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EXPERIMENT STATION.

KANSAS STATE

Agricultural College.

Bulletin No. 86-June, 1899.

PRESS BULLETINS

Nos. 1 TO 34.

MANHATTAN, KANSAS.

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INTRODUCTION.

The Kansas Experiment Station, in August, 1898, began to issue weekly press bulletins which were intended to be sent to the papers thruout the state. The papers to which these bulletins were sent were asked to make use of the material found therein whenever in their judgment it would be to the interest of their subscribers. It was hoped in this way to get the results of the various experiments at the Station before the farmers at a time when they would be most helpful.

The great demand for these bulletins, together with frequent calls for the whole series, seems to justify their re-publication in a permanent form. Numerous letters from all over the state of Kansas, as well as other states, have been received, assuring us that these press bulletins have been highly appreciated and are proving very beneficial to the farmers of Kansas.

The regular pamphlet bulletins of the Kansas State Agricultural Experiment Station, will be sent, when asked for, to any farmer in this state. The applicant's name may be placed on the permanent mailing list, so that he will receive all new bulletins as they are issued; and he may in addition receive any desired bulletin that has been printed in the past, provided it is still in stock. The list of bulletins that have been issued is printed from time to time in the new bulletins. Address Kansas Experiment Station, Manhattan, Kansas.

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Press Bulletin No. 1.—Farm Department.
August 2, 1898.

Wheat Experiments.

Wheat went thru the winter in good condition and started well in the spring, when March 22 a freeze cut it to the ground. This delayed ripening two weeks, making it so late that it was caught by the black rust after the usual time of ripening. The black rust appeared June 17 as most of our wheat was in the dough, and in three days wheat that had promised a yield of 30 to 40 bushels per acre was hardly worth cutting, the plants were dead, the straw fallen over, and the grains shrunken to less than half size.

We grew fifty-four varieties, but most of them were so badly injured by the rust that they were not cut. The highest yield of the Turkey, our standard hard wheat, was 18 bushels per acre, while the highest yield of the Zimmerman, our standard soft wheat, was 28 bushels per acre.

A test was made to determine whether it is best to plow the ground in a drouth and harrow it into shape ready for seeding at the usual time or wait until a rain comes and then plow. The early plowing was made July 30, the ground turning up hard and lumpy. It was worked with harrows and float until in fair tilth. October 16-17 a rain fell, wetting the ground four to six inches, and the late plowing was made, the land fitted, and both early and late-plowed plats seeded. From the time the wheat started until it was struck by the rust, that on the early-plowed ground appeared more thrifty and promised a better yield. The rust ruined all plats. The early-plowed land yielded 6.4 bushels per acre, the late-plowed 6.5 bushels.

A trial was made of ordinary and thoro preparation of ground for wheat. That given ordinary treatment was harrowed and floated until in fair condition, but having many small clods on the surface, a condition liked by many Kansas wheat growers. That given thoro treatment was gone over with disk harrow and float until a fine dust mulch four inches deep was made. The ordinary treatment yielded 19 bushels per acre, weighing 53.7 pounds per struck bushel. The thoro treatment gave 22.4 bushels per acre, weighing 54.7 pounds per struck bushel, a gain in yield of nearly 18 per cent for thoro treatment.

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Two trials were made of ordinary treatment of ground for wheat, thoro treatment, and treating it with the Campbell sub-surface packer. In one test the yields were, ordinary treatment 15.5 bushels, thoro treatment 17.7 bushels, and treated with the sub-surface packer 18.4 bushels. In the other trial the yields per acre were, ordinary treatment 8.6 bushels, thoro treatment 9.8 bushels, sub-surface packer run over the ground once 10.4 bushels, and packer used three times 10.7 bushels.

The Station has had an acre in wheat continuously for the past eighteen years without manure to test the fertility of the land. This year just before the appearance of the rust this acre promised a yield of 30 bushels. The wheat was nearly destroyed by the rust and the yield was 9.77 bushels. The product of eighteen years has been 342.5 bushels, an average of 19 bushels per acre.

The chief work of the Station this season in wheat has been in crossing varieties to secure higher yields and more gluten. Three thousand crosses were made this summer and will be planted this fall.

Press Bulletin No. 2.—Farm Department.
August 9, 1898.

Keeping Milk in Hot Weather.

Many patrons of creameries and cheese factories cannot keep their milk sweet for the daily delivery, and more lose Saturday night's and Sunday morning's milk—one—seventh of their entire product. This loss is unnecessary and may be prevented by care that can be given on any farm.

The souring of milk is caused by bacteria which are in the dirt on the cow's udder, milker's hands, pails, strainer and cans and in the dust in the air. Under favorable conditions these bacteria double every twenty minutes, and a single germ in a pail of warm milk increases to eight germs in an hour, 64 in two hours, 4,096 in four hours, and at the end of twelve hours if the growth was unchecked it would require eleven figures to write the number of bacteria springing from a single germ. With careless milking 500,000 germs have been found in a cubic inch of fresh milk.

The first step in keeping milk sweet is to get it clean, i.e., free from bacteria. Clean dairy utensils by rinsing in lukewarm water, then thoroly scrub in hot water and scald with boiling water or steam and expose to the sunlight. Boiling water and sunlight kill the germs found in dirt in nails and cans. Just before milking the

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milker should wash his hands in hot water, as the dirt on the hands is full of germs. We milk in a pail that has a top soldered to the sides. In the top a six-inch hole is cut, into which fits a strainer. The strainer is taken out to be washed and the opening gives room for washing the pail. This pail keeps bacteria in the fine dust from the cow's body from getting in the milk. Brush the cow's udder with a damp cloth just before milking and milk in a place free from dust. Strain the milk thru the ordinary wire screen and thru one thickness of canton flannel or four thicknesses of cheese cloth, treating the cloth with boiling water just before using. This method will give milk with few germs.

Cool milk as soon as drawn, for if kept twenty or thirty minutes before cooling the souring germs in it may double. The cooler milk is kept, the longer it will stay sweet. Milk held at 40° has been kept sweet a week in August. The germs which sour milk grow best at blood heat, at 60° growth is slow, at 50° very slow, and at 39° it stops. Water in Kansas wells stands at about 57°. With it clean milk can be cooled and held at 60° and kept sweet easily thirty-six to forty-eight hours in our hottest weather. The best method of cooling is to use a cooler in which the milk flows over a chilled surface in drops, cooling each drop thoroly and quickly.

After the milk is cooled put the cans containing it in a tank of cold water and keep at 60° or less. If the dairyman has a windmill this is easily done by letting a small stream of fresh water flow thru the tank. At the Agricultural College milk is kept good forty-eight hours without either ice or windmill. The milk is cooled to 60° on a Star Cooler with well water put in forty-quart cans and the cans set in half barrels filled with well water. The barrels are packed with chaff and the water changed night and morning. Dairymen living a long distance from the creamery or having little milk can follow the College methods and deliver their milk in good condition every other day, saving a heavy expense for hauling.

In delivering to the creamery, have a cover on the wagon, cover the cans with a wet blanket, over which put a dry cover. This will hold the temperature down until the milk arrives at the creamery. July 26 we made an examination of the milk delivered at a creamery and found the lowest temperature to be 71°, while three-fourths of the patrons delivered milk at 80° or higher, one patron's milk standing at 97°. At such temperatures milk might leave the farm sweet and arrive at the creamery sour. Milk carried in a covered wagon,

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but without blankets over the cans, raised 10° in hauling one and a half miles.

Press Bulletin No. 3.—Horticultural Department.
August 16, 1898.

The Fringed-Wing Apple-Bud Moth.

During the last two years the Fringed-wing Apple-bud Moth *(Nothris maligemmella)* has been doing considerable damage in various parts of the state. Judging from its work here and what it has done in Missouri, it promises to be a very troublesome if not one of the most destructive pests attacking our apple trees. The insect was seen in Riley county one year ago last spring, but as the injuries from it were comparatively insignificant it attracted but little attention and remained unidentified. So far as has been ascertained the insect is pretty well confined to the eastern counties of the state. During the spring of the present year, Professor Faville and assistant made several trips to various parts of the state, and reported the presence of the pest in nine counties, comprising Johnson, Leavenworth Douglas, Wyandotte, Jefferson, Osage, Greenwood, Wabaunsee and Riley.

The Entomological department desires to ascertain the present distribution of the pest, and to that end solicits correspondence from those suspecting its presence in their communities. The following facts regarding its appearance and life history will assist in its identification. That it may not gain a much wider distribution a number of remedial measures are given, some of which should be used as soon as any work of the pest is discovered.

The insect attacks the apple principally. A more extensive examination will no doubt reveal that it is common to other fruit trees. In Manhattan it was found on the pear, peach and plum, but in much less numbers than upon the apple.

The adult is a small moth with an expanse of wings of about two-thirds of an inch. It is of a brownish buff color with more or less bluish gray shading on thorax, wings and body.

