EXPERIMENT STATION.

KANSAS STATE

AGRICULTURAL COLLEGE.

Bulletin No. 99–October 1900.

ALL DEPARTMENTS.

PRESS BULLETINS Nos. 35 TO 70.

MANHATTAN, KAN.
1900.

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EXPERIMENT STATION
OF THE
KANSAS STATE AGRICULTURAL COLLEGE,
MANHATTAN.

BULLETIN No. 99—OCTOBER 1900.

ALL DEPARTMENTS–PRESS BULLETINS Nos. 35 to 70.

Introduction.

THE first thirty-four press bulletins of the Station were reprinted as Bulletin No. 86. This was received with so much favor that copies available for distribution have long since been exhausted. The present collection includes all of the remainder issued up to June 30, 1900. While some of them may be of ephemeral interest, others contain valuable material not likely to be printed elsewhere soon, and the Council feels that, by thus sending them to our regular mailing list, they will fall into appreciative hands. 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. 35. –Veterinary Department.
April 5, 1899.

Dysentery in Calves and Other Young Animals.
(Dysenteria neonatorum.)

Letters of inquiry to the veterinary department regarding this disease have, during the past month or more, been so numerous, and are continuing to come in at such a rate, that it has been thought best to give to the public, through the press, a few of the best-known facts regarding this extremely fatal disease.

Nature, Occurrence, and Cause.— Dysentery in young animals is most frequently met with in calves, but also causes untold losses in pigs, lambs, and foals, and is common in dogs and cats. That a similar disease occurs in human beings, is a well-known fad. This disease is so common in many localities, becoming more prevalent from year to year, that in some places the growing of young stock must be abandoned. According to Roell, dysentery is so prevalent in portions of Austria that, in one herd of 3318 calves, 1196 animals were attacked, and 1152 died (97 per cent.) This gives an idea of the mortality to be expected from this disease.

The disease attacks, chiefly, animals from one to four days old; after that age it is a much rarer occurrence. Often the animal become attacked immediately after birth, without previously having taken any food whatever. This seems to prove that the milk of the dam cannot be considered as a factor in producing the disease. A further proof to this effect seems to be the fact that the feeding of milk from stables free from this disease is no hindrance to its development.

Although the infectious principle is not known, there is no doubt that the disease is infectious, and that the excrements harbor the infectious principle and constitute the chief medium for its dissemination.

It seems that the disease can be transmitted not only from animal to animal of the same species, but also to animals of different species; *e. g.,* from calves to lambs and pigs (Kotelmann). Friedberger and Froehner mention the fact that infectious abortion and infectious scours (dysentery) often occur at the same time, and thus seem to have something in common.

Symptoms.— The symptoms in different species of animals are much the same and are only too well known by some cattlemen. In calves we find the following: Loss of appetite, diarrhea (very soft or even watery evacuations), restlessness, tenesmus (ineffectual straining to pass dung), and cries of distress. Later, the excrements, which at first are of a gruel-like consistence and of a yellowish color, become watery and whitish in color, mixed with mucus and particles of coagulated milk, and even blood. At this stage the excrements have a most disagreeably fetid odor. Finally, involuntary evacuations take place, the animals become weak and lie down continually, have cramps and spasms, and discharge saliva from the mouth. The eyes become sunken, the hair rough, and general indications of emaciation can be observed.

Death may occur within twenty-four hours of the appearance of the first symptoms, but as a rule not until the lapse of two or three

days. The mortality is very high (80 to 100 per cent. of all attacked animals die). Frequently every calf in a stable will succumb to the disease. When animals recover they remain weak and unthrifty for a long time.

The symptoms in lambs and colts are much the same as those given for calves. A few other diseases, which may be confounded with dysentery, are sometimes met with, but careful observation and the consideration of all facts presented will guard against a false diagnosis.

Treatment.— Our greatest and, I might say, our only hope, lies in prevention. Prevention consists in the isolation of the healthy and the diseased animals, and in the thorough disinfection (see Bulletin 79, Bovine Tuberculosis, pp. 99–101, Kansas State Agricultural College) of the infected stables, yards, and pens, as well as disinfection of the female genital organs (before and after parturition).

The isolation of pregnant cows and their removal to new or thoroughly disinfected old quarters, a week or ten days before parturition, is an excellent plan. This is more rational treatment, and promises better success than any amount of drugs and medicines administered internally. Animals already attacked may be treated as follows: Give calves two or three tablespoonfuls of castor-oil; lambs as many teaspoonfuls; colts may be given one to three grains of calomel three times a day. The calomel, after being triturated with a little sugar, may be added to a little milk and fed to the colt. On the following day, or after the oil or calomel has had its effect (laxative), the following, recommended by Friedberger and Froehner, may be given:

Powdered rhubarb root, one drachm.
Powdered magnesium carbonate, fifteen grains.
Powdered opium, thirty grains.
Good brandy or whisky, two ounces.

Mix, dilute with equal parts of water, shake well, and give to calf as one dose, repeating a similar dose every three to six hours until the diarrhea is relieved.

In the same manner, colts may be given one to two and one-half drachms of tincture of opium, lambs thirty to sixty drops, repeating the dose as above every three to six hours until relieved.

The following treatment was used with success by the author: Take wood-tar one pound, place in a vessel, and pour over it three gallon of boiling water; allow to cool, and pour off the straw-colored liquid (tar water), which is used as follows: As soon as the calf shows symptoms of diarrhea, inject with a syringe, one-fourth pint of this liquid into the rectum. Repeat the operation every half-hour. Use a hard-rubber syringe with a long nozzle, oiling it, if necessary, to

facilitate its insertion and prevent possible injury. Next day, continue this treatment and, in addition, dilute all milk fed to the calf with one-fourth its bulk of this tar water. Keep this up until recovery sets in. With this, as well as with any other treatment, the most important thing must not be neglected, viz., providing for the tender young animal's comfort. Provide a clean, comfortable stable, plenty of fresh bedding, which must be renewed every day, pure air, light, quiet surroundings, and gentle treatment. If the animal is allowed to suck, wash teats of dam with a three-per-cent. creolin solution (tablespoonful creolin to one pint of water) immediately before. If calf is fed by hand, wash your hands in hot soap water, using a stiff brush, and then rinse them in three-per-cent. creolin solution. Keep pails and all utensils with which milk is handled scrupulously clean, by means of frequent scalding. Disinfect stables and yards frequently with a one-fifth-per-cent. solution of bichloride of mercury.

Pregnant cows should be treated as follows: A week or ten days before they are due to calve isolate them, and inject (gently) one-half pint of a three-per-cent. creolin solution into the vagina. Repeat this operation every day until the calf is born. After the calf is born, inject half a gallon of this solution into the uterus, repeating the operation once daily for three or four days, or until all unnatural discharges cease.

All this means strict attention, study, work, and a little expense, but without these do not expect, or even hope for, success.

Press Bulletin No. 36.—Veterinary Department.
May 3, 1899.

Experiments with Swine-plague or Hog-cholera.

The Jensen Creamery Company, Beloit, Kan., makes the following report in the May number of Jensen's Dairyman:

"The Jensen Creamery Company, having for over a year continually lost hogs from hog-cholera, decided to investigate the new preventive experimented on by the Kansas State Agricultural College veterinary department. This preventive consists in inoculation or so-called vaccination of the hog-cholera germ into the blood of the hogs. It is on exactly the same principle as vaccination against smallpox in human beings or blackleg in cattle.

"On the 21st of January the Jensen Creamery Company received twelve shoats that had been inoculated by Prof. Paul Fischer, at Manhattan. They were subjected to the most trying exposure. A hog that died from cholera was left in the pen with them. No attempt at disinfection or cleaning was carried on. These twelve shoats, aside

from not being in the least touched by cholera or any other disease, showed extraordinary vitality and rapid gain. They were fed three months and three days during the most severe of last winter's weather.

"The record is as follows:

The twelve shoats when put in the pen weighed 1400 pounds:	
At 3 cents per pound	$42.00
They were fed:	
Wheat shorts, 5800 pounds, at $12 per ton	34.80
Buttermilk, 5320 gallons, at 12½ cents per barrel	13.00
Total..	$89.80

"When sold these hogs weighed 3750 pounds, and brought $125.62, a net gain of $35.82.

"The total gain in ninety-three days, 2350 pounds, 196 pounds per head."

The experiment above referred to is only one of a number that have been planned by the veterinary department. While this experiment is in every respect a success, a large number of similar experiments on a larger scale must be made before the real value of the method followed can be ascertained. To aid us in this work, we invite the cooperation of swine breeders all over the state. Correspondence should be addressed to Dr. Paul Fischer, Experiment Station, Manhattan, Kan.

Press Bulletin No. 37.—Farm Department.
May 8, 1899.

Kafir-corn, Alfalfa Hay and Soy-beans for Pork.

In the fall of 1898 the Kansas Experiment Station bought sixty ordinary stock hogs of mixed breeding for the purpose of testing the value for fattening hogs of Kafir-corn alone, Kafir-corn and alfalfa hay, and Kafir-corn and soy-beans. The average weight of the hogs at the beginning of the experiment was 125 pounds, and they were fed sixty-three days. The gains per bushel of feed were as follows:

Kafir-corn meal, dry, and 7.83 pounds alfalfa hay..	10.88 pounds.
Kafir-corn meal, dry, alone	7.48 "
Kafir-corn meal, wet, alone	8.09 "
Kafir-corn, whole, alone	8.56 "
Kafir-corn meal four-fifths, soy-bean meal one-fifth.	12.00 "

This experiment shows a gain in feeding alfalfa hay with Kafir-corn to fattening hogs of 868 pounds of pork per ton of alfalfa hay. Valuing the hay at three dollars per ton and fat hogs at three cents per pound live weight, the Kafir-corn fed alone brought 22.4 cents per bushel, the Kafir-corn fed with alfalfa hay brought 31.4 cents, and the soy-beans 90 cents per bushel. The hay fed was of the best quality, carefully cured, with all the leaves on.

At the conclusion of this experiment, fifty hogs of the same grade, averaging 140 pounds each, were purchased for a second test. The

gains per hog in fifty days, from the different methods of feeding, were as follows:

Kafir-corn, whole, and alfalfa hay	68.5	pounds.
Kafir-corn meal and alfalfa hay	68.6	"
Kafir-corn, whole, alone	45.6	"
Kafir-corn meal alone	44.1	"
Kafir-corn meal four-fifths, soy-bean meal one-fifth	86.8	"

The gains per bushel of grain fed were as follows:

Kafir-corn, whole, and 14.58 pounds alfalfa hay	11.17	pounds.
Kafir-corn meal and 13.4 pounds alfalfa hay	10.86	"
Kafir-corn, whole, alone	8.77	"
Kafir-corn meal alone	8.60	"
Kafir-corn meal four-fifths, soy-bean meal one-fifth	12.95	"

The hogs sold for $3.30 per 100 pounds, live weight, in Manhattan. This experiment showed a gain in feeding alfalfa hay with Kafir-corn meal to fattening hogs of 338 pounds of pork per ton of alfalfa hay. The hay was of poor quality, with many of the leaves gone, and the hogs rejected a large portion. Valuing the hay at three dollars per ton and the hogs at their selling price, $3.30 per 100 pounds, live weight, the Kafir-corn fed alone brought 28.3 cents per bushel, the Kafir-corn fed with alfalfa hay 33.8 cents, and the soy-beans $1.05 per bushel.

The fifty head were shipped to the packers, Swift & Co., St. Joseph, Mo., who valued the different lots at the following prices per 100 pounds, live weight: Kafir-corn and alfalfa-hay lots, $3.67; Kafir-corn and soy-bean meal, $3.70; Kafir-corn alone, $3.65; and Kafir-corn meal alone, $3.60. Swift & Co., slaughtered each lot separately, and make the following report:

Lot 1. Ten hogs fed on alfalfa hay and whole Kafir-corn; live weight, 2060 pounds. This lot dressed 79½ per cent. from live weight, and, when cut out 48 hours after being killed, showed that they were good, firm-fleshed hogs, suitable for light-weight products. There was a good distribution of lean and fat in the bellies, though for firmness the meat was not equal to either lot 2 or lot 5.

Lot 2. Ten hogs fed on alfalfa hay and Kafir-corn meal; live weight, 2060 pounds. This lot dressed 79 per cent. from live weight, and the class of product from this lot is practically the same as from lot 1, distribution of lean and fat being good. The firmness of the fat in this lot was far above any of the others, and the fat had a good white color that is not customary in corn-fed hogs.

Lot 3. Ten hogs on four-fifths Kafir-corn meal, one-fifth soy-bean meal; live weight, 2260 pounds. This lot dressed 80 per cent. from live weight, and the firmness of the fat in this lot is fair, but the cuts contained rather too great a proportion of fat for this weight hog, and for leanness would not compare with either lot 1 or lot 2.

Lot 4. Ten hogs fed on whole Kafir-corn; live weight, 1800 pounds. This lot dressed 80.4 per cent. from live weight, and, while the variations in weight were greater in this lot than in any of the others, it was the most suitable lot for bacon hogs of the five. There were a few hogs out of the ten that would have been suitable for English cuts, on account of the evenness of the fat and good distribution of lean through the bellies.

Lot 5. Ten hogs fed on Kafir-corn meal; live weight, 1790 pounds. This lot dressed 80 per cent. from live weight, and, while the same average weight as lot 4, the hogs were fatter and not so adaptable for fancy bacon as lot 4. Firmness of the fat in this lot was good, but not as good as lot 2, but better than any of the others.

In our estimation, lots 1, 3, and 4, for firmness of the flesh, were no better than regular corn-fed hogs, though it seems to us that corn-fed hogs of this weight would have been fatter. This excepts lot 3, which, as near as we could judge, were about as fat as corn-fed hogs of that weight would run.

Lots 2 and 5 had firmer flesh than would be found in a regular run of corn-fed hogs.

The yield of these lots from live weight was good, and on the last two lots was a little better than we would expect from the average hog.

These experiments, made with 110 hogs, indicate that Kansas farmers should plant soy-beans this spring, and feed soy-beans or carefully cured alfalfa hay with their grain to fattening hogs next fall.

Press Bulletin No. 38.—Chemical Department.
May 12, 1899.

What is a Digestion Experiment?

The animal body requires certain chemical elements to enable it to replace worn-out tissues and perform its various functions. These elements must be presented to it in an available form, however. Soft coal, with its ordinary impurities, and water probably contain all of the elements necessary to the growth of the animal body and for the production of force: but while these answer admirably for a steam-engine, the coal would be of little use to an animal.

