night as well as during the day. For the rest of the month these cows consumed less than five pounds of alfalfa hay daily per head.

If it had not been for the sorghum pasture, it would have required at least twenty-four pounds of alfalfa hay daily per head to keep these cows up to a good flow of milk. This would have amounted to ten tons. As it was, the cows consumed only four and one-half tons, making a saving of five and one-half tons. At ten dollars per ton (a low price for this year), this would amount to fifty-five dollars, which, divided between 6.7 acres, would amount to a saving in alfalfa consumed of $8.20 per acre.

On August 1 the cows were turned into a fresh field of sorghum,

from three and a half to five feet high, but with the same precautions as were exercised July 1. This time it did not take as long to get them on full feed, and after the first week they had free access to the sorghum day and night. The two fields of sorghum are connected with each other and the cows not only have access to both fields, but in getting to the second field are obliged to pass through the first, where second-growth sorghum is making a vigorous start after the recent rains. Up to the present writing (August 13) the herd has not experienced the least particle of trouble from poison or even bloating.

During the time the Kansas Station has been pasturing sorghum several reports have been received of cattle dying in ten or fifteen minutes from the time they entered the sorghum patch, but in every case where we have been able to get the details the cattle have eaten the sorghum on empty or nearly empty stomachs. Cattle should have their stomachs so well filled that they feel completely satisfied before touching the green sorghum, and then allowed to eat only a few minutes at a time until they are accustomed to it. If sorghum can be pastured successfully, as has been done by the Kansas Experiment Station, it means that the dairymen and stockmen can get an immense amount of pasture from a small area, which is available at a time when their other pastures are getting short and dry. Pasturing will also be the most economical way of utilizing sorghum. The man that turns his cattle in a sorghum field, however, must realize that he may be taking risks. He must weigh the evidence for and against its use, and then decide for himself whether the benefits will outweigh the risks.

D. H. OTIS.

Press Bulletin No. 101.—Entomological Department.
August 20, 1901.

The Hessian Fly.

During the season past the Hessian fly has caused some loss and much comment in parts of the Kansas wheat belt, and numerous letters of inquiry reaching the Kansas Experiment Station have shown the need of wider popular information on this subject. An extended account of the insect appears in Entomological Bulletin No. 16, of the United States Department of Agriculture, which should be consulted by those interested in full details of life-history. For practical purposes, however, the methods of preventive procedure are those of widest interest, and of these it appears that the most important are still the practices recommended by earlier writers.

Concerning the value of burning the stubble, and thus destroying the contained pupae of the fly, opinion is somewhat divided. If done at once after harvesting, especially in fields where the header was

used, this method is certainly effective, if practiced by the neighborhood in general. But by burning, not only the pupæ of the fly destroyed, but the contained parasites as well, whose aid is the most important factor, after all, in the subjugation of the pest. Moreover, the burning of the stubble, in the opinion of some wheat-growers, robs the soil of important physical, if not manurial constituents, which should be incorporated by plowing under and not destroyed by burning. Early plowing of the stubble-ground, as soon as possible after harvest, if the ground be compacted afterward by harrowing or rolling, will serve the same end, with less loss in this respect.

Considered in all relations, where one method alone is followed, it is best, in the writer's opinion, to depend upon late sowing. The adult insect flies and lays eggs according to season earlier or later in summer or fall, but cannot withstand the frost; and wheat appearing after the first white frost of the season will be free from attack. This fact is confirmed by the present year's experience of correspondents of the Kansas Station. Early-sown areas, on the other hand, will sometimes be found so badly infested, through the massing of the insects thereon, that the wintering of the plant will be a matter of doubt.

If egg deposit be delayed by the absence of suitable plants, the flies will remain alive for some time in waiting, but if proper opportunity is provided, the eggs are laid at once and the insects then die. Small areas or strips through fields in infested localities may be seeded early, as trap crops, and after egg deposit these may be plowed under, destroying the contained eggs or larvae before the general seeding of the field.

Against the spring brood, which weakens the stalk and lightens the grain, little can be done except by means to limit the winter brood of larvae. The thorough destruction of volunteer wheat, accompanied by late seeding, through their reduction of the numbers of insects wintering over, are the most practical means.

Owing to the situation of the larvae down in the crown of the plant, there is little possibility of valuable results from pasturing the wheat during fall and winter. Where fields are pastured early chance eggs may be destroyed before hatching, but the advantage thus gained will be slight, if any.

It is the combination of early-sown trap strips with general late seeding that is recommended for practice by Kansas wheat-growers.

E. A. POPENOE

Press Bulletin No. 102.-Department of Dairy Husbandry.
September 17, 1901.

Maintenance Ration for Cattle.

On account of the probable scarcity of feed during the fall and winter of 1901–'02, the Kansas Experiment Station undertook an experiment in feeding wheat straw and adding enough ground wheat to secure a maintenance ration. Three dry cows, averaging 1226 pounds live weight, two two-year-old heifers, averaging 1059 pounds, and three calves, averaging 510 pounds, were selected for this test. The experiment began August 1, when the aggregate weight of the eight head amounted to 7327 pounds. As the cows came from good sorghum pasture and the heifers and calves from good prairie pasture, they did not relish the wheat straw for the first few days, and only consumed about ten pounds daily per head. The cattle were fed four pounds of ground wheat daily per head throughout the experiment. By dampening the straw and sprinkling the grain on and through it, considerably more straw was consumed, the average for thirty-one days being 16½ pounds daily per head.

At the close of the first week every animal in the experiment lost in weight, the average being 62 pounds per head. During the second week they regained a considerable portion of this loss. At the close of the experiment, September 1, the three cows weighed an average of 1172 pounds, a loss of 54 pounds per head for the thirty-one days under experiment; the heifers averaged 1067 pounds, a gain of eight pounds per head; and the calves averaged 523 pounds, a gain of 13 pounds per head. The total weight of the lot at the close of the experiment was 7217 pounds, a loss of 110 pounds for the lot, or 13 pounds per head, a small item when one considers that it all came in the first week of the experiment. The total feed consumed by the lot was 4232 pounds of wheat straw and 992 pounds of ground wheat. The straw was hauled about eight miles and did not contain any chaff or refuse wheat. When the cattle have access to a straw stack they get considerable chaff and more or less shriveled or waste wheat, blown over with the chaff. Under these conditions cattle would not need as much wheat as given above.

This experiment indicates the possibilities in wintering cattle. When wheat straw, doubtless the poorest roughage on the farm, can maintain an animal, with a small outlay for ground wheat, it ought to encourage a farmer to hold his cattle. Straw is abundant, especially in the western part of the state. In many places it is being burned in order to get rid of it. Where straw can be had for the hauling, and wheat at sixty cents per bushel, the feed cost of keeping a 1000-

pound cow on a maintenance ration need not exceed $1.25 per month. Suppose the straw cost five dollars per ton, the feed cost would be only $2.50 per head per month, or $1.50 more than it usually costs in years when feed is plentiful. Most every farm produces rough feed considerably better than wheat straw. Prairie hay, corn-fodder, Kafir-corn fodder, sorghum-fodder or hay can be fed, either alone or in combination with each other, and the amount of grain required for maintenance reduced. Where Red clover or alfalfa is available, little or no grain need be fed.

The present low prices of stock cattle, with every prospect of high prices in the spring, and the cheapness with which the cattle can be wintered, as shown by the above experiment, should induce farmers to hold their cattle, even though they could be sold at fair prices.

D. H. OTIS.

Press Bulletin No. 103.—Entomological Department.
October 22, 1901.

Grain Weevils.

The common species of grain insects seem to be more than usually abundant this fall, as shown by numerous letters of inquiry received at the Kansas Experiment Station. The two forms most in evidence are the common grain moth and the black weevil, the latter generally more abundant. In either case, the most ready method of their destruction is the employment of carbon bisulphide, one pound at least of the liquid to 100 bushels of grain, or 1000 feet of space.

It seems likely, from the varying degrees of success reported with this formula, that certain essential conditions are not always strictly observed. In ordinary cribs and bins the most important provision is to make the room as nearly as possible gas-tight, in order that the gas may remain in all parts of the space in full strength and for the required time. It must enter, by diffusion, all cracks and crevices, even those between the grains of corn in the ear, and must penetrate the burrow of the individual weevil or its grub in the wheat berry. This thorough diffusion will only occur after some time, even in a saturated atmosphere. Twenty-four hours is short enough for certainty, even where the gas can be kept full strength in the bin.

Except with highly organized insects, death does not occur immediately, and partial suffocation may only render the insect insensible, leaving it to recover fully upon the airing-out of the bin; or the gradual escape of the gas through cracks in the floor or sides of the bin, allowing the entrance of fresh air, may cause failure through the subsequent revival of the insect. The adult grain moth readily suc-

cumbs to the gas, while the larva will stand more and yet revive. The black weevil is most difficult to kill, specimens remaining over night in an experimental killing bottle sometimes recovering when removed therefrom the next day. Hence, to destroy all these it will be necessary to continue the action of the gas in full strength for at least twenty-four hours, and to do this the bin must be made tight, the fluid carbon bisulphide be used in liberal quantities, and, in case of doubt, the experiment repeated.

Wheat may be largely kept free from weevil by proper handling, frequent shifting and farming, such constituting the chief reliance in the elevators. Corn in cribs can scarcely be freed from weevil while remaining there, owing to the practical impossibility of making the crib sufficiently tight. Tarpaulins and stack-covers are useful in assisting to retain the gas within limits, but are by no means tight enough to prevent the escape of the gas by diffusion before the black weevil can be destroyed.

It is suggested by a correspondent that gasoline is equally effective with carbon bisulphide, and owing to its cheapness it can be used in certainly destructive quantities at little expense. It may be necessary to warn those who employ either of these liquids that the gas is highly inflammable and explosive when ignited; hence, no fire or light should be allowed about the bin while the fumigation is in progress.

E. A. POPENOE.

Press Bulletin No. 104.—Veterinary Department.
December 2, 1901.

Cattle Distemper.

Within the past two years occasional reports have come to this department from different parts of the state of what appears to be a contagious disease of cattle that in some respects resembles lump-jaw. During the past few months these reports have been more frequent. Investigation shows the disease to be entirely different from true lump-jaw. The most important differences to be noticed by an ordinary observer are as follows: In cattle distemper the swelling comes on suddenly and always in the region of the throat, and appears to be more contagious than true lump-jaw. The lump-jaw comes on slowly, and usually attacks the region of the face or jaws, and the lump or tumor appears to have grown fast to the bone in most cases. Cattle distemper attacks young animals most frequently, but may attack cattle of any age. The first symptom of cattle distemper usually noticed is a swelling of the throat, especially the glands in this region. This swelling appears quite suddenly

often within twenty-four hours, and is usually severe. This is preceded by a slight discharge from the eyes and nose and is associated with a slight fever, the temperature of the animal rising two or three degrees. As the disease progresses the swellings increase in size, and an abscess containing a rather thick yellow pus or "matter" forms. Sometimes two or three of these abscesses will form about the throat, on the side of the head, or along the jaw. These swellings do not affect the bone, but occur in the loose tissue and glands. If left alone the abscesses break and discharge pus, but do not heal readily, often remaining open and running for some time.