The following is a brief description of the life history of the insect: The adults appear early in the spring and the females commence to deposit very small yellow eggs singly in the expanding buds and leaves. The eggs are usually deposited at night and the number laid by one female is estimated to be about twenty-five. The eggs hatch in about a week. When the larvae or worms first emerge from the eggs they are very small, about one twenty-fifth of an inch

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in length, and are of a light yellow color, with the head a shining black, and the upper part of the next segment brownish. It is these little caterpillars or worms that do the damage. The larvae begin to feed upon and to attack the buds or adjacent leaves. The damage to the buds is the most serious. When these are attacked the larvae draw several of the central leaves of the buds together over themselves as a sort of protection; and within the shelter thus provided they work their way down the center or heart of both the flower and leaf-buds. It is not long before the young shoot with its terminal bud and developing leaves and flowers is cut off, or injured to such an extent that it soon withers and dies, thus destroying the prospect for next year's crop, besides checking the growth of the shoot. Often the larvae are so numerous about the buds that they are compelled to abandon the buds and seek the leaves. This they will do either by dropping down to a lower leaf by means of a tiny thread or by crawling down the shoot, wandering from one place to another till a suitable leaf is found. Upon reaching a leaf they will draw the edges of it together by fine threads, making a sort of a case, in which they rest when not eating. When there are no close adjoining leaves they will commence to feed on the leaf furnishing them shelter. Some seem to prefer the petiole of the leaf to the leaf itself. and in a number of instances the petiole or stem is severed. causing the leaf to fall to the ground with the larva. In a severe attack the buds and terminal leaves are often injured to such an extent that the trees have a brownish appearance. Besides attacking the leaves and the buds the larvae also eat away the stem of the young apples just forming, causing them to fall, and in some instances bore into them, inducing them to shrivel. The first brood of larvae this year lasted from the 15th of April to the 4th of June.

Owing to its peculiar habits the pest is a difficult one to combat, necessitating, as it does, very close observation upon the part of the operator to determine just when the larvae are hatching. Then, just when the larvae are emerging, is the time to spray. Also one must take into consideration that larvae will appear from eggs laid later than the first. To combat these a second spraying is necessary, and possibly a third or fourth in order to guard against later appearing larvae. Spraying with Paris green or London purple at the rate of one pound to 150 gallons of water, with from one to two pounds of lime, is the most effective remedy.

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Press Bulletin No. 4.—Chemical Department.
August 23, 1898.

Soil Moisture and Soil Stirring.

The proper time for fall plowing for wheat is in the summer, as soon as possible after the removal of the preceding crop. Rarely, if ever, a summer passes in Kansas without a period of drouth between July 1 and September 1. Water is the most important constituent likely to be deficient in Kansas soils. The annual rainfall in nearly all parts of the state is nearly always sufficient to produce a crop if its precipitation could be controlled, or if, when fallen, the moisture could be conserved. Rain-makers have fallen into deserved obscurity, but means of moisture conservation are worthy of careful investigation.

The Kansas Experiment Station is studying the effect of various modes of soil treatment upon soil moisture. That the well-known effect of a mulch can be approached by proper tillage of soil is a fact not as widely acted upon as good farming dictates. One of the station fields which contained in round numbers 26 per cent of water in the first foot of soil, on July 7, 1898, had one portion plowed, another disk-harrowed and a portion left untreated. The ensuing dry weather in the course of four weeks, notwithstanding several light rains, reduced the moisture of the untreated part to 15 per cent and that of the disked land to 18 per cent, the plowed ground retaining 21 per cent. The last two were in excellent condition for seeding, while the first would plow up lumpy and unsatisfactory.

The weight of an acre of the dry soil to the depth of one foot may be taken as 1,600 tons. Each per cent of water in soil to that depth represents about sixteen tons of water per acre, or one-seventh of an inch. The water apparently lost by the untreated soil was 176 tons per acre, equivalent to over one and one-half inches of rain. This is about one-half what the soil would hold after a soaking rain. The real loss was much more than this, since as water escaped from the upper foot, other would be drawn up from below by capillary attraction. The figures given are minimum quantities, therefore.

Stubble ground should unquestionably be plowed while the moisture is still in the soil. Experiments of the Station show that simple plowing is quite as effective for moisture conservation as any tillage yet tested. If time does not permit plowing, the speedy work of the disk harrow compares favorably in efficiency. In either

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case, if rain follows sufficient to start the weeds, kill them with a harrow. This will at the same time break up any crust and preserve the soil mulch. This treatment not only insures a perfect seed-bed for wheat in respect to moisture, but the soil has time to settle to the firm condition so advantageous to wheat, and the bareness, warmth and moisture are most favorable to the formation of nitrates from organic matter. Nitrates are highly important for successful wheat production.

Press Bulletin No. 5.—Veterinary Department.
August 30, 1898.

Blackleg.

Blackleg also known as Symptomatic Anthrax or by the French name of Charbon Symptomatique, was formerly regarded as a form of anthrax; but bacteriological examinations have shown conclusively that blackleg and anthrax are two distinct and independent diseases, each of which is caused by a specific micro-organism.

For the Kansas stock-raiser no disease is of greater interest than blackleg. It is the cause of enormous losses in cattle herds, attacking chiefly the young and thrifty calves.

Native cattle above 4 years and calves under 6 months old are rarely attacked; I have, however, observed a well-marked and fatal case of blackleg in an unthrifty calf 10 weeks old.

Blackleg is an infectious disease, produced by the blackleg bacillus, a facultative parasite, which lives and propagates in the soil of infected districts and in the bodies of the diseased animals. Certain kinds of soil are very favorable to the existence of this germ, and such soil when once infected usually remains so permanently and constitutes the source of the disease in animals. Although infectious, blackleg is, strictly speaking, not a contagious disease; i.e., the disease owes its existence to an infecting principle, the blackleg germ, but a diseased animal does not transmit the disease directly to a healthy one. Healthy animals become diseased when the germ enters a wound in the skin or mucous membrane of the body. Such wounds can easily be produced on the legs while roaming over the ranches, or at the mouth while grazing. The body of an animal that has died of blackleg swarms with disease germs, and a small quantity of the diseased muscle of such an animal when inserted under the skin of a healthy animal will produce the disease. Similarly, the burying ground of such

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an animal becomes infected with these germs, which remain in a virulent condition an indefinite time, and thus becomes a new source of infection. Hence, animals that have died of blackleg should not be buried, but burned on the spot where they died. Unnecessary moving of such an animal from one place to another simply increases the danger of spreading the infection.

The characteristic symptom of this disease, and by which alone it can usually be recognized, is the appearance of large swellings on various parts of the body, usually on or near the upper portions of the legs and never below the hock or knee joints. The swellings vary in size, but are always formed by the presence of gas that has collected in the tissue meshes beneath the skin. This gas is a product of the blackleg bacilli. When the hand is passed over these swellings a characteristic crackling sound is produced. When incised with a knife a bloody fluid with a disagreeable and sickening odor is discharged. The principal general symptoms of the disease are loss of appetite, high fever, and lameness when the muscles of the legs are affected. Nearly all affected animals die within one and one-half to three days from the time of attack.

Medicinal treatment of this disease may at present be considered as absolutely useless. The only practical method of dealing with the disease is to prevent it. Keeping animals away from infected ranges or parts of ranges is an absolute protection. Sometimes this is impossible, and then protective inoculation must be resorted to. It is a well-known fact that vaccination or protective inoculation prevents almost entirely the appearance of the disease. The Experiment Station has manufactured vaccine which will soon be ready for free distribution among the stock-raisers of Kansas.

NOTE—May 23, 1899. This vaccine has since been made and distributed. Since October 15, 1898, enough for 54,000 calves has been given out. In every case, where directions were followed, the disease has been stopped.

Press Bulletin No. 6.—Horticultural Department.
September 6, 1898.

The Sand Plum.

Among the native fruits of Kansas there is none more interesting or valuable than the sand plum *(Prunus Watsoni).* Distributed abundantly over the western half of the state, it borders the streams and covers the adjacent sand-hills, sometimes extending into the clay uplands, but always at a loss of vigor in growth and quality in fruit.

In its natural habit it attains a height of from two to eight feet,

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having usually a tree-like form, though often branching and bearing fruit from ground to top. Branches horizontal with a tendency to zigzag and tangled growth, and often terminating in sharp, spiny points. Twigs slender, of cherry red color and abundantly supplied with lenticels. Leaves thick, glabrous, very finely serrate, serrations sometimes so pointed as to be spiny. In shape leaves are usually acutely lanceolate, in length varying from one-half to two and one-half inches, and in habit conduplicate or trough-like when exposed to brilliant sunlight, but almost flat in dim light. Blossoms small, occurring in dense clusters in early spring. Fruit oblong to round, yellowish pink to dark red, one-half to one and one-fourth inches in diameter, ripening from July 1, to September 15. Stem one-fourth to three-fourths inches long, slender. Pit small, roundish to long, slender and pointed. The plant propagates most rapidly by sprouts from the roots. If a specimen is dug from a thicket it will generally be observed to have but a single large root, eight or ten inches below the surface, which extends to it and passes on, supporting perhaps half a dozen other bushes.

The sand plum has varied into many types. But it has not produced, as we might suppose, different types for different localities; it has crowded them close together, often in the same or adjacent thickets. Near the Arkansas river were found as many as six perfectly distinct types on a ten-acre lot. Profusion of varieties is to be noted in every favored location.