Not only are such crude substances as coal unavailable for the nutrition of animals, but an important portion of the recognized foods is equally unavailable. It is indigestible; and only digestible substances can be taken into the animal organism and contribute to its nourishment or upbuilding. It is true that some indigestible

residue is desirable in order that the digestive apparatus may do its work and remain in a healthy condition. We are not, however, likely to obtain foods in any quantity which are too digestible. At present we should be concerned with efforts to obtain the greatest degree of digestibility possible. It is known that young plants are more digestible than more mature ones. The latter afford a greater yield, however. To determine at what stage to cut a fodder crop in order to obtain the greatest amount of digestible organic matter is not easy; in fact, it can be determined only by what is known as digestion experiments. Digestion experiments are thus of high utility.

Digestion experiments not only teach us at what stage to cut crops to the best advantage, but they teach us the relative nutritive value of different feeds. A cheap substance is not always economical, as it may be of low digestibility; and a feed somewhat higher in price may really be more economical, if it can be utilized to a greater extent. A knowledge of the digestibility of feeds is also required in the calculation of rations. Balanced rations are essential to the most advantageous production of muscle, fat, or force; but in making this balance between the nitrogenous and the non-nitrogenous constituents we must consider only the digestible portions. To supply this information as to the part of a given feed or ration that is digested by an animal, is the object of digestion experiments. The Experiment Station at the Agricultural College has been doing such work in this line as the resources of its chemical department will permit, and some of the results will soon be published.

A digestion experiment is performed, in brief, by feeding a known amount of feed that has been carefully analyzed, and at the same time collecting the excretions from the intestines, ascertaining their amount, and analyzing them. As the undigested residues of food are not excreted until some time after they were eaten, it will be seen that it is not possible, in the case of ruminants, to collect the residue from the identical portions of feed fed. To obviate this difficulty, the same ration, in quantity and composition, is fed for some days previous to the beginning of the period of the actual test. The dung collected during the actual test will then be the product of feed that is the same as that taken during the collection. A source of error then will be the probability that the intestines will not be evacuated to exactly the same extent at the end of the test as they were at the beginning, To reduce this error to a minimum, it is desirable that the experiment be continued over several days, that any difference in the intestinal contents may be distributed over the amounts for a number of days, rather than applied to one only.

From the amount and composition of the dung and the feed corresponding to it, the digestibility of each nutritive principle of the feed is calculated. Some of our typical Western feeds, such as our prairie hay, Kafir-corn, and sorghum, have not been worked on to any great extent, and it is hoped that the Station may be able to do some good work in this line.

Press Bulletin No. 39.—Farm Department.
May 22, 1899.

Skim-milk Calves.

Allow the calf with the fresh cow four or five days. This gives the calf a vigorous start and aids in reducing any inflammation in the udder of the cow. Wean by feeding ten pounds (one quart equals about two pounds) whole milk daily in three feeds, and gradually increase the amount to twelve or fourteen pounds, always weighing or measuring each feed. More calves are lost by overfeeding than for any other reason. When two weeks old the calf may be changed to skim milk, but not faster than a pound a day — i. e., the first day give eleven pounds of whole milk and one pound of skim milk; the second day, ten pounds whole milk, two pounds skim milk; and so on until the change is complete. The amount of skim milk may be increased gradually, but not to exceed eighteen to twenty pounds daily per head. Flaxseed gruel may be added to replace the butter-fat. This is made by mixing ground flaxseed in cold water, adding boiling water, and allowing to steam a few hours with cover on the pail. A teaspoonful of this gruel is enough at first, but this may be increased gradually to one-half pound of the meal daily per head. Flaxseed is better than linseed-meal, since the oil is needed to replace the butter-fat. Blachford's meal is an excellent calf feed, and may be used the same as flaxseed. The College recently started an experiment with calves, feeding part on fresh skim milk from the hand separator and part on sterilized creamery skim milk, and at the same time is testing the value of flaxseed meal and Blachford's meal for calves against skim milk alone. All the calves are allowed what Kafir-corn meal, hay and green alfalfa they will eat. The results are being watched with great interest.

Calf milk must always be fed blood warm (95 to 100 degrees F.), and a careful feeder will occasionally test the temperature with a thermometer. Skim milk not used when separated may be cooled and rewarmed when fed. Sterilizing creamery skim milk greatly increases its value for calves by enabling the farmer to keep it sweet until the following morning. At the College we keep sterilized creamery skim

milk sweet from Saturday until Monday morning by cooling to between fifty-six and sixty degrees F., the temperature of well-water. Sweet milk at one meal and sour at the next causes scours, and seriously checks the growth of the calf. Sterilizing skim milk has an additional advantage in that the heating helps to prevent scours.

Calves will begin to eat meal when ten days to two weeks old. Put a little in their mouths after feeding the milk, and they will soon eat from the feed boxes with a relish. Never mix the grain with the milk. We find Kafir-corn meal an excellent grain for calves. It is constipating and checks the tendency to scours. Our calves that average eight weeks of age consume two pounds daily per head. As the calves grow older and eat more grain the Kafir-corn may be mixed with oats, bran, or oil-meal.

Calves will nibble at hay about the time they begin to eat grain. Mixed or prairie hay is good; alfalfa or clover is better. Our calves have been eating about one pound daily per head of mixed hay. Before turning on pasture in the spring it is well to feed some green feed, which may be increased gradually until calves get all they will eat. A sudden change to pasture is apt to produce scours.

Calves can be prevented from sucking each other's ears and mouths by leaving them tied separately for half an hour after feeding. Calf buckets may be kept clean by rinsing and scalding after using. Calves need clean fresh water and salt. We find the Dewey hog waterer an excellent device for watering calves. The water is always clean and fresh. Our calves drink between seven and eight pounds daily per head.

To summarize, warm, sweet milk, fed in clean buckets, supplemented with a little ground flaxseed or Blachford's meal, with access to corn- or Kafir-corn meal, bright hay, fresh, clean water, salt, plenty of sunlight, shelter and bedding in cold weather, shade in summer, and regularity and kindness in treatment, will usually insure good, thrifty calves that will gain from one and one-half to two pounds daily.

Press Bulletin No. 40.—Department of Horticulture and Entomology. May 27, 1899.

Orchard Cultivation.

There is no longer any question as to whether the orchard should be cultivated. Experience everywhere shows that cultivated orchards live longer, bear better and are more profitable than uncultivated orchards. Many of the experiment stations of the best fruit-producing states have tried uncultivated orchards beside those that were culti-

vated, and have collected opinions of the most observant fruit-growers of their sections; and the considerate verdict in almost every case is that cultivation is necessary for healthy trees and first-class fruit. The principal orchardists of the state have expressed themselves on orchard cultivation. Out of 272 reports made to the secretary of the State Horticultural Society, 130 advocate thorough cultivation till bearing time and 130 urge continuous cultivation as long as it is possible to enter between the rows with horse and implement. Most of those advocating cultivation till bearing time only live in the lower Kansas river district, where the soil is very rich, deep and moist and will produce fine crops of clover. The general practice in this district is to cultivate well till the trees are in full bearing and then seed to clover. West of Manhattan clover does not succeed. Even if it should succeed it would not be profitable to sow it, from the fact that all the moisture that falls in this region is required by the fruit-trees, and any crop whatsoever simply robs them of the moisture they should have. For this region, then, clean and steady cultivation ought to be the rule for at least that part of the year including the dry season.

However, bare soil soon loses its humus and becomes infertile. This must be prevented. Here is one way of preventing it: Plow the orchard in the spring, cultivate both ways and keep all weeds down till September 1, at which time the soil will be in fine condition for a seed-bed. Sow rye, at the rate of two bushels per acre. This will cover the ground well before winter, and therefore protect the ground from blowing or hard freezing during the winter. Let the rye stand till knee-high in the spring, then turn under, and proceed with clean cultivation through the summer.

Deep cultivation is not essential nor advisable, but the cultivation should be frequent. Go over the ground after every rain, if possible, with the disk or the harrow to break the crust. This will give a mulch of loose earth two inches deep, which will greatly retard evaporation, and therefore conserve the moisture for the use of the trees. This system of management has the following advantages:

1. It provides the soil with a good supply of organic matter (humus), which will keep it in good physical condition, as well as prevent washing and blowing.

2. It provides a cover for the ground during winter, thus preventing the soil from blowing; it catches the snow, thereby moderating the temperature of the soil.

3. It provides for clean cultivation during the summer—the time when all the moisture that falls should be conserved for the use of the trees.

4. By ceasing cultivation and introducing a crop September 1, the trees are helped to ripen off their wood and prepare for winter.

These advantages are worthy of the consideration of the orchardist. The plan has worked well in the orchards of this department, and it will, without doubt, operate as successfully in many other regions of the state.

It is a matter of grave doubt as to whether there is anything gained in the long run by cropping the land that has been planted to fruit-trees. Of course it pays while the crops are being gathered, but does it pay to have the orchard come into bearing on soil reduced in fertility? Will not the orchard during its bearing period have need of all the food elements that the soil contained at the start? Will not the productiveness of the orchard be reduced in the same proportion as the elements of fertility have been removed by previous crops? This will certainly be the case unless the removed elements are restored by means of fertilizers. Ground that supports an apple orchard for thirty successive years has no food to spare for corn crops. Either cling to the orchard and forego the corn crop, or else depend upon the corn and abandon the orchard.

It is now the latter part of May. The soil is moist, and good growing conditions prevail all over the state. It is nip and tuck between crop and weeds on every side. With the farmer in the garden or the corn-field, the weeds grow apace in the orchard, and often predominate. Once in control they soon fully possess the situation; and, as dry weather prevails later on, they will consume the water in the soil and leave none for the trees, which thereby starve for the time being. The only remedy is prevention. Do not allow the weeds to grow.

Press Bulletin No. 41.—Chemical Department.
June 13, 1899.

A Digestion Experiment with Alfalfa Hay.

The chemical department of the Kansas Experiment Station has just completed the analyses upon one of a series of digestion experiments with alfalfa. In this experiment hay was used which was cut when in full bloom and was fed to a three-year-old grade Hereford steer. The results of the analyses show that the air-dry hay contained digestible nutrients as follows: Crude protein, 10.43 per cent. (consisting of albuminoids, 7.86 per cent., amids, 2.57 per cent.); fat, 0.69 per cent.; crude fiber, 15.99 per cent.; carbohydrates, 28.18 per cent.; total digestible nutrients, 55.29 per cent. Let us compare these last figures with those representing the total digestible nutrients

contained in some of our most common feeds used for dry roughage. Millet contains 57.6 per cent.; oat hay, 52.2 per cent.; orchard-grass hay, 48.2 per cent.; timothy hay, 48 per cent.; prairie hay, 46.7 per cent.; sorghum hay, 44.2 per cent.; red clover hay, 43.9 per cent.; oat straw, 43.9 per cent.; wheat straw, 39.2 per cent.; and corn-fodder, 35.8 per cent. We find that only one of the ten feeds named is equal to or exceeds alfalfa in its total content of digestible nutrients, while the larger part of them are far below it. This is not a fair measure of its feeding value, however, unless we also take into account the composition of these nutrients. As a rule it costs much more to produce feeds rich in protein than it does those rich in carbohydrates, and, consequently, of two feeds containing an equal amount of digestible nutrients, the one containing the most protein is the most valuable. Comparing alfalfa in this respect with the above-named feeds, we find that it ranks far ahead of the richest of them. One hundred pounds of alfalfa hay contains 11.3 pounds more digestible matter than the same amount of red clover hay and 1½ times as much protein. It contains only 2.3 pounds less of total digestible nutrients than the same amount of millet hay, and almost 2½ times as much digestible protein. It contains 2½ times as much digestible protein as oat hay; 3 times as much as prairie hay; more than 4 times as much as sorghum hay; 5 times as much as corn-fodder; 6½ times as much as oat straw, and 13 times as much as wheat straw.

In feeding value, alfalfa hay not only ranks high above all other feeds used for roughage, but it is well up among the more concentrated feeds. One hundred pounds of it contains 3.3 pounds more of total digestible nutrients than wheat bran, and almost as much protein. It is richer in digestible protein than wheat, corn, oats, rye, barley, Kafir-corn, or sorghum seed.

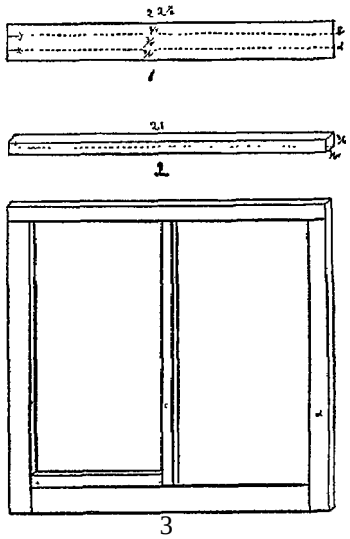
Its digestible nutrients have a nutritive ratio of 1 to 4.4. There are only a few feeds, such as wheat bran, linseed-meal, cottonseed-meal, and soy-beans, that furnish as narrow a nutritive ratio as this. Alfalfa hay, therefore, is an ideal feed to use in balanced rations, and is especially valuable to combine with corn as a ration for fattening steers, since it furnishes all the roughage necessary, and is also a cheap source of protein. It is an ideal dairy feed, furnishing almost the exact nutritive ratio required for the highest yields of milk. Its value as a feed for hogs has been shown in results previously published by this Station.

Press Bulletin No. 42.— Entomological Department.
June 20, 1899.

To Rid the House of Flies.

There is no class of insects more annoying to our personal comfort than the various flies which frequent our houses, offices, creameries, etc. How to get rid of them is often a puzzling question. The department of entomology, after experimenting upon various mechanical devices for catching flies, has contrived a trap, and recommends it for trial on account of its effectiveness and cheapness. Anybody with an average amount of mechanical ingenuity can make and attach the trap, with the cost of but a few cents. It is made as follows:

Take a flat strip of tin two and one-fourth inches wide and one and one-half inches longer than the distance between the side rail or stile and middle rail of the sash, as from *c* to *d*, fig. 3, which in this case measured twenty-one inches. For this window, the strip must be 22½ inches in length. With the tin lying on a flat surface, bend the tin along the lines *ab* and *cd*, fig. 1, which are three-quarters of an inch from their respective sides, so that the space *abdc* forms the bottom of a box and the lateral parts the sides. To close the ends, cut small incisions three-quarters of an inch deep at the points *a*, *b*, *c*, and *d*, as *ay* and *cx*, fig. 1. Bend the flaps thus made at right angles to their respective parts. We then have a box twenty-one inches long, three-quarters of an inch wide, and three-quarters of an inch deep, as at fig. 2. To make the box water-tight, solder the joints, or if solder is not handy try moistened plaster of Paris. When properly made, the box should fit snugly between the middle and side rail or style. The corners should be square and the edges straight, so as to leave no passageways between the box and the glass. The box should rest on top of the bottom rail, and can be held in place by two or three tacks or pins thrust into the rail from the back side. When the pane is very large it is well to attach another trap half way between the top and the bottom.