Treatment. — The disease appears to be contagious, but, so far, experiments do not show in what way. It is not highly contagious. Affected animals should be isolated from the healthy and not allowed to eat or drink from a common receptacle. In the early stages, if the swelling is thoroughly rubbed twice daily with a stimulating liniment, it will usually "scatter" the swelling so no abscess will form. A liniment composed of equal parts of turpentine and kerosene oil is good. If two ounces of gum camphor be dissolved in half a pint of turpentine and an equal amount of kerosene added, the liniment is improved. This should be rubbed on twice daily until the skin begins to get sore. After pus has formed, the abscess should be opened freely, washed out with warm water and a strong solution of blue vitriol (sulphate of copper), a tablespoonful dissolved in one-half pint of water. This can be injected once daily for two or three days. Pure tincture of iodine is also good. In some cases, putting a small lump of blue vitriol in the cavity works well. If the abscess is not opened early there is a tendency for other abscesses to form.

Nearly all cases recover in a few weeks. Where they do not heal, the cavity can be swabbed out with "butter of antimony" once, and then the blue vitriol solution used. N. S. MAYO.

Press Bulletin No. 105.—Veterinary Department.
December 9, 1901.

Sore Mouth of Cattle.

During the dry weather of the past summer, and in the early fall, a disease new to most cattlemen made its appearance in different parts of the state, but, with the coming of the cool moist weather of autumn, generally disappeared. The disease was a sore mouth of cattle, and was popularly called "black tongue." The disease attacks cattle of all ages, cows as well as young cattle, and appears to be contagious, although it does not spread rapidly, and in some instances only one or two cases would occur among a large number of cattle. In other in-

stances a dozen young cattle running together would all be attacked by the disease. The first symptom usually noticed was inability or disinclination to eat. There is also a profuse discharge of saliva that drips from the mouth, often frothy, due to the working of the jaws and tongue. Raw, depressed sores appear on the inside of the lips and cheeks, as well as on the tongue, gums, and pad of the upper jaw. In most cases the tissue seemed to slough out, and the sores were covered in the center by black-colored dead tissue; hence the popular term "black tongue." The edges of the sore were raw and inflamed, and often contained a little pus or matter. In some cases the sores were so extensive that the teeth are reported to have dropped out, and in other cases the tongue was swollen so severely that it protruded from the mouth. Associated with the soreness of the mouth there was an inflammation of the front feet. The feet were hot to the touch and tender to walk upon, and the animals appeared so stiff in the fore legs they could move with difficulty. There is a fever associated with the disease, the temperature rising, in most cases, to 105° F. In cows the milk flow is lessened, and all animals fall away rapidly in flesh, because of the inability to eat.

Treatment. — Sick animals should be isolated from the well and fed on soft, nutritious foods, such as mashes, gruel, etc. If left in pastures they may starve, because of the inability to eat. The mouth should be swabbed out two or three times daily with a saturated (all water will dissolve) solution of borax, applied with a sponge or soft cloth. A solution of a tablespoonful of alum dissolved in a pint of water is also excellent.

Practically all cases make a good recovery if they are cared for and carefully fed. The greatest loss is due to the falling away in flesh. Milk from cows affected should not be used for food or fed to calves.

At the present time (December 1) the disease seems to have disappeared, and it is hoped may not reappear. The disease is not serious, and is not the contagious "foot-and-mouth disease" of Europe.

N. S. MAYO.

Press Bulletin No. 106.— Department of Dairy Husbandry.
December 16, 1901.

Profit in Maintaining the Milk Flow.

It will pay to keep up the flow of milk, even though feed is high. Press Bulletin No. 102 from this Station shows that sixteen and one-half pounds of wheat straw and four pounds of ground wheat per day will maintain an average cow. The present low price of stock cattle, with every prospect of high prices in the spring, should induce farmers to hold their cattle, even though feed is high-priced. How

much more feed it will require to obtain a good flow of milk has been the subject of investigation at the Kansas Experiment Station. Three cows, representing a fair average of our Kansas milch cows, were fed wheat straw, ground wheat, and cottonseed-meal. The cows were accustomed to the cottonseed-meal gradually, by starting with one-half pound and increasing a quarter of a pound daily, until the maximum of four pounds per day per head was reached. This transition period required fourteen days. As these cows had been receiving sorghum pasture and alfalfa hay, they did not relish the straw at first, and were allowed fifty-two pounds of alfalfa hay each during the transition period. The following figures give the results in the production of butter-fat:

Daily production of butter-fat per cow previous to experiment, 30 days. . . 0.74 lb.
Daily production of butter-fat per cow during transition period, 14 days. . . . . .70 "
Daily production of butter-fat per cow during experiment, 30 days. . . . . .62 "

The reduction of one-tenth pound in the daily production of butter-fat is accounted for in the sudden change from succulent pasture to dry straw and the increase in the lactation period. After the cows were accustomed to the change, the production of milk and butter-fat was fairly uniform.

During the thirty days under experiment these three cows consumed:

Wheat straw . . . . . 1,410 lbs.
Ground wheat . . . . . 590 "
Cottonseed-meal . . . . . 244 1/2 "

According to experiments reported in Press Bulletin No. 102, these cows would consume as much or more straw and 360 pounds of wheat of the above grain as a maintenance ration. This leaves 230 pounds of ground wheat and 244 1/2 pounds of cottonseed-meal to be charged against the butter-fat account. At $1 per hundred for wheat and $1.50 per hundred for cottonseed meal, this would amount to $5.96. During this time these three cows produced 56.2 pounds of butter-fat. At seventeen cents per pound (the price promises to be considerable higher during the winter), the financial account stands as follows:

Value of 56.2 pounds butter- fat $9.55
Cost of feed 5.96
Total profit $3.59
Profit per cow 1.19

In the above account the skim-milk is to pay for the hauling. With good management it will more than do this.

It will be noticed that this experiment represents an extreme case. Nearly every farmer has some corn or Kafir-corn fodder, millet, sorghum hay, prairie hay, Red clover, alfalfa, oat hay, or even oat straw, that he can use instead or in place of part of the wheat straw with

much better results. Any of these rough feeds will enable the dairyman to reduce the amount of grain needed. Where Red clover or alfalfa is available little or no cottonseed-meal is required.

By feeding his milch cows on a milk ration a farmer will not only save more money than he would to winter them on a maintenance ration, but he will keep his cows in the habit of giving milk (a very important point), will help to keep his creamery, skimming station and cheese factory operating on a paying basis, and will have his cows on hand as a profitable investment in the spring. If he then desires, he can dispose of any of his surplus stock at high prices. D. H. OTIS.

Press Bulletin No. 107.—Veterinary Department.
December 31, 1901.

Cerebritis or "Staggers" in Horses.

Serious losses in this and adjoining states are occurring at the present time as a result of feeding wormy, moldy corn, either when it is fed as a grain ration or when obtained by pasturing in the stalk-fields or when fed upon the cut corn-fodder.

The disease is an inflammation of the brain or spinal cord and its coverings (meninges), associated with a breaking-down of the nerve tissue of the brain. It is popularly called "staggers," or "mad staggers," because of the prominent symptoms shown.

Symptoms. — The symptoms are those of a brain disease. The animal appears blind and only partially conscious. There is often a tendency to turn in a circle to the right or left, and a staggering or a straddling gait. There is usually a trembling of the muscles. As the disease progresses the animal becomes delirious and easily excitable. In many cases the animal will stand with the head or breast against a wall or manger and push. Animals will often eat when badly affected—apparently from force of habit, not because they are hungry. In some cases animals will die in a few hours after they are first noticed ailing. Most of them die within a few days; a few live a week—rarely longer. In a few cases the spinal cord is diseased, while the brain remains nearly normal. In these cases there is inability to control the muscles, or the animal may be unusually sensitive—the least irritation of the skin, even by touching the animal, often causing it to kick violently. Where the spinal cord only is affected the animal frequently recovers. Laxative food should be given, and iodide of potash in one-drachm doses, dissolved in water, can be given once daily for three or four days.

Mules are rarely affected by this disease.

Treatment. — Practically all cases where the brain is the seat of

the disease die, and all methods of treatment so far have proven of no value. The animal should be placed where it will be comfortable and cannot injure itself or other animals, and supplied with soft, laxlative food, such as thin bran mashes. The only treatment for the disease is preventive, by avoiding the wormy, moldy corn.

Care should be exercised in handling a horse to avoid injury, as the animal is irresponsible and often in a delirious frenzy.

In some cases horses do not begin to die for a month after being turned into the stalk-fields, and they may contract the disease in a week, and in some cases ten days, after the moldy corn has been withheld.

Moldy or wormy corn does not seem to be injurious to other animals, and can be fed to cattle and hogs without danger.

N. S. MAYO.

Press Bulletin No. 108.—General Department.
January 7, 1902.

Destroying Prairie-dogs.—A Preliminary Report.

During the past four months I have made numerous experiments with various gases and poisons for the purpose of finding the most effective and cheapest method of destroying prairie-dogs. These experiments were authorized under the provisions of chapter 273 of the Session Laws of Kansas for 1901. In this preliminary report it is not my purpose to give any of the details of the experiments. Many of them were failures; several were decidedly effective in destroying the animals, but were too expensive for general use over large areas.

The net result of the experiments thus far is that we have found nothing more effective than carbon bisulphide or cheaper than strychnine poison. This bulletin is intended to place before the people of Kansas the results of our experience in using some cheaper combinations of these old remedies in time to secure some decided progress in the work of extermination during the remaining winter months, when the conditions are most favorable for the work. In the meantime it is our intention to continue the experiments, particularly with the object of finding some contagious disease to complete the work of destruction.

CARBON BISULPHIDE.

A tablespoonful of carbon bisulphide placed upon some absorbent material, as cotton, dry horse manure, or a piece of corn-cob, and rolled down the prairie-dog burrows, is effective in killing the animals. It is best immediately to cover the hole with a sod and stamp down firmly.

I found by experiment that four parts of gasoline mixed with one

part of carbon bisulphlde is about as effective as the carbon bisulphide alone, and not nearly as expensive. The mixture is used in the same manner as carbon bisulphide alone, but a somewhat larger dose is needed.

STRYCHNINE POISON.

Formula No. 1.— Dissolve one and a half ounces of strychnia sulphate in a quart of hot water. Add a quart of syrup—molasses, sorghum, or thick sugar and water—and a teaspoonful of oil of anise. Thoroughly heat and mix the liquid. While hot pour it over a bushel of clean wheat and mix completely. Then stir in two or more pounds of fine corn-meal. The quantity of corn-meal needed will depend upon the amount of extra moisture present. There should be enough to wet every grain of the wheat and no more. Care should be taken that there is no leakage from the vessel in which the wheat is mixed.

Let the poisoned grain stand over night, and distribute it in the early morning of a bright day. Use a tablespoonful of the wheat to each hole occupied by prairie-dogs, putting it near the mouth of the burrow in two or three little bunches. Do not put out the poison in very cold or stormy weather. It will keep for a considerable time, and is much more effective after a cold period, as the animals are then hungry and eat the grain readily. A bushel of wheat should poison 1000 to 1200 holes.