It has been thought that the roots of this hardy plum might make valuable stocks for the grafting of domesticated varieties, but experiments at the Station tend to prove the reverse. Numerous varieties were grafted, using *Prunus Watsoni* as the stock. Failure in almost every instance was the result. The tender, succulent roots do not unite readily with a foreign scion. Even if a union were secured, the propensity of the stock to sprout would at once exert itself, resulting soon in a dense thicket. The propagation of the species is easily accomplished by means of root cuttings or seeds, preferably the latter.

The following forms are the most valuable we have been able to find:

1. A common type growing in almost pure sand, four to ten feet above the water level. Bushes in scattering thickets, two to four feet high, branching and bearing fruit from the ground up. Leaves small, one to two inches long, never open to a plane surface, thick,

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shining, finely serrate. Fruit three-fourths to one and one-eighth inches in diameter globose. Color, bright red clouded over lemon yellow ground. Flesh yellowish, tender, juicy, sweet, somewhat fibrous, and adhering firmly to stone. Ripe in southern Kansas the first week in July.

2. A small group of bushes growing in a very large thicket on the Arkansas river. Bushes extremely dwarfish but tree-like, three to four feet high. Branches unusually stout, growing laterally more than upright. Leaves larger than on common types, dark, shining green. Fruit large, one inch to one and one-fourth inches in diameter, rounded or flattened. Color dull red but somewhat hidden by the heavy bloom. Flavor excellent. Ripe in latter part of July. A variety surpassing many cultivated sorts.

3. A small clump of bushes found near the variety last described. Bushes small, two to three feet high. Foliage scant, leaves small. Fruit fine in appearance, one inch to one and one-fourth inches in diameter, roundish, bluish pink color with delicate bloom. Skin thin. Flesh juicy, melting, rich. Flavor sweet and good. The most delicious sand plum that has yet come under our observation and worthy of place in any orchard.

The hardiness of the sand plum in its native state, its productiveness, and the excellent quality of its fruit are among its most promising characteristics. By cultivation and proper breeding, the size, keeping and shipping qualities of this plum will, it is thought, be strengthened. The Experiment Station has now in operation extensive experiments along these lines. During the past season a large collection of data and of pits for planting has been made from the sand plum districts of the state.

Press Bulletin No. 7.—Farm Department.
September 13, 1898.

Kaffir Corn for Fattening Pigs.

Last winter sixteen experiments were made at the Kansas State Agricultural College to test the value of kaffir corn as compared with corn for fattening pigs and to find the best methods of feeding kaffir corn.

With pigs 7½ months old at the beginning of the experiment, averaging in weight 188 pounds and fed seven weeks, the gains per bushel of feed were as follows:

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	Pounds.
Whole kaffir corn, fed dry	10.3
Whole kaffir corn, soaked forty-eight hours	8.8
Kaffir corn meal	11.7
Shelled corn, fed dry	12.3
Kaffir corn meal and corn meal, equal parts	12.3
Kaffir corn meal four-fifths, soy bean meal one-fifth	13.9

All lots were in good marketable order at the close of the experiment. With this class of hogs 83.7 bushels of corn equaled 100 bushels of kaffir corn. The loss from soaking kaffir corn was 17 per cent and the gain from grinding was 15 per cent, which with kaffir corn at 25 cents per bushel would give 3¾ cents per bushel for the grinding.

With pigs 6 months old at the beginning of the experiment, average weight 123 pounds and fed eleven weeks, the gains per bushel of feed were as follows:

	Pounds.
Whole kaffir corn, fed dry	6.5
Whole kaffir corn, soaked forty-eight hours	7.3
Kaffir corn meal	9.4
Shelled corn, fed dry.	11.2
Kaffir corn meal and corn meal, equal parts	11.1
Kaffir corn meal four-fifths, soy bean meal one-fifth.	13.2

At the conclusion of this trial the last two lots were ready for the market; part of the pigs fed kaffir corn meal and shelled corn were in poor condition. Those in poor condition were put on rations of equal parts kaffir corn meal and corn meal, and kaffir corn meal four-fifths and soy bean meal one-fifth, each lot having skim-milk, and they fattened quickly.

Pigs 9½ weeks old, averaging 35 pounds each, were given grain and turned on alfalfa pasture for eight weeks, ending January 7. Not considering the alfalfa, the gains per bushel of grain were as follows:

	Pounds.
Kaffir corn meal	12.6
Corn meal	13.1
Kaffir corn meal two-thirds, soy bean meal one-third	18.0
Corn meal two-thirds, soy bean meal one-third	17.2

January 17 these pigs were taken from the alfalfa pasture and fed for eight weeks in pens, with gains per bushel of grain as follows:

	Pounds.
Kaffir corn meal.	10.4
Corn meal.	11.5
Kaffir corn meal two-thirds, soy bean meal one-third	15.4
Corn meal two-thirds, soy bean meal one-third	15.6

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At the close of the experiment the pigs fed kaffir corn and corn averaged respectively 110 and 111 pounds each, and were rough and lank. The pigs fed kaffir and soy bean meals averaged 164 pounds, those fed corn and soy bean meals 154 pounds, and both lots were well rounded out and were sold at good prices for light fat hogs.

These experiments show that kaffir corn is similar to corn in fattening qualities but not equal to it, and that if a small quantity of feed rich in protein, as alfalfa, soy beans or skim-milk, is added to the ration of kaffir corn, good results are obtained. Kaffir corn has advantages over corn for many parts of the state as a crop to raise for fattening pigs. On the College farm for the last nine years the average yield per acre per year for kaffir corn has been 45.9 bushels and for corn 34.2 bushels. Averaging the results obtained from fattening pigs 6 months of age and older, we have for the College farm an average per year per acre of 454 pounds of pork from kaffir corn and 402 pounds of pork from corn. In the western half of the state the difference in favor of kaffir corn is much greater; as in 1897, in fields where corn yielded 1 to 5 bushels per acre, the yield of the kaffir corn was 25 bushels.

The soy bean is one of the best drouth-resisting crops, and if farmers will raise this crop as well as kaffir corn, or corn, pigs can be fattened profitably in every part of the state.

Press Bulletin No. 8.—Botanical Deparment.
September 20, 1898.

Some Reasons Why Fruit Does Not Set.

In order that fruit shall set it is necessary that the flowers be fertilized. Fertilization is the union of the pollen with the ovules, which are the small bodies that develop into seeds. Fertilization is essentially the same in plants and animals. A perfect flower consists of stamens, which produce the pollen, and pistils, which contain the ovules. In some flowers, however, the stamens and pistils may be produced in separate flowers on the same plant, as the corn; or even on different plants, as the willows and cottonwood.

When the pistils are fertilized by pollen from the same flowers, the flowers are said to be self-fertilized. This can happen only in perfect flowers. Self-fertilization usually takes place in wheat and other cereals and in some other plants. However, most plants, especially those having showy flowers, are not fertilized by the pol-

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len from the same flower, but from a different flower; that is, they are cross-fertilized. The reason for this has been proven experimentally to be that cross-fertilization usually produces hardier progeny than self-fertilization. (It should be borne in mind that these remarks do not necessarily apply to hybridization, in which the pistil is fertilized by pollen from a different species.) In cross-fertilization the pollen may be transferred from one flower to another by wind or by insects. In our common edible fruits the pollen is carried by insects. As a rule such plants have flowers which secrete nectar, and the insects visit the flowers for the nectar, accidentally carrying the pollen upon their bodies. Bees, especially honey-bees, are the most important insects in this respect.

There are four important reasons why fruit may fail to set:

1. The pollen may be insufficient in quantity. This applies particularly to the strawberry. Many of our cultivated varieties, the so-called pistillate sorts, produce only a small amount of pollen, not enough for complete fertilization (such as Bubach, Warfield, Crescent). A failure from this cause may be easily prevented by planting pollen-producing varieties (the so-called staminate sorts) alongside the others (such as Capt. Jack, Parker Earle, Gandy).

2. Insects may be prevented from visiting the flowers during the receptive period. If bees are kept from fruit blossoms by netting or other artificial means, the amount of fruit set is little or none. It not infrequently happens that inclement weather prevents or hinders the flying of bees during the period when the flowers are receptive. A fruit tree, half of which was subjected to a continuous spray of water during the flowering period, produced no fruit upon the sprayed portion, but an abundance upon the other. A failure due to the above mentioned cause can not well be prevented, but may be modified by having bees near at hand to utilize the short favorable periods which do occur.

3. In some varieties of fruits the flowers are self-sterile and refuse to take pollen even from another flower on the same plant. Fertilization can then take place only when the pollen comes from a separate plant, that is from a plant arising from a separate seed. All our varieties of orchard and small fruits are reproduced by cuttings, grafts, buds, layers or other similar methods and not from seed, hence are merely one plant cut up into a great many parts. Therefore in self-sterile varieties (such as Bartlett pears, the Brighton, Merrimac and Wilder grapes) the pollen must be obtained from another variety. Isolated plants or large orchards of a single

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variety may fail to set fruit from this cause. To prevent such failures mix the varieties. The quickest way to remedy cases which have reached maturity is to top graft another variety upon them in sufficient quantity. (The Seckel and Kieffer pears and the Concord, Niagara, Agawam and Green Mountain grapes are self-fertile.)