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After the traps have been attached, some substance should be put into them that will either kill the insect upon falling into it, or, on

account of its sticky nature, will hold the insect so that it cannot escape. For the first, kerosene, kerosene emulsion, soap-suds and pyrethrum are the best; and for the second, molasses, or a mixture of castor-oil and resin. For general use, the soap-suds are to be recommended. *When using the liquids, fill the traps two-thirds full.*

Kerosene is most fatal to the flies, but should be used with care, as it is very liable to soil the sash. In using it, fill the trap half full of water, and then add enough kerosene to form a film.

Kerosene emulsion is made as follows: Two quarts of kerosene, two pints of water, one-fourth pound of soap. Dissolve the soap in boiling water; while the suds are still boiling hot, add the kerosene, and churn the mixture for a few minutes till it becomes a butter-like mass. Dilute the emulsion from five to six times with water before filling the traps.

Soap-suds. Make strong suds from the ordinary common washing soap. This is very easy to prepare and very effective.

Pyrethrum is an insect-powder which can be purchased from druggists. Do not buy that which is stale or adulterated. When fresh and pure, it is very effective when mixed with two times its bulk of flour. The mixture should be kept in an air-tight can twenty-four hours before using. Take enough to form a good layer in the bottom of the trap. It acts very rapidly upon flies.

Molasses. Enough cheap molasses or sorghum should be used to form a thick layer in the bottom of the trap.

Castor-oil and resin. Take three parts of powdered resin to two part of castor-oil. Mix them together, and boil till the resin dissolves. If too thick, add more castor-oil.

There should be one trap for every pane of glass of at least one window in the house. For instance, when the sash contains two panes of glass, as in the cut, there should be two traps, one at the base of each pane. When the sash contains four panes, there should be four traps, two on the bottom rail, and two on the cross-bars or munting. It is not necessary to apply traps to all the windows. Attach traps to one or two windows in the sunny part of the house, and pull down the blinds of the remaining windows. The flies will seek the lighted rooms, and especially the windows.

When the traps are full of flies, remove them from their fastenings, empty out their contents, and fill them with fresh material.

A temporary trap can be made of flexible cardboard, following the same directions as for those made of tin. Use glue or pins to fasten the ends. To render the trap water-proof, paint the inside with melted paraffin. This will hold any of the above remedies except the pure kerosene.

PERCY J. PARROTT.

Press Bulletin No. 43.—Botanical Department.
June 17, 1899.

Selection of Seed Wheat.

It is common among corn raisers to maintain or improve a given variety by selection of ther seed. Ears showing desirable characters are set aside and furnish seed for the succeeding crop. Thought not so convenient, this method can be applied with equal success to the selection of seed wheat. The Experiment Station of the Kansas State Agricultural College is endeavoring to breed up improved varieties of wheat. There is no reason why the simple method of selection should not be applied by the individual wheat raiser. We would advise the following procedure: Before harvesting, the grower should go into the wheat-field and select a number of the most desirable heads. The basis of selection depends upon the wishes of the individual, but is carried on as in the case of corn. Usually it will be upon the basis of yield and quality. In this case, the heads selected should be large, well formed, and with plump, uniform grains. The grain derived from these heads should be grown upon a plat of ground under the most favorable conditions. The grain gathered from this plat furnishes the seed for the third year, But, before harvesting, a selection of suitable heads should be made from this for the next seed-plat. In this way the seed is each year improved or at least maintained at its present standard. The size of the seed-plat depends upon the total area of wheat to be grown. Furthermore, the seed-plat may be given much more careful treatment than is applicable to the field. It is best to have the seed-plat within the main field, so as to be entirely surrounded by wheat. This lessens the loss from grasshoppers and other insects, and gives the plants better protection.

A Request.— The Experiment Station of the Kansas State Agricultural College wishes to develop improved varieties of wheat, and desires, where possible, to base the development upon varieties already found suited to Kansas conditions. For this purpose we desire samples of wheat from various localities in the state. We would, therefore, request those interested in this work to send us samples for trial. We prefer to have the samples selected from the field just before harvest. A few heads will be sufficient, and can be sent by mail. The heads should be carefully selected, and enclosed in such a way that the grains will not escape. It would be desirable if each head could be wrapped separately. At the same time the person should send us some information concerning the variety, especially the following: Date of gathering; name of variety; history so far as known (where obtained, and how long grown on owner's farm); date

of sowing (at least approximately); characters which recommend it (stooling, resistance to winter, drought, chinch-bugs, or rust, uniformity of growth, etc.); characters which are unfavorable. These notes should not be enclosed with the samples, unless letter postage is paid. Address Botanical Department, Experiment Station, Manhattan, Kan.

Press Bulletin No. 44.—Department of Horticulture and Entomology. June 17, 1899.

The Profitable Strawberry Bed.

The strawberry is one of the most profitable crops ever introduced on Kansas soil. The mention of a case or two will make the truth of the statement more impressive. Last spring a gentleman set in his garden, in Manhattan, 1025 strawberry plants, of the following varieties: Warfield, Parker Earle, Robinson, Beder Wood, and Bisel. The plants grew in matted rows and covered one-fourth of an acre. The plants grew well, the ground was cultivated frequently, and during the winter a mulch of clean straw was kept on the bed. The yield to to this date has been 2460 boxes, and will reach 3000 boxes by the time the crop has ended, The setting of the plants, the cultivation and the picking have mostly been done by the family, so that the only outlay was for the plants and berry crates and boxes. The first 400 boxes sold at twelve and one-half cents per box, the remainder at ten cents. The following is the record:

RECEIPTS.		EXPENSES.	
400 boxes berries at 124 cents . .	$50 00	Cost of plants	$3 00
2600 boxes berries at 10 cents . .	260 00	Crates and boxes.	9 00
Total receipts..	$310 00	Commission.	54 00
	66 00	Total expenses	$66 00
Gain	$244 00		

The pickers who were hired were paid at the rate of one cent per box. Estimating at this rate for the whole crop, and allowing $15 for labor of setting the plants, cultivating and mulching the bed, we still have left $199 for the quarter-acre, or a very handsome rate of $796 per acre. No irrigation was employed.

The other case is as follows: The bed covers one-sixth of an acre, Two-thirds of the bed is two years old and is bearing its second crop; one-third is one year old and is bearing the first crop. The plants have had good attention. They were cultivated well during the summer, irrigated when necessary, and mulched during the winter. The following varieties compose the bed: Schuster's Gem, Barton's Eclipse, Cumberland, Chas. Downing, Warfield, and Parker Earle.

The plants were raised by the owner, who also did most of the labor of cultivating and picking. The following statement gives a record for this year:

RECEIPTS.		EXPENSES.	
635 boxes at 12½ cents	$79 37	Cost of crates and boxes	$3 00
829 boxes at 10 cents	82 90	Cost of water	5 00
Plants sold from bed	24 50	Cost of cultivation	11 50
Total receipts	$186 77	Labor in picking	15 00
	52 70	Commission	18 20
Net profit	$134 07	Total expenses	$52 70

Rate of net profit per acre, $804.42.

The soil upon which these crops grew is a rich, deep, black loam, well suited to strawberries, but not better for the purpose than thousands of acres in other sections of the state. The fruit was all sold upon the local market, and, being of excellent quality, was but little affected by imported berries, which sold regularly at from one to two cents per box lower than home-grown berries.

Almost any portion of the state will produce berries of excellent quality, providing water can be supplied artificially, and there is no part of the state but what will now and then require irrigation for the best results in strawberry growing. Speaking generally, the most favorable location for strawberries for the local market is right in the city, on vacant lots, where the city water-works provide sufficient water for irrigation of small tracts. Besides having a water-supply, the berries are near the market and the cost of delivery is small.

Intensive culture is the only profitable method of culture in strawberry growing. Try the recommended varieties until you have found the best, and then discard all but three or four. Give the ground thorough preparation and have the soil rich. Use good, strong plants in setting the bed, and after that cultivate well, and water when the plants indicate the necessity of it. During winter, cover the whole bed with a mulch of clean straw. In the spring this can be mostly removed from the plants and placed between the rows. On the whole, the best success comes from setting a new bed each year. Old beds can be renewed, but the labor required is often greater than that required to set the new bed, while the greater profit nearly always comes from the new bed.

Press Bulletin No. 45—Chemical Department.
June 27, 1899.

Early Plowing and Moisture Conservation.

The chemical department of the Kansas Experiment Station has just finished a bulletin embodying the results obtained during the last two years in studies upon soil moisture. It is issued as No. 89, and will be sent to all applicants as long as the supply permits. Among the most timely experiments there detailed are some showing the relative amount of water in soils which were plowed soon after harvest, and in the same plowed at a later date.

Scarcely a summer passes without a drought sufficiently prolonged to dry stubble ground during July and August to such a degree that it cannot be put in good condition for wheat seeding if the plowing is left until the latter month. The disadvantage of this postponement of plowing consists not only in the greater labor of plowing, and in the hard, cloddy condition in which it turns up, but the loss of moisture at this important season of the year is of very great moment. Soil turned at the proper time breaks completely into a mass of small particles which do not touch each other with sufficient closeness to enable water to pass up readily by capillary attraction and so become lost by surface evaporation, while at the same time it does not lie up so loose as to allow the wind to pass through it, and thus dry it out. The disk harrow, while less effective than the plow in fitting ground to resist drought, is very useful in this capacity, especially if time is lacking and drought threatening.

The Kansas Station last year disked one strip of land June 27, plowed an adjacent one July 7, and another was left until August 23 without treatment, when it was plowed. During the first week after the disking the disked plat showed a great advantage over the untreated plats, but a heavy rain July 3 caused the loosened soil to run together to a considerable extent, and then the advantage of the disked plat over the untreated was less. On August 23, when the late plowing was done, notwithstanding a number of light rains, the untreated plat was reduced to 14.1 per cent. of water, and the disked plat had but 15.6 per cent., and were thus too dry to plow well or to furnish a good seed-bed for wheat. The early-plowed plat contained 20.9 per cent. of water and was in excellent condition. The plat plowed at this date was put in a condition that enabled it to retain its moisture as well as the disked plat.

From September 10 to September 16 over two and one-half inches of rain fell. This settled the ground closely on the early-plowed and the disked plats, they having had other rains on them also, while the

late plowing was less affected. From this time on, the late-plowed plat showed an advantage over the others in holding moisture, they being about equal in that respect. Had the early-plowed plat been harrowed immediately after the rains, about the middle of September, or had the surface been stirred incidentally in drilling in wheat, it would undoubtedly have held its moisture as well as before.

The bulletin includes an account of an experiment showing the relative efficiency of soil mulch and straw mulch, and also of an extended series of observations on the effect of fertilizers on the loss of water from soils by evaporation, and by evaporation and drainage.

Press Bulletin No. 46.—Farm Department.
September 25, 1899.

Soy-beans.

There are a number of varieties of soy-beans, but the Early Yellow soy has proved the best. They are erect growing, with from one to six or more stems branching out from near the ground, and reaching a height of from 1½ to 3½ feet, seldom falling down, except in very rich, loose land. The branches are thickly studded with pods from the surface of the ground to the top; a single plant having sometimes as many as 200 pods, containing from one to four beans, the usual number being three. The soy-bean is a remarkable drought-resister, and will do remarkably well on thin land, However, they respond readily to plenty of moisture and good soil. Being a legume, if the bacteria which produce the tubercles on the roots are present in the soil, they leave the land richer in nitrogen, the same as clover does. The land may be inoculated by getting earth from a field that has the bacteria in the soil and planting it in the rows with the beans. We used a fertilizer attachment to a hose drill this year with good success. Planting should not be done until the weather is warm—after corn planting. They will make a fair crop after rye or wheat, if the season is favorable. The ground should be well prepared, and the beans planted near the surface. We plowed the ground last spring, going over what we plowed each day with Campbell's subsurface packer, and planted the beans immediately, with a press drill, stopping holes so as to plant in rows thirty inches apart, and from one to two inches in the row. This required thirty pounds (one-half bushel) to the acre.

They may be cultivated as other crops; keeping the soil in good shape and the weeds down is all that is required. We used the spring-tooth cultivator, except in a few places where the weeds obtained a start on account of the wet weather. The crop can be

handled so that it will not be necessary to use the hoe at all. Land that has been lately manured is liable to give trouble, as it is usually weedy.

Until this year, the harvesting has been the great problem, but we found that there are machines manufactured for the purpose, and have tried several of them and found them to be successful; so the harvesting no longer stands in the way. The Yellow soy does not shell readily, and so can be let stand until well ripened. We began harvesting when most of the pods had turned brown and a few of the top leaves were sticking on. The bean harvester has large knives which cut the stems just under the ground, cutting two rows at a time and throwing them together in a windrow. An ordinary one-horse hay-rake will take two of these windrows at a time, and the horse walks between them. We raked and shocked immediately after the harvester, and left them to cure in the shock. Thrashing was done in the field with an ordinary separator, using all blank concave and running no faster than necessary to keep the machine from clogging in the shakers and riddles, so as not to crack the beans.

The following is the cost of production on the College farm this year. The work was conducted as nearly as possible on a commercial basis, the object being to find what could be done on a large scale. The sixty acres from which the following is taken comprises several fields, which vary widely in many respects from good land to very poor; on the whole, perhaps, below the average of farm land. Labor is computed at $1.25 per day for a man and $2.50 per day for a man and team. The cost per acre for the various items was as follows: Preparation of land, $1.35; planting, 30 cents; cultivating, $2; hoeing, 70 cents, which was confined to a few patches; harvesting, $1.40. The harvesting is considerably above what it will be when the regular harvester is used, but we did not receive the harvesters in time to begin, and the old method is much more expensive,

The thrashing required four teams and six men, besides the machine force, which was hired at fifteen dollars per day, board and coal not included. The total expense for thrashing the sixty acres, which took 4½ days, aside from cost of coal, was $155.25. The yield of the sixty acres was 932 bushels, making the cost of thrashing 16 6/10 cents per bushel. The sixty acres of beans averaged 15½ bushels per acre, making the cost of production fifty-five cents per bushel, or about $8.40 per acre.

Soy-beans as a feed take the place of oil- or gluten-meal, and in composition are richer than oil-meal. In feeding them to milch cows, fattening cows, and hogs, they have given astonishing results. In two experiments carried on last winter in feeding hogs, the addi-

tion of one-fifth soy-bean meal to Kafir-corn gave practically double the returns from Kafir alone. The ten hogs fed Kafir meal alone, during a period of fifty days, ate 2872½ pounds, and gained 441 pounds; the ten fed Kafir meal four-fifths and soy-bean meal one-fifth ate 3766 pounds of the mixture, gained 866 pounds, and sold for ten cents more on the hundred than the other lot.