An excellent substitute for the oil of anise in the above formula can be made by soaking two ounces of green coffee berries in the whites of three eggs. Let this stand for about twelve hours and use the liquid instead of anise oil.

Formula No. 2. — Through the efforts of Hon. S. E. Cave, of Lockport Kan., the College has purchased the state right to use a preparation patented by Mr. D. W. Staples, of Quanah, Tex. I have tested it in the field and have found it entirely satisfactory. The inventor claims for it that it has the advantage of being effective at any season. The simple preparation of strychnine, given in formula No. 1, is not successful while green food is plentiful.

Formula No. 2 is protected by letters patent, and cannot be used outside of Kansas without securing the right from the inventor. We have purchased the right to its use for all the citizens of the state. As this bulletin circulates outside of Kansas, the formula is not here given, but it will be sent to any resident of Kansas upon application.

Section 1 of the law authorizes townships, under some restrictions, to levy money and to purchase poison to destroy prairie-dogs. Section 4 makes it the duty of the Agricultural College to furnish the remedy recommended by it to townships that comply with the pro-

visions of section 1. Accordingly, this Station will be prepared, on January 10, 1902, and during three months thereafter, to furnish, at actual cost of materials, poison prepared according to formula No. 2. By buying materials at wholesale, a considerable saving in cost will be made. The poison will be put up in half-gallon cans. Each can will hold enough to thoroughly poison a bushel of wheat. This will be enough for from 1000 to 1200 burrows, from 100 to 160 acres, since only occupied holes need be poisoned. Directions for use will accompany each can. The price will, for the present, be $1.50 per half-gallon can, f. o. b., Manhattan. Shipment will be by express or freight and in such quantities as trustees may desire. Money-orders in payment should be made payable to Miss Lorena E. Clemons, secretary.

D. E. LANTZ, *agent.*

Press Bulletin No. 109.—General Department.
January 14, 1902.

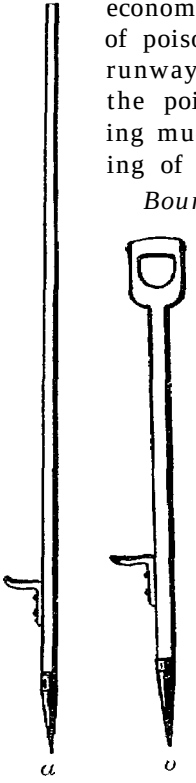
Destroying Pocket-gophers.

Press Bulletin No. 97, issued from this office July 30, 1901, contained some inquiries relative to the presence of pocket-gophers in the various townships of Kansas, with blanks for replies. It was sent to all the township trustees, together with a stamped envelope for replies. About one-half the trustees answered the inquiries. From the information thus secured it is impossible properly to map the distribution of these animals in the state. However, they have been reported from all the counties except Elk and Neosho; but it is probable that some of them occur in these counties also. In general, they are more abundant in the alluvial soil of the river valleys. They are least common in the southeastern part of the state, and most abundant in the valley of the Kansas river and along its tributaries northward. No distinct boundary between the areas inhabited by the two species—prairie gopher and plains gopher—has been discovered. The two areas frequently overlap each other.

Personal observations by the writer and the numerous complaints reaching this office all indicate a great activity of these animals and a decided increase in the area of their depredations during the past three months. Alfalfa fields have been the special theater of their operations; but clover fields and meadows have also suffered. The injury to alfalfa is done not only by the hillocks of earth, which cover the plants and interfere with cutting the crops, but also by the large quantity of root-cuttings made to supply the winter larder of the animals. Great stores of these cuttings, comprising a bushel or two at a place, may be found in the burrows. The loss to the alfalfa-growers

of the state during the past year from these pests was probably fully a tenth of the entire product, and had an actual money value of at least $500,000. Unless the pest is checked or destroyed during the next few months, another season's loss will be double as much.

I have recently made a considerable number of experiments in destroying the pocket-gopher, and have collated the experience of a large number of farmers in the matter. My experience and the consensus of opinion from others indicate that the most effective and economical method of dealing with this farm pest is by means of poison introduced into food and placed in the burrows, or runways, of the animal. An improved method of introducing the poisoned food into the runway is recommended, obviating much of the labor which has thus far attended the poisoning of gophers.



Bounties.- Many of our correspondents have expressed the opinion that a system of bounties paid by the state would be effective in dealing with gophers, prairie-dogs, and similar pests. The experience, in every case where such bounties have been tried by either county or state, has been decidedly against the practice.

Poisonous Gases.— The use of carbon bisulphide and other poisonous gases has frequently been recommended for the destruction of the pocket-gopher. While these methods have been in part successful, the great length of the burrows and their irregularities in depth prevent the gases from flowing into every part, and thus the animals frequently escape.

Trapping.— Trapping, if properly done, is a sure method of killing the gopher; but it is attended with considerable labor and is very slow. A correspondent in Doniphan county reports that 350 of the animals were caught in four months on a forty-acre field of clover. He used the "Out-o'-sight" gopher trap. An excellent trap for general use is the No. 0 ordinary steel trap. In using it, enlarge the hole sufficiently to admit the trap, and remove all the loose soil which may have fallen in to obstruct the runway. Sink the trap in loose soil to the level of the runway, and nearly conceal it by sprinkling fine earth over it. Leave the hole open.

POISONING.

Pocket-gophers are easily poisoned. They are very fond of common potatoes, sweet potatoes, apples, raisins, and prunes. The presence of strychnine, arsenic or other poisons does not seem to deter them

from eating the food; but if the poison is sweetened they seem to eat it more readily. In summer it may be desirable to take the trouble to sweeten the poison, but in the fall and early spring it does not seem worth while to do this. The poisoned food being introduced to the burrows below the surface, there is no danger of poisoning stock. It might be well, however, not to let swine run in the alfalfa fields for a time after the poison has been put out.

The following method of introducing the poison is recommended: Cut the potatoes or other food into pieces not more than three-fourths of an inch in diameter. Cut a slit in each piece and with a point of the knife blade insert a little sulphate of strychnine; as much as half the bulk of a grain of wheat will answer the purpose. The moisture from the potato will cause the poison to adhere to the blade.

Having prepared the bait in sufficient quantity, go to the field armed with a round, sharp-pointed implement an inch or an inch and a half in diameter and of sufficient length. The tools here illustrated were made by a blacksmith for the writer. One is a shovel handle and the other a spade handle, and each is shod with a conical iron point. A bar is attached about fifteen inches from the point, to enable the operator to use the foot in pressing it into the soil. These tools have proved to be quite serviceable. With one of them, it is only necessary to find the runway of the gopher. The handle is sufficiently thick to make a hole large enough to permit one to drop the poisoned potato directly into the burrow. The operator then passed on to another place, leaving the hole open. No digging with a spade or other hard labor is necessary. An experienced person can distribute poison to many acres of alfalfa in a day; and, if proper care is taken to rightly distribute the bait, it will not be necessary to go over the ground a second time.

Some experience is required to enable one to find the burrows quickly. It is best to insert the food as near as possible to the freshest mounds of earth thrown up by the animals. Two or three pieces of potato at that place are worth many scattered in other parts of the runway. The operator should avoid the larger mounds and those that are not freshly made.

D. E. LANTZ, *agent.*

Press Bulletin No. 110.— Chemical Department.
January 21, 1902.

Corn Improvement.

The superiority of our present varieties of plants over those grown even within the memory of those of us in middle life is very great in many instances. The results achieved with some are indications of

those that are possible with many, perhaps all. In the case of staple crops the improvement possible, even if it should prove to be but in small degree, may in the aggregate be of great economic moment. Seedsmen and farmers naturally give their attention to the external and physical qualities and the yield, rather than to the chemical composition. The chemical department of the Experiment Station has shown that there are significant differences in the composition, not only of different varieties of corn, but in that of different ears of the same variety, and even of the individual kernels of a given ear. Analyses by the Kansas Station and by others have shown that the germ is much richer in nitrogen than the rest of the kernel. By selecting as seed, from year to year, the ears of corn in which, as a rule, the kernels possess larger germs, a strain can be secured which will be richer in nitrogen, as this Station and others have abundantly shown that this property is inheritable. By making cross-sections of the tips of a number of kernels from each of several ears, it is quite feasible to select the ears which are richer in nitrogen. It is said that inspection enables one to select corn in which the parts of the kernel, exclusive of the germ, are richer or poorer in starch, and, consequently, poorer or richer in nitrogen, respectively. While this may be true, it seems to be less easy of application and less practical, as feeders prefer corn that is not so hard and flinty, even though it may contain less nitrogen. There is no similar difficulty complicating the selection of corn by the size of the germ, other things being equal. In fact larger germs add to the value of corn by their much higher percentage of fat as well by their higher percentage of nitrogen.

The Station is making efforts to establish improved varieties of corn, selections being based, in part, on the percentage of nitrogen, and with as much success as could reasonably be expected, in view of the almost total failures of the crops on account of drought the last two years. The ease with which corn cross-fertilizes makes these experiments very difficult, especially when any effort is made to obtain a considerable quantity of a given variety in a state of purity.

To assist farmers in the state who wish to improve the chemical composition of their corn, the chemical department has arranged to make determinations of the percentage of nitrogen for them at cost. Although on account of the scarcity of home-grown corn this season, the time is not as opportune for starting the development of improved strains of corn as would be desirable, it is hoped that some will avail themselves of the offer. Analyses of the same kind will be made of seed-corn offered for sale, where desired, and the department is making such analyses on its own account also.

That corn would be an appreciably more valuable grain for feed-

ing if it were richer in nitrogen there can be no reasonable doubt, and the farmer who will systematically set about developing a strain of an otherwise good variety that is richer in nitrogen will be a public benefactor, and doubtless will reap an ample financial reward. It is probably needless to state that corn that is being thus developed should be planted at a considerable distance from any other. Persons desiring corn analyzed should write the Station for instructions and terms before sending samples. J. T. WILLARD.

Press Bulletin No. 111.— Horticultural Department.
February 11, 1902.

Onion Notes.

Onions may be grown on any soil, yet for onions, as for all other crops, there are soils that are better than others. The best soil is a rich, sandy loam, as free as possible from weeds. A well-cultivated field of sandy loam that has been well manured with stable manure for several years will grow good onions. Onions should never be put in a soil that is foul or that has been too recently fertilized with barnyard manure, unless the manure has been well rotted.

Ground that is intended for onions this year should be plowed very early in the spring and disked later. The ground should be well cultivated just before the onions are put on the land.