4. An insufficient supply of bees will hinder the setting of fruit. While other insects may take part in the carrying of pollen, the fruit-raiser must rely chiefly upon honey-bees. Experience shows that tho hungry bees may fly two or three miles, hives should be within half a mile of the orchard or small fruit patch.

Press Bulletin No. 9.—Entomological Department.
September 27, 1898.

The Peach Twig-Borer.

A number of inquiries have been received at the Department of Entomology, concerning the peach twig-borer, which, during the past summer, has been doing more or less damage in various parts of the state. It is in response to these inquiries that the following information regarding the pest is offered.

Altho the insect seems to be common in the eastern part of the state, the department has no record of its doing any extensive injury. It certainly does not commit at present such depredations as it is known to do in some of the other states. In this state the insect has only been observed to attack the peach, while in other states, noticeably Oregon and California, it has a wider food range, attacking the peach, pear, apricot, prune, nectarine and almond trees.

The damage to the trees is done by the larvae, or worms, which bore into the terminal shoots of the new growth, causing them to wither and die, thus checking the growth of the twig.

The adult is a small moth, with an expanse of wings of about one-half of an inch, and is of a dark gray color, with darker spots on the fore-wings. The moth seems to deposit her eggs at the base of the petioles of the leaves. The eggs when first deposited are white in color, but just before hatching they turn to an orange color. They are about 1-60 of an inch in length by about 1-125 of an inch in width, and are attached to the twig by a gluey substance.

The young larvae, or worms, appear in about two weeks from the time that the eggs are laid. When just emerged from their

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eggs they are about 1-25 of an inch long, of a yellowish color, with the head and the upper part of the next segment black. The young larvae bore into the terminal buds of the new growth of the tree, causing the terminal buds and shoots to wither and die, and finally to fall to the ground. The larva does not confine its attack to one shoot, but in time will abandon the original burrow for more tender branches. Thus in the course of its life history one larva will destroy a number of terminal buds and shoots. In the case of the peach there is considerable exudation of gum from the wounds made by the larvae. When the larvae are numerous the tree of necessity suffers a check in its growth, and its appearance is marred by the uneven and irregular growth that follows such an attack. The mature larva is about three-eighths of an inch long, of a reddish brown color, with the head and the upper part of the next segment a dark brown or black.

From the observations made this summer the following record was made of the appearance of the different broods:

May 17, 1898.—Larvae were collected averaging about three-eighths of an inch in length.

May 24.—Larvae were beginning to pupate.

June 7.—First appearance of adults.

June 20 to 26.—Larvae were collected averaging about one-eighth of an inch in length.

July 9.—Larvae were collected averaging about five-sixteenths of an inch in length.

June 28.—Larvae were beginning to pupate.

July 10.—All the Larvae had pupated.

July 7.—First appearance of adults.

July 26.—Last appearance of adults.

August 5.—Larvae were collected averaging about three-eighths of an inch in length.

August 26. —First appearance of adults.

The department was not able to find the pupae out of doors, but in confinement the larvae seem to pupate in any sheltered spot, as in dried and shriveled leaves. By spinning a few threads the larvae would draw the edges of the leaves together about themselves, and within the shelter thus provided they passed into the pupal stage. Often they would not go to the trouble to find shelter but would attach themselves unprotected to the sides of the breeding-case.

By consulting the above record of the different broods it will be

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seen that the pupal stage lasts from nine to fourteen days. The pupae are brown, somewhat robust, and are about one-fourth of an inch long by one-third as wide.

To combat the insect one should cut off and destroy all twigs containing the larvae.

Press Bulletin No. 10.—Farm Department.
October 4, 1898.

Fall Preparation for Alfalfa Seeding.

Alfalfa is necessary to the cheapest production, under Kansas conditions, of beef, milk and pork. For young stock of all kinds it supplies the materials needed to develop bone, muscle and rapid growth. When alfalfa hay is used as the roughness in fattening steers, a large saving in grain is made, conservative feeders estimating the saving to be from 25 to 50 per cent. Alfalfa can be combined with the ordinary feeds grown on Kansas farms to make a good milk-producing ration without the need of any purchased feed, and induces an abundant flow of milk with good butter-making qualities. In pig-raising, alfalfa pasture with corn or kaffir corn makes a rapid growth at a low cost, the alfalfa supplying the material lacking in the other feeds. At this College pigs were pastured through the summer on alfalfa with a light feeding of corn. After deducting the probable gain from the corn, we had a gain per acre from the alfalfa pasture of 776 pounds of pork.

At least one good crop of alfalfa can be harvested in the dryest year in any part of Kansas, and in most years under favorable conditions from three to five crops are harvested. When once established it lives for years; it roots deeply and withstands drouth well.

Alfalfa collects plant food from the air, storing it up in the soil. Where a Kansas farm has been cultivated until the crop yield is reduced, then alfalfa grown on a part of the farm and fed to stock, together with the grain raised on the remainder of the land, will produce as much or more beef, milk and pork as the grain from the whole farm, and at the same time will increase the fertility of the soil. By rotating after a part has been made fertile, the whole farm can be brought back to its original condition of fertility and a profit secured while the work is being done.

Alfalfa is weak when young and on many soils is hard to establish. It grows best on a rich loam with a porous clay subsoil where water is not over twenty feet from the surface, but we have found it growing on high uplands in both the eastern and western parts

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of the state where water was from 125 to 175 feet from the surface, and it is probable that it can be grown on some spot on almost every section of land in the state.

Alfalfa needs a fine seed-bed in ground free from weeds. Seeding should be done early in April and the ground handled so that at seeding time it will be moist for at least fifteen to twenty inches. This condition can be secured on many soils by fall plowing, pulverizing the soil to a depth of five or six inches with a disk harrow before plowing, making the whole depth plowed mellow. Soil inclined to blow can be lightly ridged or sub-surface packed after plowing. In western Kansas a successful alfalfa-grower runs furrows through the prairie surrounding his alfalfa to conduct the surplus water from each rain to the field. This may be done to get moisture into the soil during the winter before seeding.

Alfalfa roots deeply and must have a subsoil which it can penetrate. Where the subsoil is impervious, a subsoiler can be used, or where there is no danger from washing the ground can be thrown up into high, sharp ridges just before freezing. The frost will thoroly pulverize the ridges, putting them in good condition for a seed-bed when levelled in the spring, and will pulverize the subsoil in the furrows deeper, better and cheaper than a subsoil plow.

Each farmer must use his judgment as to the best method to follow, using that method which will put his land in proper condition at least cost. With few exceptions, every farmer in the state who does not have a field of alfalfa should sow one next spring, and it will pay many farmers to enlarge the area already seeded to this crop. Preparation should be made this fall. It will pay.

Press Bulletin No. 11.—Department of Horticulture and Entomology.
October 18, 1898.

Celery.

Celery is one of the most palatable vegetables to be found on American tables. Its cleanness, brightness and crispness, together with its delightful odor and flavor, are the qualities that make it welcome and that have caused the demand for it to increase more rapidly than the supply.

Its culture has, however, spread rapidly in recent years, as a variety of soils has been found upon which its production is certain and very profitable. At the present time there is scarcely a town of any size in our state whose gardeners do not include celery

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among market crops, while it has also found an honored place in many family gardens.

During the last four years celery has been grown as an experimental crop at this Station. Its culture has become more successful as better methods have been worked out and adopted. Our work with the crop during the past season has been attended with marked success. From the results obtained at this Station and from data collected in various portions of the state, we feel confident in making the following cultural observations:

OBTAINING PLANTS.

Home-grown plants have given better results than those obtained from commercial growers. Fresh seed should be sown in rich soil in hot-bed or cold-frame about April 1. Rows should be six inches apart and the seed covered to a depth of one-eighth inch, Firm the earth over the seed and shade lightly. Water to keep the soil moist but not wet. Regulate temperature of the frame at from 60° to 70°. When the plants are two or three inches high they should be transplanted into other beds or else thinned and sheared off, in order to make them strong and stocky. Plants should be well hardened off before transplanting into the field.

LOCATION.

The best location for celery is a moist, cool spot, of rich loamy soil, protected from the wind, and suitable for irrigation if possible. Enrich the soil heavily with well-rotted stable manure early in spring. Give deep plowing and cultivate thoroly, in order to have the ground mellow at the time of transplanting.

TRANSPLANTING.

Several methods are in practice. Setting plants in trenches, in furrows, on the sides of furrows and on the level surface are methods employed by various growers. Our best success has been attained in the following way: Mark off rows four feet apart and furrow with stirring plow, turning the ridges in the same direction. Set the plants six inches apart on the side of the furrow next the ridge and a little above the bottom. In subsequent cultivation keep the furrow open and use it as a ditch in irrigating.

CULTIVATION AND BLEACHING.

Thoro cultivation should be the rule from the start. Permit no weeds to grow. If irrigation is practiced, the ground should be cultivated after each application of water.