When the beans are let thoroughly ripen in the field the straw is worthless, but if cut and cured while green makes excellent hay. They make excellent hog pasture and are a good crop for soiling.

Press Bulletin No. 47.—Botanical Department.
October 24, 1899.

Awnless Brome-grass.

The Experiment Station of the Kansas Agricultural College has received numerous inquiries from various localities in the state as to the value of Awnless brome-grass as a forage grass. This grass is receiving so much notice in the agricultural press that a short account of it is here given for the benefit of our readers.

Awnless brome-grass, or Hungarian brome-grass (Bromus inermis), is a native of the dry, sandy regions of Europe and western Asia. It is a perennial, about the size and somewhat the general appearance of Meadow fescue or English blue-grass. It spreads by creeping underground stems or rootstock. It has been tested by many of the experiment stations, from Canada and North Carolina to Mississippi and California. All recommend it highly for dry, sterile, light or sandy soil. It will not succeed well on wet land, but is one of the best grasses for resisting drought. Its chief value is for permanent pasture, though at many of the stations it has yielded a good crop of hay. In the South it is sown in the fall for winter pasture, but in the North it is sown in the spring. This Experiment Station now has in progress an experiment testing the relative merits of spring and fall sowing at Manhattan. At present we are unable to state positively the value of brome-grass for pasture in eastern Kansas, but, from the experience in surrounding states, we can recommend it for trial. The Garden City grass station reported very favorably upon it when tried there a few years ago. At a future time we will give the results of our trials, and we should be pleased to have our correspondents inform us as to the results of their own trials.

Much of the seed upon the market at present is imported from Europe and has not proven as satisfactory as that grown in this country, as it is not so pure; but home-grown seed is not now available

for general use. With good seed, the amount sufficient to sow an acre is from fifteen to twenty pounds. It frequently happens that an apparently poor stand allows the weeds to flourish the first year, but that nevertheless the second year's growth is favorable. For this reason, judgment should not be passed upon the success of the trial until the second season. Ordinarily it is not best to pasture the grass the first season. A weedy field should be mowed in the summer.

(See, also, Press Bulletin No. 63, this pamphlet, dated March 6, 1900.)

Press Bulletin No. 48.—October 31, 1899.

The Kansas Experiment Station.

There is a great lack of knowledge of the Kansas Agricultural Experiment Station. Many farmers have scarcely heard of it; others who have heard of it do not know that its bulletins may be had for the asking by any farmer in Kansas. The Station is a department of the Kansas State Agricultural College. Its expenses are met by an annual appropriation by congress, made in accordance with the provisions of what is known as the Hatch act. Fifteen thousand dollars per annum in quarterly payments are sent directly to the College treasurer. Only five per cent. of this may be used for buildings, and at the Kansas Station very little has been so used. The balance is used for salaries of the staff, apparatus, materials, labor, and publication of results.

The experiments undertaken at the Station are, in part, of a kind that yield immediate returns, and, in part, of a kind that must be continued for a series of years before results are manifest. Much attention has been given to feeding, and the results of this work, if intelligently interpreted, cannot but be of great value to the stock interests of the state. Much work has been done in the way of testing new plants and new varieties of old plants; in studying the insect enemies of crop and orchards; in investigation of fungous diseases of crops and their prevention, and in veterinary problems. Space does not permit even an enumeration of the subjects that have been treated more or less exhaustively at the Station. All parts of the work are not equally interesting or valuable to all. Bulletins which to some would seem worthless and the result of misplaced energy are in active demand by others.

Thus far the Station has issued eighty-nine of its regular bulletins, covering a wide range of topics. Many of these can still be supplied. Last year it began the issue of press bulletins, which, as a rule, are long enough to make about one page of an ordinary bulletin. These

bulletins are usually sent only to periodicals, but a number of them were sent to the entire mailing list. The object in issuing these press bulletins is to furnish to the press of the state authentic statements of work in progress at the Station, in the hope that much of it may be reprinted in the periodicals of the state. Forty-seven have been issued previously to this one.

The Station desires to be as useful as possible to the people of the state. It wants the farmers to have the benefit of its results, and invites correspondence concerning agricultural topics. It would like to know what problems are especially interesting the farmers at any time, and will do all that it can to solve them.

Farmers not now receiving the bulletins can have them free of charge. Farmers now receiving them are invited to send in the names of others who are likely to value them. Requests for publications and all general correspondence should be addressed, Agricultural Experiment Station, Manhattan, Kan. Inquiries upon special topics may be addressed in the same way, or to the department in charge of such work.

NOTE.—The following letter preceded the above press bulletin as issued:

DEAR EDITOR— By act of congress, the bulletins of the agricultural experiment stations must be sent to the newspapers of the states in which the stations are located, respectively. This is a recognition of their power to give currency to the results of experimentation. In view of the general lack of knowledge on the subject, will you not give a place in your columns to the accompanying press bulletin, or a part of it, or to an article of your own embodying at least an announcement that the Station bulletins are sent free to all Kansas farmers requesting them? Respectfully, J. T. WILLARD, *Chairman of Station Council.*

Press Bulletin No. 49.—Entomological Department.
November 7, 1899.

A Horn-fly Trap Experiment.

How to furnish better protection to our dairy herds and cattle against the attacks of the horn-fly is a question of growing importance in this state. The losses from the decrease of butter-fat and flesh through the attacks of this pest certainly demand that some sort of relief be furnished to our stock. During the past year, the Kansas Experiment Station has carried on a series of experiments with this object in view. Among the many measures employed, considerable time was spent in trying to construct a "trap" which would catch and kill the flies, and not merely repel them, as is often the case with so many of the "horn-fly mixtures."

The general plan of our trap was to pass the cattle through a dark space or room. At the center of the room, in the roof, was a glass cupola, the sides of which were composed of four window-sashes, with a large of glass for a roof. All the joints were made tight, so as to leave no openings through which the flies could make their escape.

A few feet from the entrance and exit doors of the rooms were roofed screens, allowing the cattle to pass in and out, but cutting off the direct light from the outside, thus making the space immediately below the cupola extremely light as compared with the rest of the room. As the animal passes under the cupola it enters through the exit doorway, which is lined with a series of brushes, sweeping all parts of the body. The flies, being disturbed and brushed off, would, it was hoped, be attracted by the greatest light, and would therefore swarm up into the cupola.

To catch the flies in the cupola, small tin troughs containing kerosene were attached firmly to the base of each pane of glass. The troughs were one inch deep, one inch wide, and of the length of the distance from side-rail to side-rail of the window-sash. The flies, in dancing up and down the window-panes, will at some time or other strike the bottom rail of the sash, but when troughs are attached they will, instead, fall into them and be destroyed by the kerosene.

By this style of horn-fly trap we were able to kill but about one fly out of twenty upon the cattle. After passing fifteen cows through several times in succession, only 300 flies were caught in the troughs of kerosene. Quite often the troughs would be nearly filled with other species of flies, where only one horn-fly would be captured.

This style of trap, however plausible it may seem, was certainly not a success. It was never possible to get all the flies to remain on the cows till the brushes were reached. Invariably, after the cows had entered the room for two or three feet the flies would suddenly rise up and pass out at the entrance doorway. They did not seem to like to enter the dark room. By equalizing the light a little in the room with that on the outside, a trifle larger percentage of flies was secured. But if too much light was admitted from the doorways the light in the cupola was not sufficient to attract the flies, but, instead, the flies upon being brushed off, would follow after the cattle, and again renew their attacks.

Press Bulletin No. 50.—Veterinary Department.
November 14, 1899.

Infectious Abortion in Cattle.

The term "abortion" means the expulsion of the offspring before it can live outside of the womb. The expulsion of the offspring after it is capable of an independent existence and before the full time of pregnancy is up is called premature parturition.

Isolated cases of abortion occur here and there, and their causes are almost as numerous as the cases of abortion. Injuries, catching

cold, general disease, improper diet, certain drugs, excessive inbreeding, etc., may be mentioned as prominent causes.

Sometimes abortion occurs in dairy herds in the manner of a plague; many or all animals in a stable may be affected, and none of the above class of causes can be observed to have acted. This is infectious abortion, and is caused by a specific organism or group of organisms. The disease is transmitted from animal to animal by direct contact. The genital organs of the male or female, walls, posts, bedding, or any other object which is in easy reach and is likely to come in contact with these regions, may act as carriers of the contagion and thus aid in spreading the disease.

Symptoms. —Since we cannot hope to check the progress of a case of contagious abortion, once infection having taken place, the premonitory symptoms will not be mentioned.

The symptoms of the act of abortion are plain enough in most cases not to need discussion. During the first three months of pregnancy, however, the abortion may take place and never be suspected if the small foetus is not found. Soiling of the tail with mucus, blood, etc., will then indicate what has taken place. Sometimes the udder becomes tense, and frequently milk is secreted.

Treatment.— The best treatment, which unfortunately cannot always be resorted to, consists in the complete separation of all pregnant animals from the rest. Immediately after delivery (whether normal parturition or abortion) remove the afterbirth and burn it. Burn all the litter with which it or any of the fluids have come in contact. Disinfect the animal's stall with five-per-cent. solutions of carbolic acid, and irrigate the vagina and uterus with a one-per-cent. solution of creolin twice daily until all unnatural discharges cease.

For irrigation, use a large funnel to which is attached a one-half inch rubber tube five feet long, and with a smooth, hard-rubber nozzle six to eight inches long at its end. Fill the funnel and tube with the liquid, insert the nozzle, and regulate the pressure of the liquid by raising or lowering the tube.

In addition to this, wash the region of the external genital organs of all pregnant cows every day with a three- to five-per-cent. solution of carbolic acid or a *one-tenth-of-one-per-cent.* solution of bichloride of mercury. Disinfect the entire stable twice a week with a similar solution. Internal applications of thirty drops of carbolic acid dissolved in a pint of water and given as a drench every other day to pregnant animals is recommended as successful in some cases.

Finally, burn all suspicious manure, avoid contact with infected animals, and breed to males from herds known to be free from the disease; but never breed to such a male without previously disinfect-

ing the genital organs of the female by injecting gently into the vagina a few quarts of a one-per-cent. solution of creolin. By following these directions minutely, we can hope to control the disease in the course of a year.

If aborting cows are not of special value as milkers, or for other purposes, fatten them for beef.

Press Bulletin No. 51.—Farm Department.
November 28, 1899.

Alfalfa in Eastern Kansas.

Alfalfa is essential to the cheapest production in Kansas of beef, pork, milk, and the rapid growth of young animals. Alfalfa is our best soil enricher, bringing up plant-food to the surface soil from greater depths than any other crop plant grown in Kansas.

Hogs fattened on grain and alfalfa hay showed a gain of 868 pounds of pork per ton of hay, and hogs on alfalfa pasture showed a gain of 776 pounds per acre of pasture. Alfalfa hay is our cheapest milk-producing food, and when fed with other farm feeds induces a full milk yield without the use of purchased feed stuffs. Feeders report nearly double the usual gains in fattening steers where alfalfa is used for roughness.

It seems imperative, then, that every Kansas farmer should grow alfalfa if possible, yet we find but little of it grown in eastern Kansas. Most trials of alfalfa in this section of the state have been failures, but we have found alfalfa grown successfully under almost every condition of soil to be found in the eastern part of the state, and the writer believes that ninety per cent. of eastern Kansas is a natural alfalfa country.

Alfalfa will not grow on wet land nor where rock comes near the surface. It is easiest grown where the subsoil is rich and porous, but good crops have been harvested many years in succession on land underlaid with as tough and hard subsoils as there are in the state.

A successful alfalfa grower of wide experience said that any land which will produce good corn regularly and on which cottonwood trees do well is good alfalfa land. This is a fairly safe guide.

The failures in alfalfa growing in eastern Kansas have come where methods suitable for western Kansas have been adopted, and successes have followed where entirely different methods have been used.

In eastern Kansas, owing to many years of cultivation and a good rainfall, the land is weedy. The usual experience is as follows: Ground thoroughly prepared in the spring, seed immediately put in, a good stand, and rapid early growth; in September a field with some

alfalfa and a perfect stand of foxtail; next spring no alfalfa or only half a stand.

As a rule, we have found that the successful alfalfa growers in eastern Kansas have started to prepare the ground a year before sowing the seed. They plant the land intended for alfalfa in corn, or some other cultivated crop. They cultivate thoroughly and keep the land free from weeds. The following spring oats, or some other crop that can be taken off early, is put in, and as soon as this crop is harvested the ground is immediately plowed and thoroughly harrowed. It is then harrowed or cultivated about once in every ten days until the fall rains come. This harrowing has a double effect: it keeps a constant succession of weeds starting, only to be destroyed, and it causes a rapid formation in the soil of the nitrogen compounds essential to the growth of the young alfalfa plants. Late in August or early in September, as early as the ground has been well wet, the alfalfa is sown. It may be put in broadcast. A better way is to mix equal quantities by measure of bran and alfalfa seed, drill and cross-drill, sowing half the seed each way. If the season is favorable the growth of the alfalfa will be good through the fall and a good hay crop will be secured the following year. If the ground does not get thoroughly wet in the fall, do not sow, but sow the following spring, and, after the alfalfa gets four to six inches high, cut every ten days or two weeks, whether the weeds are bad or not, with a mower set as high as possible.

A crop of soy-beans raised for seed is better than a grain crop to raise just before seeding to alfalfa. The beans, if planted early can be taken off in time to sow the alfalfa and the alfalfa can be put in without plowing the ground.

Alfalfa does not want a nurse crop. It does not want to be put in loose, freshly plowed ground. The ground should become settled after plowing and just the surface made loose before planting. Time after time we have heard farmers report at farmers' institutes that they plowed their ground deep, harrowed it thoroughly, immediately sowed the alfalfa, and it was a failure. Deep plowing and thorough harrowing are needed, but the ground should settle before seeding. Alfalfa should not be pastured for the first two years.

We have found many farmers who have failed with alfalfa who have cut it for hay just as they would clover—after the field had passed full bloom. In some cases this alone is sufficient to ruin the crop. Alfalfa should be cut in early full bloom, and it is better to make the first cutting in the spring before two-thirds of the plants come in bloom. On the College farm in a dry season we have seen the first crop, cut when at this stage, followed by a heavier second crop and a good third crop, while that left to be cut like clover was not ready

much before the second cutting of the early cut and yielded no hay after the first cutting.

We have secured good yields from old alfalfa fields having less than half a stand, by taking a sharp disk harrow well weighted and harrowing and cross-harrowing as deeply as the machine would run. This must be done early in the spring.

It will pay three-fourths of the farmers of eastern Kansas to make a trial of alfalfa on the lines indicated. Five acres is sufficient for the first trial; less is not practicable. Follow suggestions and watch the progress carefully. The results in most cases will be satisfactory, and where they are not a farmer with good judgment, with this close watching, can develop modifications of these methods that will succeed on his farm.