There are two methods of sowing seed. The old way was to sow in drills in the field, as you would peas or other garden crops. After this the fight with the weeds was sure to disgust the cultivator of onions. In the end we had sacrificed many of the plants in trying to kill the weeds, and, of course, had a very poor stand of onions. During the past few years the cultivators of onions for commercial purposes have been growing their onions in hotbeds and then planting them out in the field. Some of the advantages of this method are: (a) The crop matures earlier; the seeds may be sown in the hotbeds in February; (b) the onion transplants with as much ease as any of the garden plants; (c) it materially increases the yield, because of the more even stand and because of the choice of the better seedlings for the row, where, if we allowed them to grow in drills, the stronger ones are liable to come up too near together to allow them to grow, and many of the best plants are destroyed while the weaker ones grow up where we want the stronger ones; (d) it does away with the task of weeding, thus making the production cheaper. By actual experimentation it has been found that the cost of maturing the crop when transplanted is somewhat less than when the seeds are sown in drills in the field.

The temperature of the hotbeds should be below eighty degrees when the seeds are planted. When the seedlings are of a size to set out, which will be in about six weeks, the ground should be thoroughly cultivated, so as to kill all the weeds that may be starting. The ground should then be laid off in rows, eighteen to twenty inches apart. Onions will stand a great deal of crowding, and some growers put them as close as twelve inches. When the plants are being removed from the hotbed, the tops should be cut back. The plants are usually set three inches apart in the row, with the lower end of the bulb about an inch below the top of the ground. The transplanting may be done with an ordinary dibble. The cost of maturing an acre of onions in this manner is about twenty dollars, including seeds, hotbeds, transplanting, and cultivation. The cost for an acre in drills is about the same.

The cultivation may be done with a horse or with a wheel-hoe. For tending crops of this sort, the Experiment Station has successfully used a wheel-hoe with the onion-hoe attachment. The advanvantage of using this implement is that, the rows may grow closer together. The increase in yield will increase the profits on a given area. The implement adapted to this sort of work is advertised by all dealers in garden tools, and costs from four to ten dollars. No onion-raiser should be without one, as its knives run on each side of the row and clean out all the weeds except those that are directly in the row with the onions.

It is not necessary that the tops be broken over for the crop to ripen. They will ripen almost as soon, and quite as well, if left alone. In harvesting, the bulbs are pulled and thrown in windrows to lie in the sun a few days, until the outside is dry, though they must not be allowed to sunburn. When dry on the outside, they are taken in and spread upon the floor of a barn or storeroom until thoroughly dry. An open building that will keep off the sun and will allow the circulation of air is best. A corn-crib is as good as anything. When dry, they are stored in boxes, barrels, or burlap sacks. Some growers store them in layers, eight to ten inches deep, in a well-ventilated room. If the onions have not been properly dried and cured, it is necessary to sort them over very often, or, at least, to stir them, to prevent heating. The storeroom should be kept dry and cool; if just above the freezing-point, so much better. Onions may be sorted much the same as potatoes, though care must be taken that they do not get bruised. A special form of vegetable sorter is generally used.

Good land that is well cared for should grow from 200 to 400 bushels of onions per acre. Three hundred and fifty bushels would be a

good average yield on land under high cultivation. The varieties that have done best at the Kansas Station are: Prizetaker, Yellow Danvers, Red Wethersfield, Silver King, and, later, the Giant Gibraltar.

G. O. GREENE.

Press Bulletin No. 112.—Veterinary Department.
March 11, 1902.

Pneumonia in Cattle.

At various times in the past there has appeared in the West, especially during the winter season, a form of bronchial pneumonia, attacking cattle sometimes in such numbers as to appear to be contagious. These outbreaks have usually occurred during the winter which succeeds an unusually dry season, when the water-supply for stock purposes is greatly reduced and the rough forage used for feeding cattle is of poor quality. During the past fall and winter numerous reports of a disease among cows and heifers have been received from various and widely separated places in the central and eastern parts of this state. In most eases several animals were reported sick, with the same general symptoms, which caused the owner or neighbors some alarm lest it might be a serious contagious disease. Owing to the similarity of symptoms, some stockmen have surmised that their cattle were suffering from bovine tuberculosis in an acute form. An investigation of the disease shows it to be a bronchopneumonia, or an inflammation of the bronchial tubes which carry the air into the lungs, together with the adjoining lung tissue. The disease is of a comparatively mild type, and so far as has been observed has only attacked cows and heifers. Most of the animals examined have been in fair to good flesh.

CAUSES.— The disease is probably caused by a poor quality of coarse food, especially corn-fodder. The dust or other irritating material in the fodder seems to irritate the bronchial tubes. This irritation enables certain bacteria that live in the air passages normally to multiply rapidly and cause an inflammation of the tissues. The disease is not contagious, but, several animals may contract it from the same source—that is, infected food.

SYMPTOMS.— The animal is noticed coughing, especially when first turned out or exercised after lying down. The cough is painful; at first dry, and as the disease progresses becoming more moist, the animal often coughing up considerable mucus. The breathing is rapid and labored; exercise causes the animal to pant, cough, and often stand with the mouth open and the tongue protruding in order to breathe. There is a tendency for affected animals to lie down, and

in severe cases the nose is extended in front, the lower jaw resting on the ground. In mild cases the appetite may be fairly good, but in severe cases the animal eats but little, and this, with the distressing cough, causes a rapid falling away in flesh. Bowels are usually constipated. A majority of affected animals will recover, with good care.

POST-MORTEM APPEARANCES — The lungs, when examined after death, do not appear severely inflamed. They are of a grayish color, and, instead of being soft and elastic to the touch, are quite firm and hard, and do not collapse, as is usual when the chest is opened. The smaller bronchial tubes are filled with mucus; the large bronchi and the trachea (windpipe) are slightly inflamed and contain mucus.

TREATMENT.— Medicinal treatment is of little value; in fact, the excitement attending drenching the animal and the possibility of getting medicine into the lungs is apt to do more harm than good. The animal should receive the best of care, protection from the weather, laxative, nutritious, but not bulky food, and pure water. Corn-stalks should not be fed; alfalfa, millet or other hay should be sprinkled, to lay the dust. Salting the animal, with a mixture of one pound of sulphur, one pound of air-slaked lime, one pound of hyposulphite of soda, all thoroughly pulverized, and mixed with ten pounds of common salt, is good. A tablespoonful may be given once daily, the animal being allowed to lick it. Bran mashes, to which is added some cottonseed or oil-meal, are excellent. With the advent of warm weather and grass, the disease will probably disappear. N. S. MAYO.

Press Bulletin No. 113.—Botanical Department.
March 25, 1902.

Pasture Weeds — their Prevention and Eradication.

There is constant demand nowadays for information concerning measures for keeping weeds out of grazing land. Weeds are generally plants that have become adapted to living in many climates, on many soils, and under very various conditions. Some of them are truly cosmopolitan, being found in almost all countries. Their transportation to other countries is usually due to man, a very common means of distribution being through accidental mixture with grain, vegetable or grass seed. Railroads, particularly through the freight-trains, carry seeds of weed plants from place to place. In such ways weeds suddenly come to appear in new and unexpected regions.

The dominant vegetation existing in any section of country, if left to itself, usually repels invaders. The reason that certain kinds of plants only are found growing predominantly anywhere is because,

for the time being, they are best fitted to survive under local conditions. Those less well fitted are crowded out, and perish. In an old plant region, as a forest or a prairie, vegetation of a particular sort has established itself as the result of centuries of competition with other plants contesting for the same space. Seeds of invading species, however, may lie dormant for some time in the soil, awaiting the clearing of the land to germinate and grow. Notice the new plants that appear where land is cleared of trees or sod and left to itself.

So long as the conditions in nature surrounding the wild prairie-grass remain the same, they will continue to grow in about the same proportions and to about the same extent. Man, however, changes natural conditions violently. By breaking sod and putting in crops he opens places which afford room for strange plants, weeds, the seeds of which are carried thence to neighboring grazing land. Even then they will not drive out the wild grasses if the latter are left to themselves. On the contrary, if a farm is abandoned, weeds may riot for a few years on the broken land, but the sod retakes the soil eventually in the prairie regions, and the weeds are crowded out.

The most common cause of weed invasion of native pastures is overpasturing, whereby the wild grasses are kept down so that they cannot compete with the weeds. The latter, being unpalatable, usually are left undisturbed by the stock. Sometimes these are introduced weeds never found on the prairie, as iron-weed, snow-on-the-mountain or milkweed, horseweed, and thistle. Others are tough prairie perennials growing among the grasses, but not spreading greatly unless the latter are kept down.

Prevention of weed invasion of pastures is generally perfectly possible by grazing fewer head per acre. Compare the number of seeds in a prairie pasture with those in an adjoining piece of similar land not grazed but kept to be mowed for hay. What number of stock per acre can be safely grazed depends on the region. In the “short-grass” country fifteen to twenty acres per head must be allowed. In central or eastern Kansas two and one-half acres per head is perhaps a limit. Every farmer can tell by observation when weeds are coming in. If so, it is a sign to reduce the number of stock per acre. No man can afford to raise stock in such numbers that they use up the capital itself (the land) by killing out the pasture grasses which make it valuable, instead of consuming the interest only.

Eradication of weeds already present in pastures depends on the particular case. Annual weeds can be killed out by mowing before seeding. This may have to be repeated several times during the growing season, as many of them will send up new sprouts. In the

case of biennials or perennials with tap-roots, cutting the latter under ground and beneath the "crown" is effective. Perennials like the bindweed, which spread by underground stems, are extremely difficult to deal with, because every bud on such a stem is capable of growing into the new plant. Plowing under simply spreads the plant, by cutting the propagating stems and scattering the pieces. No very satisfactory way of eradicating weeds of this kind can be given that will apply for all cases and conditions. A straw mulch, by excluding the light, will sometimes kill them. Common salt applied to the soil is effective, and arsenite of soda, one pound dissolved in eight quarts of cold water, is recommended. This can be obtained of wholesale druggists at ten per cents per pound. Of course, any chemicals that will kill weeds will kill the other vegetation for several months. Chemical methods of weed extermination, then, should be used only as a last resort and under expert advice.

All bulk seed purchased should be carefully cleaned before sowing.

H. F. ROBERTS.

Press Bulletin No. 114.—Department of Dairy Husbandry. May 6, 1902.

Whole Kafir-corn Compared with Ground Kafir-corn for Young Calves.

Twenty head of young grade Hereford, Short-horn and Angus calves were purchased by the Kansas Experiment Station during April and May, 1901. The feed of these calves was gradually changed to skim-milk, with what grain they would eat, composed of a mixture of whole and ground Kafir-corn. It was found that the calves would eat the ground Kafir-corn when from ten days to two weeks of age, and would begin to eat the whole Kafir-corn when from three to four weeks old. On June 19 these calves were divided into two lots, as nearly equal as possible, the lot to receive ground Kafir-corn weighing 1570 pounds, or 157 pounds per calf; and the one to receive whole Kafir-corn weighed 1577 pounds, or 157.7 pounds per head. Each lot was fed all the skim-milk, grain and hay the calves would eat without scouring. The roughness for both lots consisted of prairie-hay only until the calves were twelve weeks old. Alfalfa was then added gradually, and for a time constituted one-half of the roughness fed, and later supplanted the prairie hay altogether. Fresh water and salt were available at all times.