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When the plants have attained the proper size for use, the leaves are brought into an upright position by boards placed on either side of the row, so that they slope toward the plants at the top, or else by dirt drawn against the plants and packed firmly around them. The object of this is to cause the leaves to take an upright position and exclude the light from the heart of the plant, so that the later growth is white or "bleached." The process of bleaching requires from two to four weeks, depending upon the variety and time of year.

DIGGING AND STORING.

After the bleaching process is carried as far as desired, the plants are dug. For early celery, this may be in September or October, but the late crop should not be taken up until there is danger from freezing. The plants are usually lifted with a spade or potato fork, and the decayed outer leaves removed. They are then ready for storing. This may be done in a damp, cool cellar, or in trenches outside. If in the cellar, the roots should be bedded in moist sand or earth, leaving the plant to stand upright. Boards should be put in every eight or ten inches to separate the plants and allow ventillation. When the crop is stored outside, trenches are dug eight inches wide and deep enough to allow the tops to be even with the surface of the ground. For a cover, nail two boards together, making a trough. Set this over the tops and spread on a light covering of hay. As cold weather increases, cover with earth to avoid all possibility of freezing. If sound when stored, celery treated in this way should keep until February.

VARIETIES.

We have as yet found nothing better than such well-known varieties as Dwarf Golden Heart, Golden Self-Blanching, and White Plume.

There is no royal road to success in celery-growing; but painstaking, watchful efforts have been and will be successful whenever put forth. We are hoping for the increase of such efforts among gardeners and farmers in the business of celery-growing.

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Press Bulletin No. 12.—Farm Department.
October 25, 1898.

The Balanced Ration.

Many feeders have asked us to explain what a balanced ration is. There are three important groups of substances in feeds—protein, carbohydrates and fats. Protein includes all materials in feeds which contain nitrogen. It enters into the composition of milk, blood, muscle, hair, and the brain and nerves, and is necessary in the formation of these, and no other substance can take its place. Protein is also used in the body in producing heat, energy and fat. Carbohydrates include the fiber of feeds, the sugars, starch and gums, and furnish heat, energy and fat to the body. The fats in the food produce heat, energy and fat in the body. Carbohydrates and fat can take each other's places, one pound of fat being worth 2.2 pounds of carbohydrates for production of heat in the body.

Extended investigations have shown that, to obtain the best results, feed should be given which will furnish these materials in the following proportions: Dairy cow, protein 2½ pounds, carbohydrates 12½ pounds, and fat ½ pound; fattening steer, protein 2½ to 3 pounds, carbohydrates 15 pounds, and fat ½ to ¾ pound; growing cattle, protein 4 pounds, carbohydrates 13½ pounds, and fat 2 pounds, for a young animal, gradually decreasing the proportion of protein until at the age of 2 years the proportions are similar to those for the fattening steer but less in quantity. A pig 2 to 3 months old needs feeds containing 7½ pounds of protein to each 30 pounds of carbohydrates and fat; while a year-old pig needs 7½ pounds of protein to each 48 pounds of carbohydrates and fat. Feeds containing a greater proportion of protein than called for by these standards can be fed, because protein can take the place of the other materials. Carbohydrates and fat can not take the place of protein, however, and no matter in how large quantities they may be fed, if protein is lacking the growth or gain will be reduced.

The weak point in Kansas feeding is that the average rations are greatly deficient in protein and have too much carbohydrates and fat. Every feeder knows that good pasture produces rapid growth, good gains and abundant milk yields. It furnishes nutriment in the proportion of 3 pounds of protein, 12 pounds of carbohydrates, and ½ pound of fat. The proportions in some of our feeds, in pounds per hundred pounds of feed, are as follows.

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	Protein.	Carbohydrates.	Fat.
Corn	7.8	66.7	1.6
Kaffir corn	7.8	57.1	2.7
Prairie hay	3.5	41.8	1.4
Corn fodder	2.0	33.2	0.6
Sorghum hay	2.4	40.6	1.2

It will be seen that none of these feeds contain a sufficient proportion of protein to secure best results, and all combinations of these feeds will have the same defect.

Some feeds have too great a proportion of protein to be fed alone, as shown below, the figures indicating pounds per hundred pounds of feed:

	Protein.	Carbohydrates.	Fat.
Alfalfa hay	10.6	37.3	1.4
Gluten meal	31.1	43.9	4.8
Linseed meal	28.8	32.8	7.1
Cottonseed meal	37.0	16.5	12.6

Making a balanced ration is combining the feeds deficient in protein with those having an excess of it, to make a ration which will contain the right proportions for the animal fed.

A balanced ration will produce much better results than the ordinary ration, which is too high in carbohydrates. A cow gave 5 pounds of butter per week on an ordinary ration, and 12 to 14 pounds on a balanced ration. Two pounds per day is a good gain for steers on the usual fattening ration. By increasing the protein by substituting 4 pounds of linseed meal for an equal amount of corn in the regular ration, a feeder made 3 to 4 pounds gain per steer per day. Fattening pigs made a gain of 9½ pounds per bushel of kaffir corn eaten. When one-fifth of the kaffir corn was taken out and soy bean meal substituted for it, increasing the protein, a gain of 13 pounds was made for each bushel of grain eaten.

Alfalfa is the cheapest source of protein for the Kansas farmer, and with a sufficient supply of alfalfa he can use the other feeds usually raised, and secure proper rations for growing and fattening cattle, dairy cows, pigs and fattening hogs. Without alfalfa, the farmer to secure the best results must purchase some of the expensive feeds rich in protein. In this case the markets should be closely studied and the feed furnishing protein at least cost should be purchased. Sometimes this is cottonseed meal, at other times it may be linseed meal, or gluten meal, or some other feed. Some feeds rich in protein, however, are not adapted to all kinds of stock. Bran and cottonseed meal are not good feeds for young pigs.

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Press Bulletin No. 13.—Botanical Department.
November 1, 1898.

Seed Breeding.

The laws governing the breeding of plants by seed are essentially the same as those governing the breeding of animals. There are two laws which express the basic principles upon which breeding is founded (in this article only propagation by seed is considered), viz:

(1) The offspring tend to inherit characters from the parents. In Bulletin No. 8, the nature of fertilization was explained. The pollen must come in contact with the pistil, grow down to and unite with the ovule, after which the ovule develops into a seed. If the pollen comes from the same plant as the ovule, it is self-fertilized; if from a different plant, it is cross-fertilized. As was also explained, plants are usually cross-fertilized; and even plants which are usually self-fertilized, are occasionally cross-fertilized.

(2) The offspring tend to vary from the parent and from each others. This principle is in some degree antagonistic to the first. The variation comes from the fact that the offspring inherit characters unequally, and from the inherent tendency in all organisms to vary. The more nearly alike the parents are in any particular, the more likely is this character to appear in the offspring. A character is said to be fixed when it appears constantly in succeeding generations.

In practical seed-breeding it is, of course, the aim to fix certain desirable characters. Before a character can be fixed it must be originally present. The breeder can not produce at will a new character; he can only make greater or less a character already present. A stock-breeder could not produce a breed of cattle with a third horn on the forehead unless the character appeared spontaneously in some individual. But he can "breed off" the horns that are there by proper selection. The same is true of plants. A spontaneous variation along a certain line may be perpetuated, or fixed; or a normal character may be made greater or less.

The variability in the offspring may be increased in various ways, such as artificial crossing, increase or alteration of food supply, and similar means; but after a suitable individual is found, one which possesses the character one wishes, at least in a slight degree, the variety is fixed by constant and judicious selection from generation to generation. With the ordinary grower of plants—the farmer, gardener, or other persons raising plants from the seed

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for the crop—selection is usually the only practical method for changing the type, or, what is still more often wished, maintaining the type or variety at its present standard. The farmer's chief care is to prevent a desirable variety which he has from deteriorating. The seed dealer produces the varieties but frequently does not grow them long enough to fix the characters. Hence the buyer finds that unless he purchases new seed each year his variety is running out. A few simple rules for fixing and maintaining varieties are appended.

(1) Give best of tillage to those plants from which seed is to be gathered.

(2) The more generations the seed is selected for a certain character, the more strongly is that character fixed; and, on the other hand, the more strongly a character is fixed, the more slowly will it lose this character or "run out."

(3) Grow the parent plants where they will not cross or mix with other varieties.

(4) In selecting the seed, choose a plant in which the parts are uniform—that is, consider the plant as a whole rather than any particular branch. In a plant which has mostly inferior fruit but which has one large fruit, seeds from this large fruit are not *so* likely to transmit the size as if the seeds are chosen from a plant in which the fruit is uniformly large.

(5) Finally, to maintain the standard, selection must be made each year. Plants which as a rule self-fertilize, such as the small grains, do not tend to run out so rapidly as cross-fertilized sorts, such as peas, beans, melons and tomatoes.

Press Bulletin No. 14.—Department of Horticulture and Entomology. November 8, 1898.

The Fruit-Tree Bark-Beetle.

(Scolytus rugulosus, Ratz.)

Beetle. (Scolytus rugulosus, Ratz.) Nov. 8, 1898.