H. M. COTTRELL.

Press Bulletin No. 52.—Botanical Department.
December 1, 1899.

Some Nitrogenous Forage-plants.

It is well known that one of the most serious problems in stock feeding is the production of nitrogenous fodder, and that one of the most serious problems in raising field crops is supplying nitrogen to the soil. The stock-feeder knows that, in order to receive the best returns from the food given, the ration must be balanced; that is, the proportion of nitrogen must not fall too low. It is usually too expensive to furnish the nitrogen in the form of bran, oil-meal, and other concentrates. On the other hand, all crops require more or less nitrogen, yet this substance is usually first to be exhausted in the soil, and the most expensive to add in the form of fertilizers. Fortunately, the growing of leguminous plants furnishes a solution for both problems at the same time.

Leguminous plants, those whose seeds are borne in pods like the peas and the beans, have the power to collect the nitrogen from the air, where it exists in inexhaustible supply, but yet cannot be utilized by most plants. The nitrogen in the soil is chiefly in the form of nitrates. As there is comparatively little nitrogen in the original rock from which our soils come, the supply in the soil depends almost entirely upon what is washed down from the air in the form of various compounds of nitrogen, and from what is taken out of the air by the roots of leguminous plants and a few others which have a similar power. As stated above, most plants are unable to use the free nitrogen of the air which exists in such abundance.

It will be seen that the raising and feeding of suitable leguminous plants constitute one of the chief agricultural problems of Kansas. It

should be remembered that, in the case of leguminous plants, not only is there a larger supply of nitrogen in the foliage and the seeds than in other forage-plants, but the roots at the same time have accumulated a goodly supply, which remains in the ground after the tops have been removed, and thus enriches the soil to that extent. It should also be remembered that there is a great advantage in turning under leguminous plants. Other plants return to the soil only what they have taken from the soil, while these return, in addition, what they have gathered from the air.

The nitrogen is gathered from the air by means of small nodules or tubercles upon the roots and easily visible when the roots of any leguminous plant are examined.

The three legumes which have thus far proved themselves worthy of cultivation in Kansas and suited to Kansas conditions are the Red clover, alfalfa, and soy-bean. To these might be added the cow-pea, but, though the latter is much used further south, it is scarcely as well adapted to our conditions as the other three. Like the others, it gathers nitrogen, but is not so good as a forage-plant.

The Red clover is grown more or less through the eastern fourth of the state. At Manhattan, 105 miles west of Kansas City, it is too uncertain to be at all generally used. It is often sown with timothy for both pasture and hay. It does not form a permanent pasture, and hence must be renewed every few years. Alsike, or Mammoth clover, is sometimes used, but has no advantages over Red clover. The other two legumes, however, can be cultivated in most parts of Kansas, and are destined to take their place at the head of the list of forage-plants.

Alfalfa can be cultivated in all sections of Kansas where the subsoil is not too compact, as is the case with gumbo. This plant is so familiar it is not necessary to go into the details of cultivation. The reader should consult Bulletin 85 and Press Bulletin 51, Kansas Experiment Station. Alfalfa is considered to be the cheapest source of protein (nitrogen-containing substance) available for the Kansas farmer. The botanical department of the Kansas Experiment Station has started an experiment upon this plant with a view of increasing the amount of nitrogen and of increasing the yield. This is part of the series under way looking toward an improvement of various agricultural plants by breeding and selection.

The soy-bean is not so well known as the preceding. Beans of various kinds are grown in other parts of the world to furnish a nitrogenous constituent in the food of stock, but in Kansas a drought-resisting species is required, and the soy-bean seems well adapted to our conditions. For a description of the plant, see Press Bulletin No.

46, Kansas Experiment Station. It can be used green as a soiling crop, but gives the best returns when raised for the seed. The beans are ground and fed with Kafir-corn or corn. They are rich in oil and protein. This plant is also being bred by the Kansas Experiment Station with a view of increasing its yield and the quality of the seed.

Table showing percentage composition of the plants mentioned above, together with a few other standard feeding stuffs, for comparison:

	Soy-beans..	Dent corn..	Linseed-meal....	Red clover, fresh	Alfalfa, fresh	Timothy, fresh	Red clover hay.....	Alfalfa hay.	Timothy hay.....
Protein (containing nitrogen)	34.0	10.3	33.2	4.4	4.8	3.1	12.3	14.3	6.0
Nitrogen free ext. (carbohydrate)	28.8	70.4	38.4	13.5	12.3	20.2	38.1	42.7	41.9
Ether extract (fat)	16.9	5.0	4.0	1.5	1.0	1.2	3.3	2.2	3.0

A. S. HITCHCOCK.

Press Bulletin No. 53—Chemical Department.
December 5, 1899.

Experiments with Sugar Beets in 1899 and 1900.

The chemical department of the Kansas Experiment Station has completed its analyses of sugar beets grown the past season. The seed from which these beets were grown was furnished by the United States department of agriculture, and was of prime quality. It was on hand early, and furnished to those desiring it immediately upon their application. The growing of small isolated plats was discouraged, farmers being urged to plant one-fourth or one-half acre, or to unite in a given locality for the purpose of making a large number of tests.

The experience of the past year seems to show that interest in the sugar-beet question is diminishing in the state. Only 105 applied for seed, and of these only twenty-two sent in beets. Many who failed to send beets were prevented from doing so by causes beyond their control.

The samples analyzed showed an average of 10.89 per cent. of sugar in the juice. In 1897 and 1898 the percentages were 11.88 and 11.56, respectively. The average coefficients of purity were 76, 78, and 73, in 1897, 1898, and 1899, respectively. A number of the samples included in the general average were grown in the vicinity of Fort Scott, and from seed not furnished by the Station. These gave an average of 10.16 per cent. of sugar and a purity of 70.

Seed was sent to forty-seven farmers in sufficient quantity to plant one-fourth or one-half acre. Of these, twelve sent in samples for

analysis. They showed an average of 11.49 per cent. of sugar and a purity of 75.

The best sample analyzed was grown by Abraham Dick, Burrton, Kan., and had 15.72 per cent. of sugar and a purity of 89. The poorest sample had but 4.33 per cent. of sugar and a purity of 43.

The results of the past three years confirm those of former years, and indicate that while Kansas has produced many individual plats of excellent quality she has produced more of inferior quality, and that states in higher latitudes are better situated for successful sugar-beet production. Doubtless with a better understanding of the conditions requisite to success, and a greater willingness to take the pains and make the necessary effort to meet these conditions, better beets can be grown. The state will always be at a disadvantage, however, and with its superb adaptation to corn, wheat, alfalfa, and other staple crops, it is probably the part of wisdom to leave this crop chiefly to other states, except as it is grown for feed.

However, the Station stands ready to assist all organizations within the state which desire to test its capabilities in this direction further, and will furnish seed next year to any group of farmers making application before February 1. This early application is necessary to insure getting the seed from the department of agriculture. Seed will be furnished only for the use of such groups of farmers.

It seems proper to once more caution the public against hasty and ill-considered efforts to establish beet-sugar factories in this state, or, indeed, elsewhere. A thorough test of the beet-producing power of the locality, and the disposition of the farmers, should be made before a dollar is invested as fixed capital. The Station is ready to do its part in all such tests, with an eye single to the ultimate prosperity of the state.

J. T. WILLARD.

Press Bulletin No. 54.—Farm Department.
December 26, 1899.

Kafir-corn.

Kafir-corn is grown in every county in Kansas, Secretary Coburn reporting 582,895 acres in 1899 for the state, yet we are in constant receipt of letters asking how to raise and how to feed it.

It has been raised on the Kansas Agricultural College farm for the past eleven years. We recommend two varieties—the Red and the Black-hulled White. For the first seven years we raised the Red. The Black-hulled White was then introduced, and from 1896 to 1898 we grew these two varieties side by side, the Red giving an average yearly yield of thirty-seven bushels per acre, and the Black-hulled White

forty-three bushels per acre. We now raise the Black-hulled White only. In western Kansas many farmers think the Red a little hardier in drought.

Kafir-corn makes a slow early growth, and should not be planted until the ground becomes warm. On cold soils surface planting is best; on warm soils listing does well. Plant in rows 3 to 3½ feet apart, dropping single seeds an inch apart in the row. Cultivate the same as you would for a good crop of corn. Many farmers sow Kafir-corn broadcast, cut with a mower, handle and feed as hay.

When grown for grain, the heads may be cut off and gathered, if the fodder is not wanted. When the fodder is to be used, the cheapest method of harvesting Kafir-corn is to cut and put it up in large shocks.

The College farm is upland. In the eleven years that we have grown Kafir-corn there has been but one failure to produce grain. In 1894 Kafir-corn yielded no grain, but gave two tons of fodder per acre. Corn the same year yielded us no grain and one ton of fodder per acre. The average yield of grain per acre on the College farm for the past eleven years has been, per year: Kafir-corn, 46 bushels; corn, 34½ bushels. Our highest yield per acre in one year has been: Kafir-corn, 98 bushels; corn, 74 bushels. In the western half of the state the difference in favor of Kafir-corn is greater, as there, in dry years, when corn yields one to five bushels per acre, the yield of Kafir-corn is 25 bushels or more.

A bushel of corn is worth more for feed than a bushel of Kafir-corn, but on the college farm an acre of Kafir-corn is worth more than an acre of corn. The average of the results where we have fed corn against Kafir-corn in fattening hogs shows twelve pounds of pork from a bushel of corn, and ten pounds of pork from a bushel of Kafir-corn. This shows for the College farm (upland) an average yield of grain per year per acre to produce 460 pounds of pork from Kafir-corn, and 404 pounds of pork from corn.

The relative values of corn and Kafir-corn are practically the same for beef production as for pork.

Kafir-corn grain and alfalfa hay make the cheapest combination of feeds in Kansas for milk production.

Kafir-corn meal is especially valuable to feed calves raised on skim milk. Its constipating effect offsets the loosening tendency of the milk.

Animals tire of Kafir-corn alone more quickly than they do of corn alone, but combined with other feeds they relish it for any length of feeding.

In three experiments in fattening hogs, a mixture of Kafir-corn

four-fifths and soy-beans one-fifth gave again per bushel of feed of over thirty-six per cent. more than Kafir-corn alone. Hogs fed Kafir-corn and alfalfa hay gained ninety-one pounds each, while hogs fed Kafir-corn alone gained fifty-two pounds each. Hogs fed Kafir-corn and five pounds of skim milk each per day gained sixty-six pounds per hog, while those fed Kafir-corn alone gained forty-two pounds each.

Kafir-corn is our best drought-resisting grain feeding crop, and our heavist yielder on poor soils. We recommend it in place of corn for the uplands of eastern Kansas, and for all soils in western Kansas. When this recommendation is followed, and the Kafir-corn is fed with drought-resisting feeds rich in protein, the beef, pork and milk production of Kansas in dry years will be equal to that of our best years now, without more acres being planted.

Press Bulletin No. 55.—Botanical Department.
January 2, 1900.

Plant Breeding by Bud Selection.

In Press Bulletin No. 8 of the Kansas Experiment Station, and in other places, I have indicated the methods used in breeding plants by seed propagation. I wish now to call attention to the subject indicated in the title — a subject familiar to florists, but scarcely so to the general public.

All plants are made up of a succession or colony of shoots, originating in buds. These shoots show as much tendency to vary as do seedlings. The degree of variation is not usually as great, since the latter unite the qualities of two parents, while the former are the product of one parent. Nevertheless, sudden and marked bud variations are not uncommon. As a matter of fact, many of our cultivated varieties have originated from bud sports. The nectarine came from a branch of the peach. A French horticulturist gave, in 1865, a list of 154 commercial varieties which had originated by bud variation, while Professor Bailey estimates that there are over 300 such sorts grown at present in our own country.

In plants like the apple, which are widely dispersed by means of graftage, there is more or less departure from the original type. The Newtown Pippin, which originated in Long Island, has varied in Virginia into the Albemarle Pippin — a poorer keeper than the original. In the Northwest it has varied into a form which has five ridges at the apex, while in Australia it is so different as to have been renamed the Five-crowned Pippin.

Professor Bailey grew the Chilian strawberry in his garden two years, during which time the new plants varied into a form indistinguishable from the ordinary cultivated sort, though quite different at first. Many other instances might be cited of plants propagated by vegetative methods which have varied into distinct varieties. Florists and horticulturists are constantly on the watch for "sporting" shoots. When the sport is desirable it is fixed by vegetative propagation. Many forms with cut leaves, variegated foliage, weeping habit, double flowers, flowers of different color from type, and others, have been produced in this way. From the above, it will be seen that bud variation is a fact well recognized among horticulturists, especially florists and growers of ornamental shrubs and trees. I wish especially, however, to call attention to the good results following bud selection in ordinary propagation. While a sudden and marked variation from the type (usually called a "sport") is an exception, yet slight, though recognizable, variation among shoots on a tree is the rule, and these variations tend to perpetuate themselves, though they sometimes revert, as do seedlings. Our orchard fruits would be improved more rapidly if there were more care used in selecting the scions, buds or cuttings from those individuals which have proven themselves to be in advance of the average. Not only should buds be selected from proper individuals, but even from a particular branch. Small fruit can be easily improved in this way.

The common practice of plowing up or digging up at random the young plants from a strawberry bed is not conducive to improvement of the varieties. The most successful growers are learning that it pays to select from the best individuals each generation. In fact, it is advisable to keep a patch on purpose for breeding. Of course a grower cannot take time to select individual plants for his customers, but he can select his breeding plants each year from the best plants of the preceding year, and thus gradually improve his breeding plants, and, through them, the general crop. A. S. HITCHCOCK.

Press Bulletin No. 56. —Chemical Department.
January 9, 1900.

Digestion Experiments with Kafir-corn Stover and Kafir-corn Meal.

Among the digestion experiments conducted by the chemical department of the Kansas Experiment Station are two upon Kafir-corn stover and Kafir-corn meal. The Kafir-corn stover, viz., the entire stalk without the heads, was well cured, of good quality, and had been cut fine with an ensilage cutter before being fed. The Kafir-corn

meal was very finely ground and of good quality. The animal used in the experiment was a two-year-old grade Hereford steer, and a good feeder. In each experiment the feeding was divided into two periods —one of seven days in which the excrement was not collected, followed by one of seven days in which the excrement was collected and saved for analysis.

The results obtained are presented in the following table. For convenience in making comparisons, similar figures for corn-stover and corn-meal, calculated to the dry substance, from a table found in Henry's book on "Feeds and Feeding," are introduced into this table.