GROUND-KAFIR-CORN LOT.— For the 112 days under experiment these ten calves consumed 14,748 pounds of skim-milk, 1394 pounds of ground Kafir-corn, 2381 pounds of prairie hay, 125 pounds orchard-grass hay, and 6222 pounds alfalfa hay. The total gain of the lot

during the experiment was 1580 pounds, or 1.41 pounds daily per calf. With skim-milk at 15 cents per hundredweight, grain at 50 cents per hundredweight (plus 3 cents per bushel or six cents per hundredweight for grinding), and hay at $4 per ton, the feed cost of raising these calves amounts to $47.37, or $4.73 per head. The cost per hundred pounds of gain is as follows: Skim-milk, $1.40; grain, 49 cents; roughness, $1.10; total, $2.99.

WHOLE-KAFIR-CORN LOT. — These calves consumed 14,620 pounds of skim-milk, 1641 pounds of whole Kafir-corn, 2381 pounds prairie hay, 125 pounds orchard-grass hay, and 5982 pounds alfalfa hay. The total gain was 1406 pounds, or 1.26 pounds daily per calf. The feed cost amounts to $47.09, or $4.70 per head. The cost per 100 pounds of gain is as follows: Skim-milk, $1.56; grain, 58 cents; roughness, $1.20; total, $3.34.

Comparing the two lots, it will be noticed that the whole-Kafir-corn lot consumed 247 pounds more grain, but 240 pounds less of alfalfa hay, and made seventy-four pounds less gain. There were a large number of grains, in the case of the whole-Kafir-corn lot, that passed through the calves undigested. This experiment indicates that better and more economical gains are made from ground Kafir-corn than from the whole grain. Nevertheless, if a man is so situated that he cannot grind his Kafir-corn, very fair gains can be made with the whole seed. Again, it is possible to feed the ground Kafir-corn the first two or three months and then gradually change to the whole. The weekly weights and gains show that the calves receiving whole Kafir-corn gained nearly as well the last five weeks of the experiment as those receiving the ground Kafir-corn. Feed ground Kafir-corn until the calf is three or four months old; then, if it is more convenient or economical, the whole Kafir-corn may be substituted.

D. H. OTIS.

Press Bulletin No. 115.—Veterinary Department
May 27, 1902.

Contagious Sore Eyes in Cattle.

There exists in this and other Western states a contagious inflammation of the eyes among cattle that is popularly called “pinkeye,” from the red and inflamed appearance of the eye. The disease is quite widely distributed, and while it occurs at all seasons of the year it is most frequently observed during the summer months, while the cattle are on pasture, as dust and pollen from plants increase the irritation of the eye. The disease was first observed by the writer in this state in 1890, but since that time has spread rapidly and is now quite common. The disease seems to attack young cattle more frequently

than old cattle; but cattle of all ages will take it, and it seems to affect old cattle more severely than calves. It does not attack other animals than cattle.

CAUSES. — The cause of the disease has not been discovered, although it is believed to be due to a germ. The manner in which the disease is spread from one animal to another is little understood, although flies are believed to play an important part. The disease, however, also spreads during the winter, when there are no flies about. Direct contact seems to be a means of spreading the disease. There is a popular idea that pollen and dust cause the disease. They undoubtedly aggravate it, but the disease must be introduced into a locality by an affected animal.

SYMPTOMS. — The first symptom usually noticed is a profuse discharge of tears from one eye, that run down over the face. Dust and dirt often adhere to the moist hair and a dirty streak is observed, especially in white-faced cattle, extending from the inner corner of the eye downward across the face. The disease usually begins in one eye, and later attacks the other eye. In some cases both eyes may be attacked at the same time. Associated with a discharge of tears is a swelling of the eyelids, which are nearly closed, partly from the swelling, but principally to keep the light from the eye, as bright light seems to increase the pain. The front part of the eyeball becomes milky white in appearance and one spot, usually near the center, red or copper-colored. At this point an abscess or small gathering usually forms, and looks to be a reddish, fleshy mass. It breaks, and discharges a small amount of pus or matter that escapes with the tears. As the animal recovers and the eye returns to its normal condition a white speck remains on the eyeball for a time as a scar, showing where the abscess existed. In a few cases this abscess weakens the front of the eye to such an extent that it bursts, and allows the contents of the anterior chamber of the eye to escape. A few of the cases where the eye bursts will heal and the animal will recover the sight, but in a majority of the cases the animal will be permanently blind in that eye. A few cases are reported where both eyes have burst and the animal was permanently blind in both eyes. During the acute stages of the disease, if both eyes are affected at the same time, the inflammation may be so severe as to cause a temporary blindness, the animals being unable to see at all, and it is necessary to feed and water them to prevent them falling away rapidly in flesh. If the animal has the disease in an acute form there is often some fever associated with the disease, and in practically all cases the cattle cease to ruminate, and will stand about with ears lopped and eyes closed, exhibiting all symptoms of severe suffering. Milch cows

usually fall away in the amount of milk secreted, or in severe cases it may be stopped entirely. Owing to a closing of the eyes, together with the pain, animals do not eat well, especially while at pasture, and as a result fall away in flesh.

Since practically no animals die from the effects of this disease, and only a few are permanently affected by the loss of sight, the greatest loss is in the shrinkage of flesh that follows an attack of this disease.

Treatment.— If possible the disease should be prevented by keeping infected animals away from the healthy. After the disease is once introduced among a bunch of cattle, by separating and isolating the affected animals as soon as the first symptoms are shown, the disease can be checked. It is not practicable to attempt to treat a large number of animals, unless they should be espcially valuable or suffer from the disease in a severe form. When it is advisable to treat an animal, it should be placed in a darkened stable, the eyes thoroughly washed with cold water, all secretions removed, and a solution of boric acid, twenty grains dissolved in an ounce of water, should be applied. A few drops of Haarlem oil, or a little ointment made by mixing one part of finely pulverized iodoform with twelve parts of fresh lard or vaseline, can be applied directly to the eyeball, by putting it on the inside of the eyelid, and gently rubbing it over the surface. Cloths wet with cold water and kept over the eyes are useful in reducing the inflammation. Practically all animals make a good recovery in three to four weeks. N. S. MAYO.

Press Bulletin No. 116.—Veterinary Department.
August 19, 1902.

Glanders and Farcy.

Glanders and farcy are different forms of the same disease. When the disease attacks the mucous membrane of the nostrils, it is called glanders; when the lymphatic glands of the body, especially of the legs, are attacked, the disease is called farcy. Glanders is a contagious disease caused by a germ *(Bacillus mallei)* that attacks horses, asses, and mules, and can be transmitted to other animals, including man, by inoculation through wounds, sores, or mucous membranes. The germs of glanders do not float through the air. The disease is commonly transmitted from a glandered horse by means of the discharge from the nostrils or sores. This discharge contains large numbers of germs of glanders, and may be transmitted to another horse directly, or by means of watering-troughs, feed-boxes, mangers, hitching-posts, equipment or utensils that may be infected with the discharge. It is possible that it may be carried by flies.

SYMPTOMS.— Glanders may occur in a mild chronic form, in an acute form, or attacking the lymphatic glands in the form of farcy. In the early stages it is often difficult to recognize, especially in the chronic form. One of the first symptoms noticed is a discharge from one or both nostrils. At first the discharge is thin, sticky, and often resembles linseed-oil; it dries about the nostril, making it appear smaller than usual. As the disease progresses the discharge becomes more profuse, thicker, yellowish in color, and sometimes streaked with blood. The mucous membrane lining the nose, especially on the partition between the nasal chambers, becomes ulcerated. The ulcers are raw, depressed in the center, with reddish edges. In some cases the ulcers may perforate the partition between the nostrils. In severe cases the mucous membrane of the nose becomes bluish or slate color, instead of a healthy pink. The lymphatic glands beneath the jaw usually enlarge, are firm to the touch, and often seem grown fast to the bone. These glands rarely gather and break, as they do in distemper. As the disease progresses the animal falls away in flesh, gets out of condition, and the coat looks bad. In severe cases there is often excessive discharge of urine.

When the disease attacks the lymphatic grands of the body it is called farcy. It is most frequently seen in the region of the hind legs, but may occur anywhere on the body. It usually begins with firm lumps forming beneath the skin, that may attain the size of a hickory-nut or larger and often occur in a string up and down the inside of the hind leg, on the course of the large lymphatic vessels. These enlarged glands are commonly called farcy "buds." They often break, and discharge an amber-colored fluid that dries upon the hair. These sores do not heal readily, and often show a tendency to spread.

TREATMENT.- Glanders and farcy are practically incurable, and all diseased animals should be destroyed and burned or buried deeply. In doubtful cases the disease can be recognized by injecting mallein (a chemical product of the glanders germ). If the horse has the disease there will be a rise of temperature of two degrees or more, with a well-defined swelling at the point of injection. All suspected animals should be carefully isolated from others and watered and fed from separate receptacles. Infected quarters should be thoroughly cleaned and disinfected, by removing and burning all litter and similar material. Stalls, mangers and feed-boxes, neck-yokes, etc., should be cleaned and scrubbed with a five-per-cent. solution of carbolic acid in water, and when dried should be whitewashed or painted. Equipment that cannot be burned can be disinfected by boiling for one hour. Persons caring for glandered horses should be careful not to contract the disease.

N. S. MAYO.

Press Bulletin No. 117.— Veterinary Department.
September 18, 1902.

Ergotism.

CAUTION, STOCKMEN! — During the present season, owing to the heavy rainfall or other climatic conditions, there has been developed upon wild rye and other similar grasses a fungus known as ergot, commonly called "spurred rye." Within the past few weeks a number of complaints have been received at the Kansas Experiment Station from the eastern and central parts of the state indicating that injurious and fatal results have occurred among stock from eating this fungus.

Ergotism is a disease of animals caused by eating ergot either on pasture grasses or hay. Ergot is a parasitic fungus *(Claviceps purpura)* that develops on the heads of wild rye, redtop, and similar grasses. This fungus replaces the ordinary seed or grain with a black or brown-black grain much longer than the ordinary rye grain, cylindrical, pointed, and slightly curved. The number of grains of ergot in a single head of rye or grass will vary from one to a dozen or more. The grains of ergot can be easily recognized by their shape and color. There is no dust or smut upon the heads of grain, as there is with some fungi. Ergot does not attack corn or sorghum.

Outbreaks of ergotism occur nearly all over the world and often cause heavy losses among cattle and horses. Serious losses from ergot in this state have not occurred since 1884, but it is possible that, owing to the abundance of ergot upon grasses the present season, serious loss may follow, unless care is exercised to prevent feeding a large amount of ergot. Cold weather and a limited supply of drinking water seem to favor the development of ergotism.

SYMPTOMS.— The symptoms of ergotism may occur at once after eating the fungus, provided the animal gets a sufficient quantity, or they may occur only after the animal has eaten the fungus for some time. Ergot lessens the blood supply, especially in the extremities— feet, tail, and ears; the affected parts swell, get cold; a well-defined line usually forms about the part, below which the tissue dies and sloughs off. When the feet are attacked the animal becomes very lame. Ergot causes abortion in pregnant animals, but this must not be confounded with contagious abortion among cattle. Ergot also affects the nervous system, causing trembling of the muscles, weakness, staggering gait, and sometimes convulsions. The digestive system is often affected and there may be purging, indigestion, and abdominal pain Cattle are more seriously affected by ergot than horses.