Of the insects that have been introduced into this state during the past few years, none seem to be more destructive to stone-fruit trees than the fruit-tree bark-beetle, or shot-borer, as it is sometimes called, from its peculiar habit of riddling the bark of the trees with numerous small holes. The insect has been found in Riley, Bourbon and Allen counties, and without doubt is present in a large number of the other counties of the state. In Allen county it was very numerous, particularly in an orchard of cherry trees,

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which were suffering badly from the cherry scale *(Aspidiotus forbesi).*

The presence of the pest will probably be first shown by the wilting and falling of the leaves at an unseasonable time. A close examination of the tree, infested with the insect, will reveal numerous small holes in the bark, from which in the case of the stone-fruit trees, such as the plum, peach, cherry, etc., there is a considerable exudation of gum. To show how the insect may riddle a tree, a piece of bark less than an inch square, taken from an infested cherry tree, contained nineteen perforations about the size of a pin-head.

The insect that is the cause of the mischief is a small beetle about one-tenth of an inch in length by about one-third as wide. It is black in color with the exception of the wing covers and the lower part of the legs, which are reddish.

With the beginning of spring, the beetles appear and commence to bore small round holes thru the bark to the sap wood, where they make a central burrow or brood chamber, on each side of which little pockets are made, in which eggs are deposited. As the larvae hatch from the eggs they commence to make burrows away from and at right angles to the brood chamber, which become larger as the larvae develop in size.

The larva is a small grub about one-tenth of an inch in length. It is footless and white, with the exception of the head, which is brownish.

When the larva has attained its full growth it makes a slightly enlarged chamber, in which it pupates. Upon becoming an adult, the beetle makes its way out thru small holes in the bark. and escapes. It takes about a month for the insect to go thru its various stages, so that during the summer there may be several broods. Many of the beetles upon emerging will return and renew their attack upon the tree, thus increasing the damage that has already been done. In time the tree becomes completely girdled by the numerous channels, and dies.

Strong and vigorous fruit trees may resist for a time the attacks of the beetles thru the exudation of the gum, which seems to be obnoxious to both the beetles and the larvae. But if the attacks are continued for a length of time, the tree may be so weakened that the flow of sap will not be strong enough to repel. In such a case it is not long before the fate of the tree is sealed, unless vigorous and prompt measures are taken for its protection.

To prevent loss from this insect, the tree should be kept in a healthy condition. The stronger the tree the better it can resist

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attack. Trees that are diseased or are suffering from the attacks of scales or other insects seem most subject to attack.

It is a good practice to remove and destroy all dead wood in the orchard, as it furnishes excellent breeding places for insects and is a source of danger to surrounding trees.

Badly infested trees should be cut and destroyed. In the early spring the trunks of trees liable to attack should be coated with an alkaline wash, consisting of soft soap reduced to the consistency of paint by adding washing soda dissolved in water. Enough carbolic acid should be added to give a strong repellant odor to the mixture. Apply the wash with a stiff brush, Several applications should be made during the spring and summer.

Press Bulletin No. 15.—Chemical Department.
November 15, 1898.

Kansas Sugar Beets for 1898.

The Chemical department of the Kansas Experiment Station has been continuing its investigation of the adaptability of the sugar beet to Kansas climate and culture. It would seem probable, from our rather high summer temperature, that the beet would not grow with high sugar content in most parts of the state. Analyses made thru a series of years have tended to confirmation of this view. Not only analyses made by our own Station, but by the Department of Agriculture at Washington, have shown that, while beets of high quality may be produced at times and places, the general run of them in this state is only fair in quality. One great difficulty in this work is that farmers do not give them the specified care. The modern sugar beet is a product of seed-breeding with the plants growing under the most favorable conditions, and, like fine stock, it will at once deteriorate if put into less favorable conditions.

The soil for sugar beets should be prepared the previous fall if possible, by subsoiling or deep plowing. Any persons contemplating a trial next year should get the ground ready now. This year at two localities the farmers co-operated in a test of their respective regions. This is the proper thing to do. The Station will not encourage and perhaps not co-operate in tests by isolated farmers another year. But where the people of any locality recognize the value of *a* sugar beet factory to local business and to agriculture, and are willing to grow the beets according to standard directions, the Station will gladly make the necessary analyses.

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In many cases the beets sent in this year bear evidence of having been grown on land not suited to them or not properly prepared. This is shown by their stumpy form, and large proportions above the surface of the ground. The growers in comparatively few cases followed the directions for culture as to distance between the rows. It is a well-ascertained fact that to produce a beet rich in sugar it must be kept down in size. One and one-half pounds is about right. This with a perfect stand would give over thirty tons to the acre, if the rows were eighteen inches apart and the beets eight inches apart in the row. Large yields are possible, therefore, without sacrificing quality to weight. To plant and till rows as close as eighteen inches, on the large scale, special drills and cultivators are used. For experimental plats hand work must be depended on. A fair test of our state can never be made until those engaging in the work follow the methods which experience has shown to be essential to the highest success.

The past season has been unfavorable in many localities because of the extremely wet spring followed by summer drouth. The number of plats destroyed by heavy rains would surprise any one knowing the state only as "Drouthy Kansas."

About 100 samples have been analyzed thus far, coming from all parts of the state. Twenty-five of these were grown in Reno county and eight in Sumner county, these counties giving special attention to the test. They, being in the southern part of the state, are not well situated climatically. Twenty-five samples from Reno county gave an average result of 10.98 per cent of sugar in the juice, The eight samples from Sumner county gave 11.32 per cent. These beets are thus of only fair average quality. Tho they could be used in sugar-making, the manufacturers would be at a great disadvantage.

The average for the state is 11.41 per cent. This is somewhat lower than last year. Twelve, or about one in eight, yielded juice with over 14 per cent of sugar. Only one of these was from the counties named above, altho they furnished one-third of all the samples. The rich beets have nearly all come from northern and western counties. The richest were from Cloud county, with 17.21 per cent.

The advantages of a successful sugar beet factory to a locality are very great, but the injury of a boom collapsed is only too well known to our citizens. If the Experiment Station saves us from the latter it will repay its cost for many years; it stands ready to assist

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to the former if its analyses of properly grown beets point to commercial success in that line. Let every locality, hoping to establish this industry, first thoroly test its soil capacity and the willingness of its citizens, by showing that it can raise the necessary raw material, before it puts its money, or more likely bonds, into an expensive factory.

Press Bulletin No. 16.—Veterinary Department.
November 29, 1898.

Actinomycosis (Lump-Jaw, Big-Jaw).

This is one of the common cattle diseases of Kansas. Altho occurring in pigs and in rare instances observed in horses and man, this disease attacks chiefly, cattle, and is one concerning which the Veterinary department of the Experiment Station receives many inquiries.

The disease is characterized by the gradual appearance of irregularly shaped tumors, which, after a certain development, become soft in the interior, break at one or more points, and discharge a stringy mass of pus containing minute yellow granules, which can be recognized, by careful examination, with the unaided eye.

These small granules, when viewed under the microscope, are seen to be composed of groups of radially arranged club-shaped bodies, known as Actinomyces bovis, which constitute the cause of the disease (Bollinger, 1877).

The tumors of actinomycosis appear most frequently on the lower jaw-bone, or in and under the skin of that region. The parotid gland, lying below the ear between the lower jaw and the neck, is also a favorite point of attack. Sometimes the muscular portion of the tongue is fairly riddled with minute tumors of the same character, causing that organ to become stiff and hard (woody tongue) and interfering seriously with mastication. Often the teeth are affected, get loose and drop out, and in many instances the tumors on the jaws originate in the sockets of the teeth. Internal organs, the throat, lungs and first and second stomachs may be the seat of the disease. When the lungs are affected, the symptoms are similar to those of tuberculosis, but the characteristic yellow granules indicate the actinomycotic nature of the disease.

The external tumors (lumps) when first appearing on the jaw-bones are often mistaken for results of accidental blows, and are then described as such. They can, however, readily be distinguished by the fact that the former are usually cold and free from

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acute pain, while swellings resulting from bruises and blows are usually warm to the touch (inflamed) and painful, and these symptoms soon disappear upon applications of cold water, the pain ceasing and the swelling disappearing. In case of true actinomycosis, cold water applications have no effect, but, on the contrary, the tumors continue to increase in size, finally breaking in various places, producing ugly raw sores, and discharging their characteristic pus. The abscess cavities thus formed often heal, only to break out, soon after, in an adjacent region.

As already stated, the cause of this disease is a fungus known as *Actinomyces bovis*. This fungus grows on various kinds of grasses, but especially on the awns and glumes of barley and related grasses, and when these have grown on swampy or flooded fields, bottom lands in particular.

When these are fed in their dry state (winter and early spring) the awns and other sharp points of the grasses produce, and find access into, small wounds of the cheeks, gums and other places, carrying the fungus with them and thus inoculating the animal with the fungus. The possibility also exists that these fungi be inhaled and thus infect the lungs. Hence, we see, that the disease is of a distinctly infectious nature, but, as far as observation goes, the disease is not contagious, i.e., affected animals do not tend to spread the disease, but all affected animals become infected from the same source. Stacks of barley straw used by cattle as food and shelter often seem to be the cause of this disease. The writer observed a herd of twenty yearling heifers and steers every individual of which was affected with actinomycosis in various parts of the head and neck, and the only assignable cause was a barley straw stack which served as shelter and in part as food for these animals. All animals should, of course, be kept away from such suspicious places when cases of lump-jaw exist on the farm.