TABLE I. Percentage digestible nutrients in water-free substance,

	Total solids, excluding ash.	Crude protein.	Carbohydrates.	Fat.	Nutritive ratio.
Kafir-corn stover	57.50	3.49	52.79	1.25	1:15.9
Kafir-corn meal	74.50	7.30	65.20	.....	1:8.9
Corn-stover	58.50	2.86	54.46	1.18	1:20
Corn-meal	88.14	8.72	74.62	4.80	1:9.8

A study of the table shows that 100 pounds of dry Kafir-corn stover contains one pound less of digestible matter than the same amount of corn stover. The nutritive ratio of a ration of this feed, however, is much narrower than the nutritive ratio of a ration of corn-stover, and therefore we may safely conclude that the feeding value of Kafir-corn stover is fully equal to that of corn-stover, if not greater than it.

One hundred pounds of Kafir-corn meal contains 15.6 pounds less digestible matter than the same amount of corn-meal. A ration of Kafir-corn meal furnishes a somewhat narrower nutritive ratio than one of corn-meal, and the difference between their feeding values ought to be reduced more or less by this factor. Practical feeding experiments made by this Station and reported upon in Bulletin No. 61 and Press Bulletins No. 7 and No. 37 show the difference to range from 6.7 per cent. to 28.8 per cent. in favor of corn-meal. The average is 15.6 per cent., while our digestion experiment shows corn-meal 21.5 per cent. better, calculated upon the basis of the total digestible matter in the Kafir-corn meal. None of these experiments are conclusive, however, and more work in the future will be required to determine to what extent the narrower nutritive ratio of Kafir-corn meal can compensate for its greater indigestibility.

In the above table the figures representing the digestibility of corn-stover and corn-meal are averages of the results of many experiments, while those for Kafir-corn stover and Kafir-corn meal are the results of but one experiment. The Oklahoma station has been working on the digestibility of Kafir corn, and they have published results in

Bulletin No. 37 of that station. In the table below we give their results along with ours, and also an average of the two. In this table, as well as the first one, we have calculated results to a basis of the water-free substance.

TABLE II. Percentage digestible nutrients in water-free substance.

	Kafir-corn stover.			Kafir-corn meal.		
	Protein.	Carbohydrates and fats.	Nutritive ratio.	Crude protein.	Carbohydrates and fat.	Nutritive ratio.
Kansas station . . .	3.49	55.54	1:15.9	7.30	65.20	1:8.9
Oklahoma station . .	1.83	54.18	1:29.6	6.62	64.63	1:9.8
Averages	2.66	54.86	1:20.7	6.96	64.92	1:9.3

R. W. CLOTHIER.

Press Bulletin No. 57.—Veterinary Department.
January 23, 1900.

Protective Inoculation against Blackleg in Cattle.

During the year 1899 and part of the year 1898, the veterinary department of the Kansas Experiment Station has sent out material sufficient to inoculate about 100,000 head of susceptible cattle. This material was sent free to all applicants owning cattle in Kansas. The object of the experiment was to study the value of protective inoculation, the best methods of inoculation, and the prevalence and extent of blackleg in Kansas. The results, in brief, are given below. A preliminary bulletin on this subject is in preparation and will soon be ready for distribution.

Extent.— Blackleg exists in practically every county of Kansas. We have definite reports to this effect from all but seven counties.

Occurrence.— The disease occurs in cattle of all ages and both sexes. The most susceptible age is six to thirteen months. Human beings are immune.

Mortality.— In 1896 the death-rate from blackleg was ¾ of 1 per cent. of the entire cattle herds of Kansas; in 1897 the death-rate was slightly greater; and in 1898 the death-rate was nearly twice as great as in either of the two preceding years. This means that the state of Kansas, in 1898, lost at least 1½ per cent. of 2,000,000 cattle (this is exclusive of milch cows). This would be a loss of 30,000 cattle, with a value of at least $600,000. This loss could have been almost entirely prevented. In single herds the death-rate varies from a fraction of 1 to 100 per cent. During 1896, 1897, and 1898, 40 per cent. of all cattle owners in Kansas sustained losses from blackleg. In 1898, out of 541 cattle owners, 100 owners lost over 4½ per cent. of their entire herds, comprising 26,693 animals, In 1899, 146 cat-

tlemen report an average loss of over 6 per cent. of their entire herds.

Treatment.— Curative treatment is not practicable, for many reasons.

Prevention.— Vaccination is the only successful preventive measure known.

Vaccination.— True vaccination consists in the artificial production of a mild form of blackleg, from which the animal recovers and becomes immune to further attacks. If properly vaccinated, over 991/2 per cent. of susceptible animals can be saved.

Place of Vaccination.— Animals may be vaccinated in the end of the tail, shoulder, ear, and other places. The loss from blackleg and other causes as a result of vaccination in the shoulder, thigh, ear, etc., is about one-third of one per cent. The loss of resulting from tail inoculation is less than one-tenth of one per cent., a showing decidedly in favor of tail inoculation. Tail inoculation is a little more difficult to perform, but pays best on small and valuable herds.

Immunity produced by vaccination lasts about one year, but the time varies with the age of the animal at the time of vaccination and with other conditions. All animals above three months old and below the age of thirty to thirty-six months should be vaccinated every year. If cattle begin dying before the end of a year after vaccination, revaccinate immediately. For further information, address Dr. Paul Fischer, Veterinarian, Experiment Station, Manhattan, Kan.

Press Bulletin No. 58.— Botanical Department.
January 30, 1900.

Questions about Forage-plants.

The Experiment Station of the Kansas Agricultural College wishes to obtain information concerning the best methods of growing our cultivated grasses and forage-plants. We wish to have the cooperation of our correspondents through the state, and ask if you will kindly give us your experience with any of the forage-plants mentioned in the list below.

We append an outline which will aid in giving your results. It is intended to issue a bulletin embodying the results of the inquiries, and all our correspondents will receive due credit at that time. Information is especially desired upon the following points:

Method of preparing the soil and planting the seed.

Amount of seed per acre.

State if it is advisable to plant a mixture, and, if so, what mixture is most suitable for the purpose.

What kind of soil is preferred ?

What treatment do you give the crop the first year?
State whether the crop is raised for hay or pasture.
If for hay, at what stage should it be cut ?
If for pasture, at what season can it be used without damaging the pasture?
For what kind of stock is the crop best adapted?
How many years will a field yield profitable crops, or how long can it be pastured ?

Here is a list of cultivated grasses and forage-plants more or less grown in Kansas:

Pasture Grasses.— Timothy, orchard-grass, English blue-grass, Kentucky blue-grass, Texas blue-grass, redtop, Johnson grass, Awnless brome-grass.

Fodder Grasses.— Millet (Hungarian, German, Italian, or Common), Pearl millet, Texas millet, Indian millet, cane, or sorghum.

Clovers.—Red clover, White clover, Alsike clover, Mammoth clover.

Address A. S. Hitchcock, Botanist, Kansas Experiment Station, Manhattan, Kan.

Press Bulletin No. 59. — Botanical Department.
February 6, 1900.

How to Test the Vitality of Garden Seeds.

It is well known that the vitality of seeds diminishes rapidly with age. Dealers sometimes keep seed over from one season to another, and, if the vitality is too low, may mix fresh seed with this. Low vitality may not be due to age, but to unfavorable conditions at time of harvesting or to immaturity. In any case, it is well to determine the vitality before planting. While it requires some experience to determine the impurities in seeds, the farmer can at least test his seed for vitality.

A cheap and convenient form of apparatus for testing the vitality of seeds at home is the following: Choose two earthenware plates of the same size. Cut out two circular layers of flannel somewhat smaller than the plates. Between the two layers of flannel place 100 seeds of the variety to be tested. Moisten the flannel with all the water it will absorb. The two layers of flannel are placed in one plate and covered with the other and set in a warm place. If the flannel is thin, several pieces should be used, in order to absorb sufficient water. Other kind of absorbent cloth or blotting paper can be used, but thick flannel is rather more satisfactory. At the Kansas Experiment Station we have used damp sand for a seed-bed with good success. The dishes should be placed in a room which is kept warm at night, or at least where the temperature does not fall to freezing. The flannel should be kept moist by the addition of more

water when necessary. Some seeds will commence to germinate by the third day. Each day an examination should be made, and those seeds which have germinated should be recorded and removed. For practical purposes, two weeks is a sufficient time for the test. The results obtained may be considered as representing the per cent. of vitality under favorable conditions. The per cent. germinating in the ground is likely to be less. In counting out the 100 seeds, care should be taken to discard poor or shriveled seeds and the seeds of weeds or other plants which may be present.

Grass seeds require as much as three weeks, and seeds of some trees a still longer time. Beet balls contain from three to seven seeds. With very small seed, it may be necessary to provide for the circulation of air by placing small pieces of wood between the layers of cloth among the seeds. With most varieties of garden plants the majority of seeds should germinate within a few days after the first sprout appears. If the period of germination extends over a longer time, it shows that the vitality of the seed is low. Seeds of carrot family and some melon seeds may not show as high results in the germinating dishes as they do in the ground. Below is given a list of common seeds, with the average number of years that they will retain their vitality (taken from Professor Bailey's Horticulturists' Rule Book).

Bean, 3.	Cucumber, 10.	Parsnip, 2.	Tomato, 4.
Beet, 6.	Indian corn, 2.	Pea, 3.	Turnip, 5.
Cabbage, 5.	Lettuce, 5,	Pumpkin, 4.	Watermelon, 6.
Carrot, 5.	Muskmelon, 5.	Radish, 5.	
Celery, 8.	Onion, 2.	Summer squash, 6.	

A. S. HITCHCOCK.

Press Bulletin No. 60.-Farm Department.
February 9, 1900.

Gophers and Crab-grass versus Alfalfa.

The two enemies of alfalfa, after it is once established, are the pocket-gopher and crab-grass. The pocket-gopher digs its runs three to four inches under the surface, cutting off the roots which happen to lie in its path, but, worst of all, it throws up a chain of mounds along the run which render mowing very difficult. If unmolested, this pest will carry on its depredations to such an extent that the field will have to be plowed up. They also feed on the alfalfa roots.

No preventive has been found. Trapping may be employed against them, but it is tedious and generally unsatisfactory. Poisoning is perhaps the easiest and most satisfactory method of destroying the gopher, and if properly done they may be almost entirely exterminated. To poison them, as soon as a fresh mound is seen, get some potatoes and cut them as they are usually cut for seed. A bottle of crystal-

lized strychnine, which may be obtained by any adult at a drug-store, at fifty cents per bottle, should be at hand. Then, with a pocket-knife or old case-knife, slit the pieces and drop a crystal of strychnine not larger than a wheat grain in the slit, so it will lodge near the middle of the potato. The potato being moist, the strychnine will soon be dissolved and carried all through it, and it should be used as soon as poisoned. Take a spade and a wagon rod and the potatoes and proceed at once to the "gopher patch." With the rod poke in the ground around the fresh hill until the run is located, and open with the spade. Drop in a potato, cover up, and proceed to the next hill. Gophers are very fond of potatoes. One dose usually kills the gopher. If too much strychnine is used, or the potatoes are not used as soon as prepared, the poison is not so effective. If the field is gone over once a week, the old hills leveled down and the new ones given a potato, the gophers' work will soon be very much lessened. Now and then one will be too smart for the potato and will keep at work. Try to trap him.

For crab-grass, in the spring, just before the alfalfa gets started, take a disk, set it nearly straight, and thoroughly disk the field, going both ways, and leave it in good shape to put in oats. This loosens up the ground, splits the old crowns, thereby thickening the stand, and giving the alfalfa new life, so that it grows in spite of crab-grass.

Many successful alfalfa raisers disk the alfalfa fields every two years, whether the crab-grass bothers or not, and consider it very beneficial. Alfalfa should never be put in a field that is foul with crab-grass. First clean the field by growing small grain or summer fallowing, and then use the disk after it appears in the field. Care must be exercised in using the disk if the field is young, but at any time it will stand more of such treatment than would be supposed.

J. G. HANEY.

Press Bulletin No. 61.—Horticultural Department.
February 13, 1900.

Salsify, or Oyster Plant.

Vegetable oyster, or salsify, is a most valuable addition to the list of cultivated vegetables, but at present is little known and scarcely appreciated. It is not a native of America, so far as is known, but is indigenous to the southeastern counties of England, where it grows in the meadows. Nothing from the ordinary sources of information can be found as to its introduction into this country, but it is not well enough known to indicate that it has been long in cultivation. Henderson, in his "Gardening for Profit," says that, although the consumption is limited, the prices are high and remunerative, and that the

amount grown is increasing. Whether or not it should be grown extensively is a question that the demand for the vegetable will settle, but there is no question whatever that it is worthy of cultivation for family use in every vegetable garden.

Botanically it bears the name *Tragopogon porrifolius* Linn., belonging to the Compositae, and is a biennial plant. The varieties Long White and Sandwich Island have been tested by the horticultural department of the Kansas Experiment Station. There was little difference in the total yield, Sandwich Island being ahead, but the roots of Sandwich Island had fewer laterals and were smoother. Where a good stand, the yield was very nearly a pound to the foot of row.

Salsify is easily grown, may be cultivated without trouble, and is easily stored for winter use. The seeds are sometimes planted with a drill, but on account of being so sharply curved at the ends it is rather difficult to obtain an even distribution in this way, unless they are very thoroughly cleaned. They may be planted thickly, to be thinned later on, or the seeds may be dropped from four to six inches apart in the first place. The soil should be rich, but with well-rotted manure worked deep and thoroughly. Upon the perfect condition of the soil depend the straightness and smoothness of the roots, there being a tendency to branch where fresh manure is applied. the plants should be cultivated as parsnips are. They are very hardy, are not affected by frost, and may be left in the ground all winter without harm. But to have the roots ready for use they should be dug in the fall and stored away in soil or sand where the temperature is low. If exposed to the air the roots become shriveled and tasteless, and are without value.

Salsify may be prepared for the table in many appetizing ways. When the flower-stalks are used they should be prepared like asparagus. This part of the plant is, however, little used. The root is the portion for which it is usually cultivated. These are said to possess qualities which make this one of the most healthful of vegetables, ranking even above the dandelion root in the excellence of its medicinal qualities. The root is a rather difficult one to dress for cooking, as it is filled with a milky juice that is sticky and darkens the hand, unless the utmost care is exercised in handling them. This milky juice, however, is the most valuable portion, and on account of its flavor and medicinal qualities should not be lost. On this account, where the roots are smooth and of good size they may be boiled without scraping and the skin removed afterwards. Their flavor quite strongly resembles that of oysters, and they will be found appetizing used in any way that oysters may be cooked, yet in no way can they be said to quite equal the oyster. The following recipes for prepar-

ing salsify for the table have all been tried, and are warranted to be excellent:

Salsify Soup.— Prepare white sauce for soup as follows: One level tablespoon of butter; one level tablespoon of flour; one-half teaspoon of salt; one saltspoon of pepper; one cup of milk. Combine salt, pepper, and flour. Have butter melted in saucepan; stir in flour till smooth, then add hot milk gradually, stirring five minutes. Thin to consistency required. Boil the salsify, slice into pieces one-fourth of an inch thick, and add to the white sauce. Serve hot.