TREATMENT.— To prevent the disease, do not feed animals hay or grass containing ergot, and when the disease occurs ergot should be withheld at once. A purge of one pound of epsom salts for adult cattle, or a quart of raw linseed-oil for horses, should be given. Give sloppy, nutritious foods, with plenty of drinking water. Bathe affected parts, feet, etc., with hot water, rubbing to stimulate circulation, and apply antiseptics, such as a five-per-cent. solution of carbolic acid.

Suspected specimens of ergot may be sent to the botanical or veterinary department, Agricultural College, Manhattan, Kan., for identification. Hay that has been cut early is less apt to contain ergot than late-cut hay.

N. S. MAYO.

Press Bulletin No. 118.—Veterinary Department.
January 12, 1903.

Scab or Itch in Cattle.

Scab or itch, sometimes called mange, of cattle is caused by a minute mite, *Psoroptes communis,* var. *bovis,* that lives upon the surface of the skin and burrows in the epidermis. It does not attack other animals than cattle, although scab of sheep is caused by a similar parasite.

SYMPTOMS. — Scab or itch does not trouble cattle to a noticeable extent during the grazing season, when they are doing well on grass. Close observation is required to detect the disease in a bunch of cattle, but as soon as they are placed on dry feed, and cold weather sets in, the disease appears, and, if the cattle are not doing well, in an aggravated form. Scab usually attacks young cattle—calves, yearlings, and two-year-olds—but may attack cattle of any age if they are "out of condition." The first symptom noticed is an intense itching of the skin, usually in the region of the neck or shoulders. The animals lick themselves, dig at the skin with their teeth or horns, rub against posts or barbed wire, often tearing the skin until it bleeds. The disease gradually spreads along the back, sides, and outside of legs, but does not attack the inside of the legs, thighs, or thin skin of the abdomen. In the early stages the coat looks rough; there is a scurfy condition of the skin; the scurf becomes mixed with a gummy exudate and forms crusts in the hair, sometimes one-half inch thick; the hair then comes off or is rubbed off the badly affected area, leaving bald patches of thick, calloused, wrinkled skin. These patches often show first and prominently on the top of the neck, as if the neck had been calloused from wearing a yoke. After the hair comes off the parasites leave that part and hair grows in again. Animals suffering from scab present a dejected and debilitated appearance and fall away rapidly

in flesh; they do not eat well and spend a great deal of time and energy in scratching themselves.

Scab spreads quite rapidly through a bunch of cattle, especially if the cattle are not doing well. Six or eight weeks after the disease first makes its appearance is sufficient time to disseminate the disease pretty thoroughly. Thrifty, vigorous animals resist infection longer than others, and recover more quickly under treatment than debilitated animals. The disease is spread by direct contact and by contact with infected posts, feed-racks, walls, etc., against which infected animals have rubbed. The mites will live from a week to ten days in protected places but are killed quickly by direct sunlight.

By scraping off some of the scabs, and especially the epidermis, from the infected part and placing the material in a clean, dry, glass bottle, in a few hours minute white specks, barely visible to the naked eye, can be observed crawling on the inner surface of the bottle. By the aid of a hand lens these mites can be easily recognized.

TREATMENT. — As soon as the disease is discovered in a bunch of cattle the affected animals should be isolated, and the infected quarters and rubbing-posts disinfected with a five-per-cent. solution of carbolic acid. Affected animals should be well fed and cared for and be salted with a mixture of one pound of flowers of sulphur mixed with ten pounds of common salt. To cure the disease, external treatment must be applied. If a large number of cattle are affected, the most satisfactory method is to build a dipping vat, through which the animals must swim, in the dip used to destroy the mites. The vat should be forty feet long. Efficient remedies used for external application are some of the coal-tar products, such as car-sul, chloro-naphtholeum, zenoleum, creolin, etc,; these are used in two-and-one-half-per-cent. solutions with water; that is, one part of the medicine to forty parts of water. A very effective and cheap dip is composed of lime and sulphur in the following proportions:

Flowers of sulphur	21 pounds.
Unslaked lime	16¾ "
Water	100 gallons.

Slake the lime to form a thick paste, sift in the flowers of sulphur, and stir well; put this mixture in a kettle with twenty-five or thirty gallons of water and boil for thirty minutes at least; two hours is better. The chocolate-looking mass is allowed to settle, the clear liquid is drawn off, and water enough is added to make 100 gallons. All dips are more effective when used warm—from 100° to 110° F. Animals should be kept in the dip about two minutes, or until the scabs are thoroughly saturated. A second dipping in two weeks will kill any mites that may have hatched from the egg after the first dipping.

One dipping, if thoroughly done, is usually sufficient, however, to free a bunch of cattle from this disease.

Where only a few animals are affected, hand treatment can be resorted to, but it should be thoroughly done. The remedies can be applied with scrubbing-brushes, cloths, or sponges, and all scabs and crusts should be thoroughly saturated. The remedy should be applied warm, as in dipping. In dipping or hand treating, warm, sunny days should be selected for treating the animals.

Cattle scab is rather common in some parts of the great plains region, and stockmen in purchasing cattle should be cautious about getting animals affected with this disease. While the death loss is usually not high, the loss of flesh, general deterioration and annoyance resulting from this disease are considerable. Cattle that have been treated should be carefully watched for reappearance of the disease, especially when taken off of grass the next season.

N. S. MAYO.

Press Bulletin No. 119.— General Department.
February 3, 1903.

Poison for Prairie-dogs and Pocket-gophers.

On January 7, 1902, the Experiment Station announced that we would furnish a prepared liquid poison for the purpose of destroying prairie-dogs. The poison was that adopted and recommended by the Station under the provisions of section 4 of chapter 273 of the Kansas Session Laws of 1901, and it was sent out to all applicants in the state at the cost of the materials used in its preparation. As the poison is patented, it could not be furnished outside of Kansas, for we had purchased only the right to use it in this state. It was supposed that the demand for the poison would cease with the coming of grass in the spring, but it did not, for we have had orders for the poison almost every week since then. While the conditions for poisoning prairie-dogs are best during the winter, this poison has been reasonably successful in the spring and summer months.

Up to this time we have filled more than 500 orders for the poison, aggregating over 4500 half-gallon cans, and requiring of strychnine alone over 9000 ounces in its manufacture. Although we had made large contracts for this drug in the fall at the old price of fifty cents per ounce, the heavy orders of the past two weeks have exhausted our supply, and we have been compelled to make new contracts at an advanced price. It is therefore impossible for us to continue to furnish the poison at the old price of $1.50 per can.

It is thought best to take advantage of the necessity of announcing this advance in price to give some more specific directions than

those found upon the can labels for using the poison, and also to include directions for using it in destroying pocket-gophers.

FOR PRAIRIE-DOGS.—The poison is put up in half-gallon cans, with labels describing the contents, naming the ingredients, the quantity, the manner of preparing, and giving careful directions for its use. The price is $1.75 per can, delivered at the freight or express office in Manhattan. One or two cans may be sent by express, wrapped in paper, but a larger number must be boxed. Any number of cans may be sent by freight, but they must be boxed. No charge is made for packing. A can of poison weighs five and a half pounds, and will poison a bushel of wheat. It should be enough for 1200 burrows.

The strychnine in this poison is not in solution, but is held in suspension in the syrup. It settles to the bottom of the can, after the manner of lead in ordinary mixed paint. A common error in using it is to pour off a part of the contents without first having *thoroughly* shaken or stirred the liquid. When thus used, this top part of the liquid is not sufficiently poisonous to kill all the animals that eat of the mixed wheat. If it is first stirred or *thoroughly* shaken, a part of the can may be used as successfully as the whole of it.

We recommend that the area of "dog town" to be poisoned be gone over very carefully, placing the bait at the outside of all occupied burrows, as directed. If not all the animals are killed at the first application, a change of bait to Kafir-corn, broken corn or corn-meal is recommended for those that remain. If after a second application any animals still remain, carbon bisulphide is probably the most effective means of destroying the remnant.

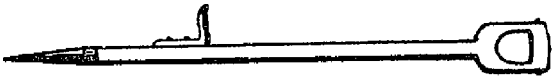
FOR POCKET-GOPHERS.—We have found that this poison is excellent for destroying pocket-gophers, and that it is even more convenient to use than the dry strychnine and potatoes or raisins recommended in Press Bulletin No. 109. The poisoned bait is to be inserted into the runways of the gophers in the same manner as described in that bulletin.

The poison for gophers is put up in quart cans, and by leaving out one ingredient (potassium cyanide) the strychnine is kept in solution. The liquid is therefore equally poisonous throughout and any part of the contents of the can may be successfully used. A quart will poison a half-bushel of grain, and the price of it is ninety cents per can.

Pour boiling water over a half-bushel of shelled corn and let it stand over night to swell and soften the grain. Then drain off all the water possible, and pour the quart of poison and a cup of syrup over the corn. Add a few pounds of corn-meal and mix all thor-

oughly. The mass of corn should be somewhat sticky, and there should be no dry corn-meal present.

Make openings into the runways of the gophers with a pointed stick (see illustration below) and with a spoon drop a few kernels of the corn down each opening. A spade or shovel handle shod with an iron point and having a bar for the foot about sixteen inches from the point is recommended for making the holes into the burrows. No digging or covering of holes is required.



The best time to poison pocket-gophers is in the fall or spring, when they are most active. It is not usually necessary to go over the ground with poison a second time, but much will depend on the judgment and care of the operator in putting out the first poison.

Orders for poison for prairie-dogs or gophers should be accompanied by money in payment. Money-orders or drafts should be made payable to Miss Lorena E. Clemens, who is secretary of the College. Method of shipment preferred should also be stated.

D. E. LANTZ, *agent.*

Press Bulletin No. 120.—Agricultural Department.
February 24, 1903.

Better Bred Grain and Corn for Kansas.

There are a few simple rules, if they are observed, by which any farmer may improve the quality and productiveness of his corn and other grains.

The vitality of seed depends largely upon three factors, viz., the maturity of the seed, that is, its perfect development, the vigor and healthiness of the parent plant, and the saving and storing of the seed.

Seed-corn should be selected in the field, so as to observe the stalk as well as the ear. Select the best ears (those which hang down indicate weight and small shank), from strong, healthy, leafy stalks. Gather two or three times as much corn as you need for seed, and, after shucking, select only those ears which are sound and true to type, well dented, with deep, wedge-shaped kernels and straight rows, well filled out at butts and tips. Thoroughly dry the corn in a well-ventilated room, supplying artificial heat when necessary, and store in a dry place, away from rats and mice.

So important is it to save seed only from the strongest and most productive plants, that every farmer ought to select the field in which to grow crops for seed. Give the land special preparation, plant at the most favorable time in order to secure quick and sure germina-

tion, and give the crop the best possible care and cultivation, so as to get the fullest development of the plants.

Sow the grain or plant the corn thinner than you do for the general crop, in order that the plants may be vigorous and fully developed in productiveness. Seed from large-productive plants is more apt to produce large-productive plants than seeds from stunted, crowded plants.