The treatment of this disease, up to a few years ago, was almost entirely a surgical one, consisting of extirpation of the affected parts when they were small and circumscribed enough and not too near vital organs or large blood vessels, and of the application of strong and dangerous caustics.

For the past few years great success has been had with the internal use of iodide of potash administered in ten-gram doses per day for animals of one thousand pounds weight. For heavier or lighter animals the dose can be adjusted in proportion to the difference in weight. Each dose of iodide of potash is dissolved in a pint

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of water and given as a drench, the dose being repeated daily for ten days to two weeks or until recovery sets in. Sometimes symptoms of iodide poisoning develop as a result of continuous dosing with potassium iodide. These consist of discharges from the nose, watering of the eyes and peeling off of thin layers of skin. These symptoms disappear soon after the drug is withheld, and are not serious. Local applications of tincture of iodine on the tumors are also advisable. The animal in the herd of twenty yearlings above referred to were thus treated and, altho some were quite seriously affected, all recovered completely.

This is not an infallible specific, but as a rule very excellent results are obtained from its use. Advanced cases of long standing are, of course, always less likely to result in recovery than cases treated in the first stages.

The flesh of animals affected with strictly localized actinomycotic tumors, if otherwise in good health, can not at present be considered as unfit for human consumption. The affected parts themselves, of course, must be discarded.

Press Bulletin No. 17.—Department of Horticulture and Entomology. December 1, 1898.

Hardy Ornamental Shrubs.

The person who is expecting to add any new features of beauty to his home grounds in the coming spring should begin now, if he has not begun already, by perfecting the plan by which he is to proceed. If one does not plan he is sure not to execute or to execute improperly. The ornamentation of the home, above all things else, should be done with forethought and mature consideration. If you would be satisfied with your home and contented in it, then, in planting, sowing and pruning, adopt a plan and follow it out.

It is not enough to adopt a plan in time. It is essential also to order in due time the stock you wish to plant. Nurserymen can not, and most of them do not claim to guarantee their late shipments as they do their early ones. It is in late orders that substitutions of variety and quality are made. Order in time.

Decide on what you want and order from the nearest reliable nurseryman. If he does not have it he will procure it for you or give you the addresses of those who do have it. This department is always ready to furnish the addresses of reliable firms to those who ask.

The question of soils is scarcely to be considered, since almost

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any soil to be found in the state is capable of supporting the best of our handsome bloomers. However, the physical condition of the soil may be such as to require some treatment before committing a valuable shrub to it. If the subsoil is hard and tenacious it should be broken up so that the roots of the plants and moisture can penetrate it. For large plots a subsoil plow is best, but for single plants, or for a small number, a spade is effective. Dig a hole wide enough and deep enough for the roots to grow uncramped for a year or two. Fill in the bottom of the hole with surface soil and tramp it until it is firm. It is best to set the plant a little deeper than it grew in the nursery. Before placing it in the ground see that the broken and torn roots are all cut away. If the ends of the roots are injured they should be pruned off, leaving a smooth cut. Further than this root-pruning is of very doubtful efficacy.

The tops may, perhaps, be shortened advantageously, but if the top is of good shape severe pruning is not desirable. The soil should be packed firmly around and over the roots to the level of the ground, but if dry weather is expected, leave the soil around the plant lower than the surrounding surface. This method has been found of great advantage in the drier portions of the state.

The following shrubs arranged in the order of their blossoming period, have been found perfectly hardy at the College and have, besides the highest attributes of beauty, dignity and grace.

PYRUS JAPONICA (Japan Quince).—An upright bush bearing scarlet flowers very early in the spring before the leaves are out.

SPIREA PRUNIFOLIA (Bridalwreath).—A small spreading shrub, five feet high, bearing small white double flowers in great profusion.

SPIREA VAN HOUTII.—A very graceful shrub, six feet high, spreading, bearing a wealth of white blossoms in early spring, about a week later than *S. prunifolia.*

LONICERA TATARICA (Bush Honeysuckle).—An upright shrub, eight feet to ten feet high, bearing handsome pink or white flowers in rather early spring.

PHILADELPHUS CORONARIUS (Mock Orange).—An upright shrub, resembling in habit the one described next above.

VIBURNUM OPULIS STERILIS (Snowball).—Well known; excelled by none in its grand white clusters in rather late spring.

CARAGANA ARBORESCENS (Siberian Pea).—A legume of beautiful upright habit and dense, soft foliage, bearing small yellow flowers in late spring.

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TAMARIX JUMPERINUS.—A tall, graceful shrub, with foliage resembling the cedar. Bears small pink blossoms in spikes in late spring and early summer.

SPIREA BUMALDA.—Small, one to one and one-half feet high. Bears pink blossoms in corymbs in June and July.

HIBISCUS SYRIACUS (Althea).—Small shrub, four to five feet high, bearing brilliant white flowers in July.

HYDRANGEA PANICULATA GRANDIFLORA.—This shrub opens its grand clusters of blossoms in July and holds them till August. Unsurpassed in beauty.

Press Bulletin No. 18.—Botanical Department.
December 13, 1898.

Notes on Weeds.

Our common weeds may be divided into three categories:

(1) Weeds of cultivated soil, including tame grass pastures.

(2) Weeds of native pastures. These are coarse plants, native in the grass-land, but not eaten by stock. These plants do not usually become troublesome unless the land is overstocked. In that case the weeds are better able to compete with the grass and increase more rapidly. Mowing pastures helps to keep down such weeds, but the best remedy is to take off the stock for a season or two and allow the grass to recuperate.

(3) Weeds of waste places, dooryards, fence rows, and similar neglected spots. Weeds which confine themselves to such localities do little actual harm other than being unsightly. But, unfortunately, many weeds of the first category find a refuge here, and are propagated from year to year. For this reason, it is best to have no "neglected spots" upon the farm.

WEEDS OF CULTIVATED SOIL.

It is to this category that our most troublesome weeds belong. About half of our bad weeds are native and include the cocklebur, sand-bur, sunflower, and ragweeds. A few are native farther west and are introduced in Kansas, as the bull-nettle, snow-on-the-mountain, and prickly nightshade. Most of the remainder are introduced from Europe, not directly, but at various times in the past, thru the Eastern states.

Many of our weeds have excellent facilities for the distribution of their seed. Some are tumble-weeds, which break off near the ground at maturity and roll before the wind, scattering their seeds as they go. The common tumble-weed, the sand-hill tumble-weed

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and the Russian thistle are examples. Some have tumbling fruit clusters, as tickle-grass; some have tufts of hair on the fruits, as thistle and prickly-lettuce; some have fruits or seeds which attach themselves to animals, as cocklebur, sand-bur, beggar-ticks, devil's claw. Many seeds are small and are blown along with the dust or upon the surface of the snow. Some are eaten by birds or other animals and escape digestion, or are carried about in the mud upon their feet. These various methods serve to scatter seeds from field to field or from farm to farm. One of the most important agencies for distribution over vast areas is man. Seeds of weeds are carried along with those of grass, grain or vegetables. Great care should be taken when importing seed to avoid introducing weeds in this way. Buy seed of responsible parties who will guarantee it to be pure or at least free from seeds of noxious weeds. Railroads are great carriers of seed, often in the bedding in cattle cars. Ground planted to imported seed should be watched and strange weeds eradicated before they have had time to spread.

Many of our annual weeds have the power to exist as dwarfs. Species which normally grow three or four feet high may occur as dwarfs not more than an inch or two in height. In this way they escape notice and elude the vigilance of the farmer, and yet produce seed for a succeeding crop.

To illustrate how weeds tend to occupy new soil, a plat of bare soil ten feet square was laid off, and the seedlings counted and removed at intervals as they appeared. During four years 70,825 seedlings were removed. Of these, 17,792 were purslane and 28,303 were bull-nettle. A great number of other plants which apparently had an equal chance were present in small numbers or not at all.

Many of our worst weeds have the power to produce an enormous number of seeds. Estimates based upon a partial count of the seeds on a single plant of each kind showed the following: Purslane, 69,000; red-root, 85,000; pigweed purslane, 155,000: yellow foxtail, 113,600; sand-hill tumble-weed, 357,600; water-hemp, 945,000.

As to duration, weeds may be annual, living one year, as the cocklebur; biennial, living two years, as the burdock; or perennial, when they live more than two years, as the ox-eye daisy and the bind-weed. The perennials may produce a crown without spreading under ground, as the ox-eye daisy and plantain, or they may spread under ground by creeping stems or roots. These creeping parts throw up plants at the extremity, or, especially where the creeping

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part is a root, at intervals along their entire length. Plants of the latter kind are often very difficult to eradicate when once well started because plowing them or cutting the creeping parts tends to increase rather than diminish the number of plants.

Bind-weed is one of the worst weeds of this class that we have. The best way to eradicate a patch of this is to mulch it thoroly with straw or hay, thus preventing the appearance of green leaves to gather nourishment for the roots, in which case the latter must sooner or later die. Two full seasons of careful mulch should be sufficient. At least the stragglers could be dug out easily after such treatment. Perennial weeds which form a crown and biennial weeds can be eradicated by cutting off below the crown. The dandelion can not be killed by this method because it produces buds upon the cut root. Annuals can be eradicated or at least kept within control by careful cultivation. Proper rotation of crops will subject all the fields of a farm successively to the cultivator.