Scalloped Salsify.— Boil the salsify and slice into thin pieces. Crumble a quantity of cracker crumbs. Put in a basin a layer of cracker crumbs, then a a layer of salsify; spread over this bits of butter and sprinkle with salt and pepper. Repeat until the dish is full. Moisten with milk or cream, and bake. Serve hot.

Salsify Croquettes.—Boil the salsify, slice lengthwise, and cut into pieces one and one-fourth inches long. Roll these pieces alternately in egg and bread or cracker crumbs until thickly coated. Fry brown in hot butter or lard. Serve hot.

Salsify Croquettes.— Boil the salsify, mash, season with butter, pepper, and salt, roll in egg and bread or cracker crumbs. Fry brown in hot butter or lard and serve hot.

Creamed Salsify.— Boil the salsify, slice in small pieces, and serve hot with a dressing of cream, with salt and pepper. A. DICKENS.

Press Bulletin No. 62.—Farm Department.
March 6, 1900.

Tame Grasses for Kansas.

We are receiving inquiries from all parts of the state in regard to the best grasses for permanent pastures and meadows. There are no tame grasses that are permanent in Kansas except in a narrow strip along the eastern border of the state. In this strip the same grasses do well that are the standard field grasses of Missouri and Illinois. West of Topeka the only permanent grasses are the wild prairie-grasses, and it will pay the farmer who has native sod to care for it well.

No grass equals alfalfa for hay for steers, dairy cows, young stock, hogs, and sheep, nor for pasture for horses and hogs.

The College farm is 118 miles west of Kansas City, and is all upland. Tame grasses have been grown here since 1873; nearly all known kinds have been tested, and many kinds have been tried repeatedly. Of all the hundreds of kinds tested, we can recommend but two grasses for field seeding — orchard-grass and English blue-grass; and but one other for trial on a small scale— *Bromus inermis.* While many others have made satisfactory growth for one to three years, all the varieties tested except the ones mentioned have finally totally failed. Timothy does well in a wet year, but in a dry year every plant in a field dies. Tall Meadow oat-grass will sometimes

give a profitable yield for two or three years, and then die from drought. Kentucky blue-grass lives for years, but supplies feed only in wet weather. Johnson grass furnishes no pasture until June, gives a moderate yield of coarse hay, and in a severe winter is entirely destroyed.

Orchard-grass has been grown on the Kansas Agricultural College farm in large fields since 1875, and has successfully withstood all droughts, floods, heat and cold since that date, except during the winter of 1885–'86, when all orchard-grass on the College farm but that in one field was killed by the severe cold. The orchard-grass not killed was seeded in 1885. This has been pastured or mowed each year since, and is apparently in as good condition to-day as at any time in its growth. This record shows but one season in twenty-five years in which orchard-grass has been seriously injured.

English blue-grass has been grown in fields on the College farm since 1879, and has withstood all extremes of climate except in the fateful winter of 1885–'86, when all seedings of this grass were killed. It suffers more than orchard-grass from drought, but is not so coarse, and many farmers are using English blue-grass and clover for hay on account of its fine quality.

For pasture and for hay, where alfalfa is not wanted, we sow, per acre, orchard-grass twenty pounds, English blue-grass fifteen pounds, and, if the season is favorable, Red clover two to three pounds. We seed with a press-wheel drill, about the middle of April, on thoroughly prepared ground that has been allowed to settle after plowing. Seed without any other crop and mow the weeds the first summer. Pasture from this seeding stands drought and heavy pasturing well, furnishes early and late feed and good pasture in midsummer, unless drought is severe, when it dries up, to start up again vigorously when rain comes.

Grass from this seeding is ready to cut early in June, in favorable seasons will give a second cutting, and in all seasons may be safely pastured after the first crop of hay has been removed. Orchard-grass cut in blossom makes fairly good hay; cut when ripe, the hay has about the same feeding value as rye straw.

Bromus inermis has been grown for nine years on the College farm on a small scale, and has withstood the severest drought and cold during this time. It quickly forms a thick sod on upland, starts early in the spring and grows late in the fall, drying up during drought. It gives a fair yield of second-quality hay, and promises well for pasture and hay for the western half of the state. It has not been sufficiently tested to be recommended for large fields, but we do advise a trial of not more than five acres. H. M. COTTRELL.

Press Bulletin No. 63.—Farm Department.
March 6, 1990.

Bromus Inermis.

Seed men are pushing this grass through their catalogues, and are ascribing to it so many good qualities that Kansas farmers are becoming interested, and are writing for what information we can furnish on the subject.

This grass has been grown on the College farm on small areas since 1891. It has withstood the severest drought and cold we have had during these nine years without injury. It dries up during drought, but starts growing again rapidly as soon as rains come. We have grown it on upland only, and on this land it quickly forms a thick sod. It is one of our earliest grasses to start in the spring and stays green late in the fall, and will furnish pasture from two to four weeks longer in a season than will prairie-grass in this section of the state. We have not had a sufficient area to test its ability to stand heavy pasturing and trampling, but, judging from the character of the sod formed by this grass, it will stand as hard treatment in this respect as any tame grass tried. It yields about the same amount of hay as orchard-grass or timothy. The hay is of second quality—not better than orchard-grass hay—and is not particularly relished by farm animals.

We have not made trials of this grass in large fields nor advised farmers to try it, because until this year the only seed that would grow came from the department of agriculture, and could only be obtained in small quantities. From 95 to 100 per cent. of *Bromus inermis* seed purchased of seed men failed to germinate. It was chiefly imported seed. This year seed men guaranteed their seed of this grass to have good vitality, and we expect to sow it in large fields, and advise Kansas farmers to try it on a small scale.

From our study of it, *Bromus inermis* seems to be the only tame grass so far tested that will grow in the western half of the state, and, judging from its habits here, it will probably thrive there when a stand is secured. It also promises to be a grass that will grow well on upland pastures in eastern Kansas where the prairie-grass has been killed.

Like most tough, hardy grasses, *Bromus inermis* is not of the best quality. Judging from our trials of it, no farmer will want it for hay (except for horses) who can raise alfalfa. As a pasture, we expect it to be found inferior in quality to our buffalo-grasses, or to the bluestem of eastern Kansas, but it can be grown on land where these valuable wild grasses have been killed, and will furnish the best substitute

for them that we have yet found. Its early and late growing qualities give it one advantage over the wild grasses.

We would advise sowing from twenty-five to thirty pounds of seed per acre, sowing in this section of Kansas about the middle of April and in the southern part of the state a little earlier. The ground should be free from weeds, thoroughly pulverized, and well settled after plowing, before the seeding is done. If the soil is inclined to be dry, we would advise packing with some implement like the Campbell subsurface packer. In dry seasons we have secured good stands where the packer was used, with total failures where it was not used, all other conditions being the same. We would put the seed in with a drill having press wheels.

These opinions of *Bromus inermis* are formed from an experience on small areas. After growing this grass on large fields we may think differently of it.

As the seed is high-priced and the grass a new one, we would not advise a first trial of more than five acres.

(See, also, Press Bulletin No. 47, dated October 24, 1899.)

H. M. COTTRELL.

Press Bulletin No. 64.— Botanical Department.
March 13, 1900.

Prevention of Grain Smuts.

The smuts of grain are due to a small plant or parasitic fungus which gains an entrance to the grain plant at some period in its existence after the germination of the seed and grows entirely within the body of its host until it is mature, when it forms its spores or reproductive bodies in some definite portion of the host, such as the seed, as in the case of wheat smut. Since the parasite lives at the expense of the plant upon which it grows, the latter is weakened in proportion to the amount of smut. The following are of economic importance in Kansas:

Corn-smut. Observations made at the Experiment Station of the Kansas Agricultural College show that the average loss from smut is two per cent. of the grain crop. But often in certain fields the loss may be considerably more, even as much as twenty per cent. There is no remedy for the disease. Soaking the seed in chemicals, which has occasionally been recommended, is without effect. Unless the smut is exceptionally severe, it may not pay to attempt to restrict the disease. In severe cases, however, the smut boils should be gathered and burned. Fresh manure is favorable to the development of the smut.

Smut of oats. The spores gain an entrance during the germination of the seed. If the spores sticking to the surface of the grain can be killed, the disease can be almost wholly prevented. To kill the spores, the seed is soaked in hot water or in certain chemicals. The hot-water treatment is the cheapest, but on small quantities it is not so convenient of application as the other method. To apply the hot-water treatment, soak the seed oats in water heated to a temperature of 133 degrees F. The grain, in about half-bushel quantities, is placed in a sack, wire-netting cage, or other closed receptacle allowing free access of water, and plunged in the water, which should be in a large tub, kettle, or vat. It should be kept in the water, being meantime rotated and plunged, about ten minutes. A thermometer should be at hand constantly, for if the temperature is too high the seed will be injured, and if too low the smut will not be killed. It is a good plan to dip the seed first into water about 110 to 120 degrees F., so that the hotter water will not be so much cooled by the process. After treatment the seed is spread out on a floor to dry.

The second method for treating oat-smut is to soak the seed for twenty-four hours in a solution of liver of sulphur, one and one-half pounds in twenty-five gallons of water. Care should be taken to completely wet all the grains. The solution should be kept in a wooden vessel.

Stinking smut of wheat. Wheat is affected by two smuts. One, the stinking smut, or bunt, remains within the grain and is observed only when the covering to the grain is broken, when the interior is found to be a mass of black dust or spores. This can be prevented by the hot-water treatment, as described for oat-smut, or it can be treated as follows: Soak the seed in a solution of copper sulphate (bluestone or blue vitriol) for twelve hours and then for five or ten minutes in a solution of lime. The solution of copper sulphate is made by dissolving one pound of copper sulphate in twenty-four gallons of water. The lime solution is made by slaking one pound of fresh quicklime in ten gallons of water. The copper solution must be kept in a wooden vessel.

Loose smut of wheat. The second kind of smut on wheat is the common, conspicuous sort which makes the whole head a black mass. To prevent this kind of smut, soak seed four hours in cold water, set away in the wet sacks for four hours more, and then treat with hot water as described for oat-smut, but soak at 132 degrees for only five minutes. The seed is likely to be injured some, so one-half more seed should be used than would otherwise be required.

A. S. HITCHCOCK.

Press Bulletin No. 65.— Entomological Department.
March 20, 1900.

Horn-fly Remedies.

During the past year the department of entomology of the Kansas Experiment Station made extensive trials of a number of horn-fly traps and repellent mixtures for the purpose of finding some means of furnishing protection to stock from the horn-fly at a reasonable cost. In no cases were the fly-traps effective, but with the mixtures more satisfactory results were obtained.

It is quite evident from the experiments that a large number of horn-fly remedies are not as effective in this state as they are claimed to be in others. For instance, fish-oil ceases to be a repellent here before two days have passed, while elsewhere it is said to repel for a longer period, from two to six days. The greatest objection to the use of so many of the horn-fly remedies is that the resulting benefits are not proportionate to the cost. In some cases the remedies were entirely useless. One of the best remedies on the market, in order to be reasonably effective, had to be applied every day, and in such large quantities as to make a cost of twenty cents for each application for one cow, a sum greatly exceeding in value all the benefits derived from the use of the mixture.

Of a number of remedies of our own compounding that were tested, we have selected one which for cheapness and effectiveness seems deserving of a more extensive trial. It is not as satisfactory as we would like it to be, but it is considerably cheaper, as effective and often more lasting than fish-oil, which, in our opinion, is one of the best of the horn-fly remedies. It is made as follows: Pulverized resin, 2 parts, by measure; soap shavings, 1 part; water, ½ part; fish-oil, 1 part: oil of tar, 1 part; kerosene, 1 part; water, 3 parts. Place the resin, soap shavings, ½ part of water and fish-oil together in a receptacle and boil till the resin is dissolved. Then add three parts of water, following with the oil of tar mixed with the kerosene. Stir the mixture well and allow it to boil for fifteen minutes. When cool the mixture is ready for use, and should be stirred frequently while being applied.

The mixture costs about thirty cents a gallon. From one-eighth to one-half pint is sufficient for one application. To apply the mixture, a brush is essential. We find nothing more satisfactory than a large painter's brush. At first it is well to make an application for two or three days in succession. Afterwards an application every other day will suffice. Cows, in standing in water and mud, running through weeds and brush, and rubbing against trees, often remove some of

the mixture. In this case it is well to retouch the unprotected parts. It is often more economical not to attempt to protect the entire animal, but only those parts not reached by the head or tail. This mixture is very sticky, and for this reason is not recommended for horses. It is perfectly safe, and in no case has it appeared detrimental to the health of the animal.

There are those, perhaps, who may not want to take the trouble to make the above mixture. In this case we recommend fish-oil, which can be purchased at any drug-store. It also has to be applied with a brush, and at the rate of one-eighth to one-half pint for each application. The cost of the fish-oil would be greatly reduced if farmers would combine their orders and purchase at wholesale rates.

We often receive inquiries for some mixture to protect horses. It must needs be of such a nature as will not mar the appearance of the horse or prevent his being curried. It seems difficult to obtain a mixture that possesses lasting with safe qualities. The following remedy is the best that we have tried. It is safe, and does not gum the hair, and is effective for three or four hours, and even longer. It is made as follows: Fish-oil, 2 quarts; carbolic acid (crude), 1 pint; pennyroyal, 1 ounce; oil of tar, 8 ounces; kerosene, 1½ quarts, or enough to make one gallon of the mixture. This will cost about eighty cents a gallon, and must be applied with an atomizer, not with a brush. An atomizer costs about $1.50, and can be obtained at any hardware or drug store. It is very economical in the use of the mixture, and enables one to make a very quick application.

Whether or not it is profitable for one to go to this expense in protecting his stock is a question which the individual must decide for himself. In experimenting with a small dairy herd, it was very apparent that the saving of milk and butter-fat from the use of horn-fly mixtures more than paid for the cost of such protection, without taking into consideration the increased comfort of the animals. Those intending to use horn-fly remedies should experiment upon a small scale first, to decide what mixtures are effective and profitable. Do not continue to use a mixture because it is widely advertised, but rather because you yourself have found it to be efficacious and profitable.

P. J. PARROTT.

Press Bulletin No. 66.—Entomological Department.
March 27, 1900.

Causes of Failure in Spraying.

A belief exists in the minds of some fruit-growers that recommended methods for the destruction of the codling-moth are worthless; that spraying with arsenic compounds has proven of no avail. Disregarding the opposition of some whose ill-chosen statements furnish their own refutation, we must still admit that trials of spraying methods by our fruit-growers have too often resulted in apparent failure, and, in consequence, have measurably destroyed confidence in these methods.