Allow grain to become fully ripe before harvesting for seed, keep it from getting wet in the shock if possible, and thrash it when it is thoroughly dry, so that there will be no danger of heating in the bin. Store in a dry place. Always clean your seed grain, removing all foul seed and light kernels. Like produces like with the plant as with the animal. If you want to produce heavy, plump grain, plant heavy, plump grain.

The agricultural department of the Experiment Station will begin a series of experiments in 1903 for the purpose of testing and comparing all kinds of grain and corn which are being grown or recommended for planting in Kansas. These trials will be made at this Station, and duplicated, as far as possible, at the Fort Hays Branch. I wish to secure seed of all the best varieties of grain and corn which are now being grown by the farmers of Kansas. If you have a good strain of corn, wheat, oats, barley, flax, Kafir-corn, sorghum, etc., which you would like tested in this trial, send a sample of seed to the agricultural department of the Experiment Station, Manhattan.

For all varieties which it is desirable to grow here and at the Branch Station, one bushel of grain and one peck of corn will be required. For a single trial, one-half bushel of grain and one-half peck of corn is sufficient. I prefer to have the corn not shelled, but in the ear, in order to compare varieties and make some selections for breeding purposes.

The results of the variety trials will be published, and it is the purpose, if certain varieties are found to be better adapted to the state or to parts of the state than others, to propagate and improve them, and ultimately to distribute to the farmers of the state better varieties of grain and corn than those grown at present.

I believe that the surest and quickest way to get improved varieties of grain and corn for Kansas is to begin with the best native varieties — those sorts which have been planted and grown in this state for a long time, until they are thoroughly adapted to the soil and climate. These varieties have the stamina to withstand the adverse conditions; all they need, perhaps, is a few years of careful and scientific breeding and selecting to improve them and make them superior to the best we

can get from other states. Some who have planted the high-bred corn from Illinois have reported that the crop from the Illinois seed was much inferior to that from their own Kansas-grown seed. It does not follow from this that we should discontinue the testing of varieties from other states or climates, but the suggestion is that such trials should be made on a small scale at first, and, if a variety proves to be hardy and adapted to Kansas conditions, then begin planting it in a larger way. Meanwhile let us breed up the best Kansas stock.

I earnestly invite the farmers, and especially the grain- and corn-breeders and seed-growers, to cooperate with the Experiment Station in this work.

A. M. TEN EYCK.

Press Bulletin No. 121.—Veterinary Department.
March 3, 1903.

Fistulous Withers and Poll-evil.

Fistulous withers, often called "thistelow," is a running sore that follows the formation of an abscess or "gathering" in the region of the withers of horses, or in the upper part of the neck just in front of the withers, A poll-evil is a similar condition occurring in the region of the poll.

Causes.— Fistulous withers and poll-evil are caused by specific germs gaining entrance to the system, probably through the food or water, and locating in the regions above described, where they cause pus or matter to form, and thus produce an abscess. It is possible that they may be caused or aggravated by local injuries, such as blows or ill-fitting collars or saddles, or from hitting the poll against the ceiling, or from pulling on a halter.

Symptoms.— At first there is a diffuse swelling of the withers or poll, usually on one side or the other; this swelling is often tender and causes some stiffness in the muscles of the part. Later the swelling becomes more prominent in some part, softens, and, unless opened, breaks and discharges pus or matter. The sore thus formed is lined with a smooth "false membrane" that secretes pus and is very difficult to heal. Sometimes a fistula of the withers, or poll-evil, will discharge for a year or two and frequently causes the death of the animal.

Treatment.- In the early stages it is often possible to cause their absorption or "scatter" them by bathing the affected part with hot water, rubbing and kneading the parts thoroughly, and applying a stimulating liniment, such as the following: Strong ammonia one ounce, turpentine one ounce, water one ounce, linseed-oil five ounces. This should be applied once daily until the skin begins to get sore,

when it can be withheld for a few days and repeated. Application of tincture of iodine and blisters are also used to "scatter" fistulae and poll-evil.

After much pus or matter has accumulated it is impossible to scatter them; then they should be opened freely with a knife; good surgeons often dissect them out, at least so far as is possible. The incision should be made as low down as possible, to give free drainage. In most cases a cavity will be found with one or more "pipes" extending into the tissues. In case the bones of the withers are ulcerated they must be removed surgically. The cavity should be thoroughly cleaned out and kept clean, all pieces of diseased tissue removed, and the cavity dried by swabbing out with absorbent cotton. Pure tincture of iodine should be injected once daily after cleaning and drying. A solution of one part of carbolic acid in twenty-five parts of water is good to clean it out. Pure turpentine can be used in place of iodine with good results in some cases.

Another method of treating after opening is to thoroughly swab out the inside of the cavity and "pipes" with a good liquid caustic, such as butter of antimony. In place of a swab, rags saturated with butter of antimony can be packed in the cavity and "pipes"; they should be removed in a few minutes. This destroys the "false membrane," which sloughs out in a day or two. The fistula should be washed out daily, a four-per-cent. solution of carbolic acid used, and the parts kept clean. In using a caustic, it should be used once carefully and thoroughly. Repeated use of caustics is injurious, and strong caustics should be used with caution.

Rubbing with liniment or applying a light blister about the diseased part is often useful in assisting the healing process. Other good solutions used to inject into the cavities for cleaning and healing are: Corrosive sublimate one part, water one thousand parts; blue vitriol, pulverized, one teaspoonful dissolved in a pint of water; or a one per cent. solution of creolin or similar coal-tar products.

In treating these diseases, a good syringe with a long nozzle that can be inserted into all parts of the fistula is essential. Showering the part once daily with cold water with considerable force from a hose, and then rubbing briskly until it is dry, is often beneficial. It is important that the fistula should heal from the bottom; if the outside opening is allowed to close before the cavity has healed it will break out again.

Animals with a fistula or poll-evil should be well fed with nutritious food, and salted frequently. A tonic condition powder is often very useful. The following is good: Sulphate of iron one ounce, hyposulphite of soda one ounce, saltpeter two ounces, nux vomica seed one ounce, gentian root two ounces. All should be well pulverized and mixed. A heaping teaspoonful can be given in the feed twice daily.

N. S. MAYO.

Press Bulletin No. 122.—Animal Husbandry Department.
April 28, 1903.

Pasture for Hogs.

The Kansas Experiment Station has realized $11.90 per acre from rape pasture and $24.10 from alfalfa pasture in ninety-eight days. These results were obtained from the following experiments, which were begun July 25 and concluded October 31, 1902:

Thirty shoats, averaging fifty-two pounds in weight, were divided as nearly equally as possible into three lots of ten each. Lot I was fed on a grain mixture of shorts one-half, corn-meal one-fourth, and Kafir-corn meal one-fourth, in a dry lot. The other two lots were fed the same grain ration, but one received rape pasture and the other alfalfa pasture in addition. Each lot was given what grain the hogs would eat up clean, and each had access to water and ashes. The weights of grain consumed and gains made are as follows:

Feed.	Grain consumed, in pounds.	Total gain, in pounds.	Grain consumed per 100 lbs. gain, in pounds.
I. No pasture	3,801	1,023	371
II. Rape pasture	3,244	1,076	301
III. Alfalfa pasture	3,244	1,078	300

The gains of the three lots are very nearly equal. The dry lot consumed 557 pounds (or seventy pounds for every 100 pounds of gain) more grain than the pasture lots. The lot on rape required one acre of pasture, while the alfalfa lot used a trifle less than one-half acre.

The lot without pasture required 3.71 pounds of grain to produce one pound of gain. Assigning the same value to the grain fed the hogs on rape pasture, we have 877 pounds of pork credited to the grain and 199 pounds credited to the rape. At six cents per pound, the price at which hogs were selling at the close of the experiment, this would be a credit of $11.90 per acre for the rape. In a similar manner, the alfalfa is reedited with 201 pounds of pork, equal to $12.05, and as there was only a half-acre of alfalfa, this makes a rate of $24.10 per acre.

The cost of preparing the seed-bed and seeding the rape was $1.80 per acre. It was seeded in the feed-lots, on soil that would otherwise have remained idle or would have grown up to weeds.

The shoats on pasture enjoyed their diet and seemed satisfied. Those in the dry lot seemed to be hankering after something green. and their appetites seemed unsatisfied without some kind of roughness. They would even nibble at straw, in a vain attempt to satisfy their craving.

The experiment emphasizes the superior value of alfalfa pasture. Where alfalfa is not available, or where variety is wanted, or it is desired to utilize otherwise waste land, Dwarf Essex rape, seeded at the rate of six to eight pounds per acre, any time from early spring to late summer, will furnish an excellent diet that is greatly relished by the hogs. Succulence and variety will make healthier hogs, that will return increased profits.

D. H. OTIS.

Press Bulletin No. 123.—Dairy Department.
May 26, 1903.

A *Test of Hand Separators.*

STATEMENT AS TO CONDITIONS. *Operating Test.*— The figures given under this table are the average of from five to seven tests of each machine. The separator in each test was operated ten minutes under conditions prescribed by the book of instructions, with milk at ninety degrees F., not over thirty-five minutes after milking-time. The work was done under the direct supervision of the dairy department, Kansas Experiment Station.

TABLE I.— Operating test of hand separators.

NAME OF SEPARATOR.	No.	Capacity per hour, lbs.	Test of skim-milk.	Test of cream.	Lbs. lost in bowl-washing.	Total per cent. loss.
De Laval	1	472	.048	37.8	.011	.064
Sharpless Tubular	4	518	.042	31.7	.014	.069
Empire	2	442	.038	33.8	.057	.126
Iowa Dairy	0	457	.054	37.1	.038	.110
National	6	496	.051	44.8	.031	.095
United States	6	429	.033	36.1	.015	.058

Explanation of Table I.- The capacity per hour is calculated on the basis of a ten-minute run, as are all the other data in table I. Samples of skim-milk and cream were taken from the total amount of each when ten-minute run was completed, and tested in Babcock tester by usual methods given for such testing. The pounds of butter-fat found in bowl-wash is the total amount of fat in bowl and contents of bowl after turning off the milk and flushing the bowl with from three to six quarts of skim-milk. The total per cent. loss is found by computing the pounds lost in skim-milk, adding this to the pounds lost in bowl-wash, and the whole calculated in per cent. of loss in skim-milk. It should be noted here that the loss in bowl-wash would not differ much in varying lengths of run. There would be about the same loss in a twenty-minute run as in a ten-minute run. This being a fact, a twenty-minute run would show a less percentage of total loss than the ten-minute run. A ten-minute run is probably a little below the average for all users of hand separators.

TABLE II.— Power test made by department of electrical engineering.