These reported failures may have come from one of several causes: First, an exaggerated idea of the results to be obtained by spraying has led to anticipations of a degree of success not warranted by the experience of the most successful experimenters. Second, proper spraying demands such close adherence to several indispensable points of practice that even careful men may fail through oversight of these particulars; or, finally, the adverse report is made without a just estimate of the result of the experiment; for it will be granted that a true judgment of the degree of success can only be had by the comparison of trees treated with trees untreated in the same surroundings, and this comparison lacking, the estimate of success or failure is altogether a matter of opinion, and not to be admitted as evidence.

As to the first: No one qualified to advise in the matter will claim that a single season's trial of spraying against the codling-moth can alone bring perfect success, especially where the neighboring fruit-growers do not follow the same methods, and where these have not been practiced for several years together, or long enough for the cumulative effects to become apparent. It must also be remembered that it is only the worms of the first brood that are killed by the spraying, however effectually done, while from the individuals escaping this attack come the moths that are the parents of the worms that spoil the apples at maturity.

Moreover, spraying alone, though successful within its own limits, cannot insure the fullest product of perfect apples without the concurrent practice of other methods looking to the final reduction of the numbers of the pest. The most important of these associated methods is the banding of the trees and the destruction of the attracted worms every ten days, from the fall of the first wormy apple till the fruit is all in the bin; the second is the immediate destruction of all fallen worm fruit; and the third is the destruction of as many as possible of the worms wintering over under bark scales, in old birds'-

nests, in cracks in apple-bins or barrels, or elsewhere in the fruit-room. These associated practices are not to be expected to show their full results in the season in which the work is done, though the immediate value of the first is considerable as a means of reducing the number of worms of the second or later broods of the same season.

It is also possible that some of the reported failures are referable to the use of adulterated or low-grade poison. In several states the experiment stations find greatly inferior samples of Paris green on the market; and, while tests made at the Kansas Experiment Station a few years ago showed a fairly uniform high grade in samples analyzed, it is quite possible that those at present in our market may be found defective, as has been reported from neighboring states.

It is the purpose of the Kansas Station to repeat this year its former careful tests in spraying, if the apple crop gives opportunity, and we hope to be able to correct, by fresh evidence, the idea hastily expressed in some quarters, that spraying against the codling-moth is time and money wasted.

Meantime, we advise strongly that every fruit-grower continue his efforts to destroy the apple pest by all possible means. Especially should he continue spraying, and with careful attention to the conditions needful to success. It is only by perseverance in a united effort on the part of the orchardists that the apple crop may be brought to to its condition of highest profit. E. A. POPENOE.

Press Bulletin No. 67.- Botanical Department.
April 24, 1900

The Cultivated Catalpas.

The Experiment Station of the Kansas Agricultural College having received numerous inquiries in regard to catalpas and the characters by which the different species can be distinguished, this opportunity is taken to give descriptions of the forms commonly cultivated.

Catalpas are well known and easily distinguished from other trees by their large, heart-shaped, opposite or whorled leaves; showy, irregularly bell-shaped, white or yellowish flowers, more or less dark-spotted; and the long, slender seed-pods, which contain numerous flat, winged seeds.

The wood is very durable and much used for fence-posts and railway ties. Catalpas are propagated by seeds sown in the spring or by cuttings from the ripe wood.

There are three species in common cultivation:

C. *bignonioides* Walt. (*C. syringaefolia* Sims). A rather small tree, native of Southern states as far north as Tennessee, and planted

farther north. Leaves downy beneath. Flowers about two inches in diameter, white, with two yellow stripes within, and spotted purplish-brown. Pods about two-fifths of an inch wide when flattened out, and a foot or more long, with thin walls.

There are some garden varieties, such as *aurea*, with yellow leaves; *nana* (sometimes improperly called *C. bungei),* a bushy form; and *purpurea,* with young leaves purple.

C. speciosa Warder. Grows to be a larger tree and is more hardy in the North. This seems to be the commonest species cultivated in Kansas. It can be distinguished from the preceding chiefly by the flowers and fruit. The flowers are larger, two and one-half inches in diameter, much less spotted within, and fewer in a cluster. The pods are thicker and three- to four-fifths of an inch wide, and with considerably thicker walls and somewhat larger seeds. Its natural range is from southern Illinois and Indiana to Mississippi and Louisiana.

C. ovata Don. (*C. kaempferi* S. & Z.) A low tree, about twenty feet high, native of China. Hardier than the two preceding. Flowers smaller, only about an inch in diameter, yellow, with orange stripes inside and dark violet spots. The leaves are usually more or less angled at the sides and are nearly or quite smooth at maturity. The pods are very long and slender, only about one-fifth inch in diameter.

The species all flower in June. In addition to the above there is a hybrid, between *C. bignonioides* and *C. ovata,* called Teas' Japan Hybrid (also called *C. hybrida).* It is a profusely flowering and hardy tree.

A. S. HITCHCOCK.

Press Bulletin No. 68.-Entomological Department.
May 14, 1900.

The Buffalo Tree-hopper.

Numerous inquiries received by the entomological department of the Kansas Experiment Station from different parts of this and neighboring states, accompanied by specimens of apple twigs and branches showing the work of the buffalo tree-hopper, lead us to believe that the apple-growing public is becoming awakened to the abundance of this orchard insect, though not aware of the methods of avoiding the injury of its numerous punctures. The facts brought forth by correspondence with those who report the damage confirm the previously published deductions of this Station, where the true nature of these injuries was first made known. Upon inquiry as to the condition of the injured trees during the previous August and September, it appears in each case that the trees were grown at that time in weeds and grass, cultivation having been suspended for one

cause or another, and the orchard weeds allowed to grow unchecked. Inquiry from the same reporters as to the amount of injury in orchards where cultivation was not thus suspended shows in such an almost entire immunity from the work of the pest. The inference is too plain to need special argument. Clean culture during the late summer, to keep the ground free from the weeds on which the young hoppers feed, will protect the young orchard from attack. When the the trees are already badly punctured, the only thing that can be done is to cultivate generously the coming season, to keep the injured trees in the best of thrift, and so assist them in outgrowing the injury. It has been suggested by some that the injured branches should be pruned out and burned, thus reducing the number of the pests the next season, but if such a plan were to be put in practice it would result in many cases in the removal of entire trees, no part of the small tree being exempt from attack. The eggs, which are laid in August in the wounds in the bark, hatch the next May or June, and it is suggested by this Station that, at the time when observation shows the insects to be emerging, it will be possible to destroy most of the tender young by a spray of kerosene emulsion at a moderate strength. So much reliance may be placed upon clean culture, however, that this spraying is not considered necessary, though it is a practical method of destruction, if done at the right time.

E. A. POPENOE.

Press Bulletin No. 69.—Botanical Department
June 12, 1900.

The Cultivated Millets.

There are several different agricultural grasses of economic importance sold in the trade under the general name of millet; hence there is more or less confusion.

FOXTAIL MILLETS. To this group belong what is generally sold as "Common" millet, and also a number of other varieties, all belonging to the species known to botanists as *Setaria italica,* and which is considered by many to have been originally derived from the common weedy, green foxtail *(Setaria viridis).* The seed is borne in a compact cylindrical, often more or less nodding cluster at the top of the stalk. The seed can be distinguished by the numerous minute transverse wrinkles. There are four groups of varieties. 1. Common millet, which is more resistant to drought. 2. German millet, also called Golden millet, and Bengal grass, the commonest variety in the South; the latest of the Foxtail millets and coarser in foliage. Some of the so-called Japanese millets belong here. 3.

Golden Wonder millet, which, under favorable conditions, gives the largest yield of seed, but is susceptible to drought. 4. Hungarian millet, or grass, more commonly cultivated in the Northwest. This has the disadvantage of volunteering or persisting in the soil. The "New Siberian" millet is related to Hungarian grass, but may be a distinct variety. There are a number of different varieties of each of the groups mentioned.

BARN-YARD MILLETS. These have been long grown in the old world, both for forage and food for man, but have only recently received much notice in this country. They received their name from the fact that they are derived from the common and well-known barn-yard grass - a weed in cultivated soil. They are characterized by having the flowers in branching clusters like the barn-yard grass *(Panicum crus-galli),* and the seed smooth and about twice as long as the Foxtail millets. Barn-yard millet gives promise of making a successful forage grass in this country. Closely allied to this are the Shama millet *(Panicum colonum)* and Sanwa millet *(Panicum frumentaceum),* both grown extensively in India and other parts of Asia for the seed, which is used as food by the poorer classes. They do not give promise of success in this country.

BROOM-CORN MILLETS. These are derived from *Panicum milaceum.* This species has been cultivated for centuries in Europe, where it is the "Common" millet. It is not extensively grown in the United States, but is offered in the trade under the names of Broom-corn millet and Hog millet. The seeds are borne in loose, drooping clusters, the branches of the cluster being long and slender, somewhat resembling the seed cluster of broom-corn, whence the name. The seeds are from white to yellow and dark red, and, like the preceding sorts, are flat on one side and convex on the other, and resemble the Barn-yard millet in size and absence of wrinkles.

PEARL MILLET *(Pennisetum spicatum or P. typhoideum).* Extensively cultivated in Africa for the seed, which is used for food, and occasionally in the southern United States, where it is used for fodder. Plants tall and stout; the seeds borne in a dense, cylindrical cluster, but without the bristles characteristic of the Foxtail millets.

INDIAN MILLET *(Sorghum vulgare).* Certain varieties of sorghum or cane are very extensively grown in Africa and Asia for the seed, which is used for food. They also go under the names of Chinese millet, Black millet, African millet, Guinea corn, etc. At present these varieties of sorghum are not grown in the United States on a commercial scale.

A. S. HITCHCOCK.

Press Bulletin No. 70.— Botanical Department.
June 26, 1900.

Botanical Notes on Wheat and Spelt.

The wheats of the world are all referred by botanists to three species, which form a natural group among the grasses.

I. ONE-GRAINED WHEAT *(Triticum monococcum* L.). This wheat is of great antiquity, as is shown by its presence in the Swiss lake dwellings of the stone age. It is now cultivated to a considerable extent in Spain, and more rarely in some other countries of south Europe. It is not often used for bread, but for mush and "cracked wheat" and for fodder.

II. POLISH WHEAT *(T. polonicum* L.) This did not originate in Poland, but probably in Spain. It is now grown in that country and also Italy and Abyssinia. The grain resembles rye. The heads are very large and of a blue-green color. The Polish wheat of Russia which is being introduced by the United States department of agriculture and is being tried by the experiment stations of this country is not the true Polish wheat, but a variety of common wheat.

III. COMMON WHEAT AND SPELT *(T. sativum* L.) This group is divided into three races:

1. Spelt *(T. spelta* L.) This was anciently the chief grain of Egypt and Greece, and was commonly cultivated in the Roman empire. At present it is cultivated in a few localities in south Europe.

2. Emmer *(T. dicoccum* Schrank). This grain is cultivated more or less in countries of south Europe and in parts of Russia. Mr. M. A. Carleton, of the United States department of agriculture, has introduced varieties of this for trial. It was tried by the Experiment Station of the Kansas Agricultural College, but failed to mature. It is often called Russian spelt, but is different from the true spelt. In Russia it is sometimes used for making bread, but more often for gruel or porridge. This is advertised by the John A. Salzer Seed Company, under the name of "speltz." Seed obtained from that firm failed to produce a crop at the Kansas Experiment Station, only a few heads being formed, and these not producing grain. Like the preceding group, the Emmers are characterized by the fact that the grain remains within the chaff when thrashed. The heads are usually awned, but the awns (beards) are removed in the thrashing.

3. True wheats. This race falls into four more or less well-marked subraces:

(*a*). English wheat *(T. turgidum* L.) Leaves broad and usually clothed with velvety hairs. The grain is plump and truncate or cut off at the upper end. This wheat is cultivated in Mediterranean coun-

tries, and more rarely in England. It is poor in gluten and makes a grayish flour. The so-called Miracle, Egyptian or Mummy wheats *(T compositum* L.) form a group of varieties of this subrace, which originated as a sport. Their culture is not profitable, as the grains develop unequally.

(b). Macaroni, Durum or Flint wheats *(T. durum* Desf.) The heads have long, bristly awns like barley. The grain is very hard, and is used extensively for making macaroni and similar products. Grows in Mediterranean countries. In Russia it is used for making bread, mixed with ten to twenty-five per cent. of soft red wheat. The Kansas Experiment Station has some of these Russian varieties under trial.

(c). Dwarf and Hedgehog wheats *(T. compactum* Host.) These varieties are grown in the mountainous regions of Europe, Chili, Turkestan, and Abyssinia, but are of little interest to us.

(d). Common wheat *(T. vulgare* Vill.) The varieties of this subrace are the common forms cultivated in the United States and need no further description at this point. The soft wheats contain less gluten; the pronounced sorts, such as the English wheat mentioned above, under (*a*), are better adapted for making starch than baking. The very hard kinds are overrich in gluten, and bread made from them is too firm. They are used for making macaroni, "cracked wheat," and mush. Several promising Russian varieties are being tried at the Kansas Experiment Station and were crossed this season with some of our best Kansas varieties. A. S. HITCHCOCK.

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NOTICE.

The Bulletins of the Experiment Station issued during a fiscal year constitute a volume, and are paged consecutively. They are not reprinted with the Annual Report.

The Annual Reports since 1889 do not contain matter of general interest, and are printed in but small numbers.

The Press Bulletins are sent to all of the newspapers of the state, to many public officers, and to some other persons who have exceptional opportunities for giving them publicity.

The Bulletins will be sent free of charge to all residents of Kansas who apply for them. Address:

AGRICULTURAL EXPERIMENT STATION, Manhattan, Kan.

W. Y. MORGAN, STATE PRINTER.
October 1900.

NOTICE.

The Experiment Station desires to increase its usefulness by extending the knowledge of its work. One means looking to this end is the issue of Press Bulletins. As the name implies, these are not for general distribution, but are designed for the press. They are sent to every newspaper in Kansas and are issued weekly, as a rule. The special object of this notice is to urge the reader to use his influence, and ask others to do the same, to induce the local papers to reprint these Bulletins regularly. The papers will undoubtedly be glad to print them if convinced that the farmers wish them to, and a few requests will be sufficient. The press bulletins are short, timely, readable articles, consisting wholly or in part of statements of results of experiments or observations of the Experiment Station force. They are disinterested, and are believed to be thoroughly reliable.

Another way in which you can assist in extending the influence of the Station is by sending in the names of those whom you know would value the regular Bulletins. In doing so, please write the name and address very plainly and send to

AGRICULTURAL EXPERIMENT STATION, Manhattan, Kan.