NAME OF SEPARATOR.	No.....	Turns of handle per min.	Revolutions of bowl per minute.....	Weight of bowl, lbs. and ozs.....	Length of crank, in....	H.-P., no load	Pounds pull on crank, no load....	H.-P., full load..	Pounds pull on full load.
De Laval.....	1	45	7,065	12–10½	10½	.08	11.3	.10	14.3
Sharpless Tubular.....	4	45	16,515	6–7¾	13	.06	6.5	.10	11.2
Empire.....	2	55	9,969	8–12	9½	.09	11.2	.11	13.7
Iowa Dairy.....	0	60	10,680	7–14½	9¼	.13	15.2	.15	17.1
National.....	6	60	10,200	9–8¾	9½	.12	13.1	.13	14.8
United States.....	6	60	10,200	11–6½	10¾	.18	17.8	.19	18.8

Explanation of Table II.— The last two columns of this table are of direct interest to the operator of a separator—the horse-power required to operate the machine when it is doing work, and the amount of exertion that must be applied to the handle to keep the machine at its work. This exertion is measured in the number of pounds the operator is required to push on the handle. In comparing results of the different machines, there must be taken into account the number of turns of the handle and the length of the crank. Others things being equal, the faster the handle is turned the more horse-power will be used up in turning; but here must also be considered the weight of the bowl and the smoothness with which the gearing works. In all cases, the longer the crank the less pull will be required to turn the crank. The turns of handle per minute, revolutions of bowl per minute, weight of bowl and length of crank are from exact measurement and need no further explanation.

Summary of Points.— Points in which machines excel, as given in above tables, are as follows: Capacity per hour, Sharpless; test of skim-milk, United States; minimum urn loss in bowl-wash, De Laval; minimum total loss, United States; minimum horse-power to operate, De Laval and Sharpless same; minimum pull on crank, Sharpless.

Conclusion.-Do not from the above draw too hasty conclusions. These tests were made under best conditions and with new machines. There are two points the intending purchaser should carefully consider, namely, the ability of the machine to do good work under trying conditions and the durability of the machines. Neither of these are covered in this bulletin, and we have no data covering such conditions at present writing.

ED. H. WEBSTER.

Press Bulletin No. 124.-Agricultural Department.
June 2, 1903.

Late Crops.

The crops on much of the river-bottom land have been totally destroyed by the extensive floods, and farmers are undecided as to what to plant in order to gain some income and secure fodder and grain for their stock next winter. The information and general suggestions given below may assist some in taking advantage of the opportunity for producing crops which still remains.

DATES OF FIRST KILLING FROSTS.-The dates of the first killing frosts for the last twenty-three years, as they have been recorded at this Station, are given below:

Year. Date.	Year. Date.	Year. Date.	Year. Date.
1880, October 4.	1886, October 1.	1892, October 8.	1898, October 14.
1881, September 17.	1887, October 10.	1893, October 15.	1899, September 30.
1882, October 13.	1888, September 28.	1894, October 8.	1900, October 8.
1883, October 14.	1889, September 27.	1895, September 30.	1901, ———.
1884, October 9.	1890, September 13.	1896, September 29.	1902, October 5.
1885, October 4.	1891, September 29.	1897, October 29.	

Average, October 5.

During the twenty-three years no frost has been recorded earlier than September 13, although a light frost occurred in 1902 on that date and light frosts occurred in September in 1889, 1893, and 1894. Eight years out of twenty-three, killing frosts have occurred in September. October 5 is the average date of killing frosts, while the average date of September frosts is September 25, and of October frosts the 10th day of that month. It should be noted also that many of the frosts recorded as killing frosts were not so severe as to entirely stop the growth of corn and of Kafir-corn. By a killing frost is meant frost hard enough to destroy tomato vines, sweet potatoes, melons, etc.

CORN.—At this Station, early varieties of corn—King of the Earliest, Pride of the North, Early Huron Dent, Dakota Dent, Minnesota King, and early flint varieties— have matured in 95 to 100 days when planted about the 1st to the 10th of May, while medium early varieties, as Leaming, Kansas Sunflower, Early Mastodon, Iowa Gold Mine, Legal Tender, Silver Mine, Champion White Pearl, and Boone County White, have matured in from 105 to 120 days. The first varieties named are usually classed in the catalogues as ninety-day corn, the last as one-hundred-day corn. Corn planted in June, with good growing conditions, will mature in a shorter period than corn planted in the early part of May. Any of the varieties named in the second class planted in June, with ordinarily favorable conditions of growth, ought to mature in about 100 days. Therefore, these varieties may be planted before June 15 with a fair promise of a crop. After June 15 and until June 25, the varieties which belong to the ninety-day

class may be planted with a reasonable promise of a crop, assuming September 25 as being the possible date of the first killing frost. If the frost should hold off until October 5, June-planted corn ought to be a safe crop, as far as injury by frost is concerned.

Trials at this Station in 1895 and 1896 (average seasons) in planting corn (Leaming variety) at different dates favored early planting. Corn planted May 30 gave about three-fourths the yield of corn planted May 1 to 10. A wet season should favor late planting more than the average season.

In a five-year trial (1891 to 1896), the earlier sorts yielded on the average two-thirds as much corn as the medium and late varieties.

KAFIR-CORN.-In 1895 Red Kafir-corn planted May 20 required 123 days to fully mature seed. In 1890 Kafir-corn planted May 4 was ripe September 12, 130 days after planting. On the average, Kafir-corn planted in May at this Station takes 125 days to fully mature the seed. The Red Kafir is a week or ten days earlier than the Black-hulled White, but at this Station the last-named variety has yielded five to six bushels more seed per acre in a two-year trial than the Red variety.

The yield of Kafir-corn, as compared with corn, in a ten-year trial, at this Station, is as follows: Kafir-corn, 43.8 bushels per acre; corn, 31.6 bushels per acre. Corn has ten to twenty per cent. greater feeding value than Kafir-corn.

At this Station the practice has been to plant Kafir-corn in drill rows, three to three and one-half feet apart, with a grain-drill set to drop single seeds an inch apart in the row. If the development of seed is the main object, a little thinner planting is necessary. Kafir-corn may be planted with a corn-drill or drill corn-planter, if special plates are provided to drop the seed at the proper distance. "On warm soils and in late planting, listed Kafir-corn does well." Planted as stated above, one bushel (fifty-six pounds) of seed will plant five acres.

Since Kafir-corn requires more time to mature than corn, since it cannot be so readily converted into money, since it is more difficult to harvest and store, and since it is adapted to dry seasons rather than to wet seasons, it would seem to me advisable to plant a large amount of corn on wet bottom lands, rather than too much Kafir-corn. With a light corn crop, Kafir-corn seed will sell well at a fair price, but with a good corn crop, it can only be used as feed on the farm. If Kafir-corn fails to mature a full crop of seed, it may still make an excellent fodder, but this true of corn also.

SORGHUM-Sorghum may be sown broadcast for fodder as late as July 10, or it may be planted in drill rows, as described for Kafir-corn.

When sown broadcast or in close drills, 50 to 100 pounds of seed per acre will be required.

Early Amber cane ripens in about. . . . . 90 days.
Early Orange cane ripens in about . . . . . 100 "
Colman and Kansas Orange in . . . . . 120 "

SOY-BEANS AND COW-PEAS.— In 1890 soy-beans planted June 7 matured as follows:

Extra Early Dwarf . . . . . 70 days.
Early Yellow . . . . . 90 "
Early Soy . . . .124 "
Late varieties . . . . . 128 to 166 "

The average yield at this Station for twelve seasons was twelve bushels per acre. At this Station soy-beans are usually planted with the grain-drill, in drill rows thirty to thirty-six inches apart, beans one to two inches apart in the row. The beans may also be planted with the lister in warm soils or late in the season. Planted in drills thirty inches apart will take three to four pecks of seed per acre. The Early Yellow variety has yielded best at this Station.

Cow-peas may best be used as a forage crop. The hay is similar to alfalfa hay in composition and feeding value, being even richer in protein than alfalfa. In the average season the yield per acre should be three tons. Cow-peas may be sown broadcast and disked in, or they may be planted with the grain drill in close drills. This method requires one and one-half bushels of seed per acre. Some plant in rows and cultivate as described for soy-beans, which requires much less seed. The Whippoorwill is the earliest and one of the best varieties to grow in this state. The Clay, Black and Blackeye are other well-known but later-maturing sorts.

Cow-peas may be planted even later than soy-beans. The crop should be mowed for hay when the peas are well formed and the leaves and pods are just beginning to turn yellow. The hay-making process is a difficult one, and requires even more care than the making of alfalfa hay. Cow-peas planted with corn and cut for fodder make excellent forage for all kinds of stock, and are also recommended for ensilage. Soy-beans and cow-peas belong to the legume family, and tend to increase the fertility of the soil, and make an excellent rotation crop for corn or wheat.

MILLET.—Millet may be sown for forage late in July, if the soil remains in good condition to sprout the seed. Usually early seeding is best, as millet should have a good start before dry weather sets in. Millet may be safely cut for hay any time during the period from complete heading to late bloom. Siberian, Hungarian and Common millet will make hay in from 60 to 70 days from seeding; German

millet requires 70 to 80 days. The first-named varieties will mature seed in 90 to 100 days; the last in 110 to 120 days.

For seed-production, Hog or Broom-corn millet is preferable to the Foxtail varieties. Some early strains of Hog millet will mature in seventy days. Japanese Barn-yard millet is a late variety, but a rank grower, and will produce more fodder than the early millets.

Sown broadcast or in close drills requires two to three pecks of the Foxtail or Broom-corn sorts. One to two pecks of the Japanese variety is sufficient. Sow thinner for seed-production than for fodder-production.

RAPE.- Rape may be sown for pasture as late as August 1. Sown with the grain-drill, in drills thirty inches apart, will require three or four pounds of seed per acre. Rape makes excellent pasture for hogs, and may be used for sheep and cattle.

PASTURE. - Millet, or millet and oats, or oats and field peas, may be sown for early pasture. Sorghum will furnish a large amount of pasturage, and may be sown any time up to August 1. Cow-peas sown broadcast as described above make an abundant and excellent pasture. There is nothing better for dairy cows. Cow-peas sown with oats, sorghum or corn make excellent pasture. When two crops are planted together, use a little more than half as much seed of each as would be used in seeding the crop alone.

ALFALFA. — The fields which have been flooded should be disked as soon as the ground is dry enough. There is a possibility, if the crop has not been under water too long, that the alfalfa may start again. It is practical to reseed the fields at once, after thorough disking and harrowing. In case of an old field in which alfalfa has been cut for seed or allowed to mature, it will not be necessary to sow nearly so much seed as is usually required for the first planting. Eight or ten pounds per acre ought to be enough to reseed an old field. In case the field has grown alfalfa six or eight years, it may be advisable to rotate with other crops and seed alfalfa on new fields.

OTHER CROPS. — Broom-corn, buckwheat, navy beans and garden crops may be planted, if convenience and time permit, as extras, to bring in a little pocket-money.

SOIL MOISTURE. — The soil is full of moisture. Every means should be used to drain off the surface-water at once. But do not forget that Kansas is noted more for her droughts than for her floods. Practice the best methods of tillage and cultivation, so as not to waste the capillary water now stored in the soil. With the large store of water now in the soil, by careful cultivation corn should be made a profitable crop, even if drought should prevail in the latter part of the season.

A. M. TEN EYCK.

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AGRICULTURAL EXPERIMENT STATION, Manhattan, Kan.