Press Bulletin No. 19.—Department of Horticulture and Entomology.
December 20, 1898.

The Potato-Stalk Weevil.

The potato-stalk weevil *(Trichobaris trinotata)* tho unfamiliar to many potato-growers, is by no means a new pest. Its presence in this state has been known since the year 1873. Tho quite common, there is no record of any extensive or continuous injury sustained from its attacks till the year 1897, when there seems to have been a special onslaught by the insect. In June of that year there were many complaints of serious damage to the potato crops by this insect. During the spring of 1898 the insect was found in large numbers in Riley county. Investigations that were carried on during the same year reveal the fact that the insect is pretty well distributed over the eastern and east central parts of the state. It was found as far west as Dickinson and Saline counties.

The attacks of the weevil are not confined to the potatoes alone, as the insect is to be found in as large if not greater numbers in certain weeds which seem to be the original host-plants of the insect. The horse-nettle, *Solanum Carolinense;* cocklebur, *Xanthium Canadense;* stinkweed, *Datura Stramonium;* bull-nettle, *Solanum rostratum;* ground cherry, *Physalis longifolia;* are all subject to more or less attack by this insect. In several of the weeds, particularly in the ground cherry, the insect is more numerous than in the potato. As many as eight adults have been taken from the stalk of one

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ground cherry while in the potato vines we have never found them so numerous, but only one specimen in the root and from one to five in the upper parts of the plant. Whenever the above-mentioned weeds are allowed to grow wild in any large numbers they are a constant menace to potato culture, in that they support the insect in large numbers to infest adjoining potato fields in the spring.

The adult is a small snout-beetle about one-fifth of an inch in length. It is an ashy gray color, and marked with three black spots at the base of the wing covers.

The weevil passes the winter in the adult stage, remaining till spring in the same plant in which it has passed thru its transformations. About May the weevils emerge from their winter quarters and pass to the young growing potato plants, where they spend some time feeding. By June the female adult commences to deposit eggs. She first makes in the stalk a small slit about one-twelfth of an inch long, in which she deposits one egg. In the same way eggs are deposited in the main and secondary branches. In about a week the larva or grub hatches out and commences to work downward towards the root of the stalk. As it develops in size its channel becomes larger and more conspicuous. After channeling down a distance the larva turns around and commences to enlarge its old channel for at least a part of the way. It is this mining of the pith and the wood by the sevaral larvae in the stalks and branches that impairs the vitality of the plant.

The larva when first hatched is a small, footless and whitish grub. At maturity it averages from six to eight-sixteenths of an inch in length, with a brown head and with dark-colored mouth parts. The body bears a few light-colored hairs.

Just before pupating the larva constructs a cocoon of fibers in which it pupates. The pupal stage lasts from eight to eleven days. By July 22 a large number of the larvae had pupated and by August many were complete beetles.

REMEDIES.

As the adult passes the winter in the same plant in which it has gone thru its transformation, the best remedy to use in combating the insect is to destroy the vines as soon as the crop is gathered. It is also a good plan to destroy in the fall all the above-mentioned weeds upon the farm. They should be pulled up with a good portion of their roots and destroyed. If pulling them should be too expensive an operation they should be cut down while young and

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allowed to dry up. By this means many of the immature larvae will be destroyed for want of proper food.

Promote a vigorous growth in the plants by clean cultivation and fertilizers. A healthy vine does not suffer so severely from the attacks of the pest. The greatest injury is seen in the vines of low vitality, which have suffered from the attacks of other insects, heat, and drouth.

Press Bulletin No. 20.—Farm Department.
December 27, 1898.

Possibilities in Corn Improvement.

That corn is the king of American grains admits of no dispute. That its composition is such that it is far from a perfect grain food for any of the purposes for which grain is fed is recognized by most thoughtful feeders. That its defective composition may be, at least partly, corrected by intelligent selection of seed has probably occurred to comparatively few. The composition of a grain, or indeed of any plant product, can not, as a rule, be inferred from any physical signs. The selection of seed with a view to improvement is thus limited to a consideration of yield chiefly, though some physical characteristics are given more or less attention by the more thoughtful. Selection based on composition requires the co-operation of a chemist as a rule, at least until his investigations have discovered some physical accompaniment of certain composition. The Experiment Station at the Agricultural College has in progress an investigation which has for its object the discovery of the varieties of corn which are richest in protein, and the production from these of new varieties still richer in protein.

The protein of feeds includes the nitrogenous constituents. It is for these that feeders purchase oil-cake, gluten meal, wheat bran, etc., at a high price to balance the rations fed their milch cows, their young stock, or even their fattening animals in some cases. Corn is rich in starch and other carbohydrates and in fat, but is correspondingly poor in protein, its average amount of the last being about 10 per cent. Wheat has about 12 per cent of protein, wheat bran 16 per cent, and oil meal 33 per cent. While the average amount of protein in corn is 10 per cent, it may fall as low as 8 per cent or rise to over 12 per cent. If we could raise the average to the height of the best it would be equal to wheat, if of equal digestibility. Analyses made by the chemical department of the Experiment Station, of single ears of thirty-three varieties

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of corn, showed a variation in protein from 8.78 to 12.71 per cent. This does not really make a fair showing in respect to the varieties, as but one ear was used in each ease as the source of the sample, and other analyses of additional ears of two of the varieties showed as great or greater variation in the composition of different ears of the same variety. One of these varieties has been grown for thirty years by the same man without intermixture of any other variety. It would seem that, if possible, a fixed type should have been reached in this time, but analyses of ten different ears showed a minimum of 8.60 and a maximum of 12.60 per cent of protein. Such great variations indicate the possibilities in seed selection if some means can be discovered by which the rich in protein can be distinguished from the poor. The department has gone further, and has examined individual kernels from the same ear. These showed a considerable variation also, but the difficulties attending the work are such as to make any general statement, as yet, premature.

The Station intends to continue its work until a variety or varieties rich in protein have been established, and if possible a means has been discovered whereby, thru simple observations or processes, the farmer may select seed without the assistance of a chemist and get that which is of high protein content. In the meantime, attention is drawn to the fact that the germ is richer in both protein and fat than any of the other parts of the kernel, and by choosing ears for seed in which a large germ is found in the kernels the chances are greatly in favor of improving the quality of the crop. Taking as a basis the present relative cost of carbohydrates and protein, could we increase the latter from 10 per cent to 11 per cent, at the expense of the former, the actual cash value of the average corn crop of Kansas would be increased at least 1 per cent, or $380,000. A greater increase in protein would increase the value proportionately, and that a considerably greater increase is possible, there can be no serious doubt.

Press Bulletin No. 21.—Department of Horticulture and Entomology. January 10, 1899.

Winter Protection of Peach Buds.

The fact that peach trees produce a full crop only on occasional years has caused such little planting of trees in Kansas that good peaches are always scarce, and some years not produced at all in the state. The uncertainty of this crop is due to the changeableness of the climate. Peach buds can stand intense cold if it comes when

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they are mature and dormant. We say, the cold spell in February killed the buds, when, in reality, the warm spell in January was as much the cause. A well-ripened bean will endure the most extreme cold, but is quickly killed if frozen before it ripens or after it has germinated. The case is the same with peach buds. The crop may be ruined in the fall before the buds have matured; warm weather may start growth in mid-winter, and subsequent cold kill the buds, or they may endure the winter, start properly in spring and be killed by late cold spells.

By splitting a bud longitudinally and examining the pistil, the small flask-shaped organ in the center, it is easy to determine whether the bud has been killed or not. A brown or black withered pistil indicates that it has, while if a large number of buds have green, plump pistils there are still good chances for a crop. To-day (January 11, 1899,) an examination of one hundred buds of several varieties showed the following number of dead pistils: Elberta 25, Family Favorite 9, Alexander 7. There are still chances for a full crop. How to make the chances better, is the point that is causing various experiments in bud protection to be undertaken.

To insure a crop, the buds must be matured in the fall before cold weather and kept dormant through winter and early spring. To accomplish this, the Station has protected standing trees by various means, such as binding the tops full of evergreen branches, hay, etc., sometimes surrounding these materials with burlap. Such protections have at times resulted in the production of fruit when otherwise there would have been none, but for all years have not proved sufficiently reliable for recommendation.

To test results obtained in Missouri, trees of different varieties have been kept sprayed with whitewash containing milk and salt to cause it to stick longer. The twigs of trees thus treated are several degrees cooler during the warmest winter days, and a few days later in coming into full bloom. These effects may be all that is needed some seasons to prevent a destruction of the crop, but they are too slight to save buds from all kinds of weather.

It may be that the most practical means of bud protection has not been discovered, but at present the most promising is that of laying the trees to the ground in late fall or early winter and covering the tops with old hay or like material. This method has produced good results at this Station and promises to be a profitable procedure for peach growers of the state. Other stations have reported favorable results. The process is simple, the material in-

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expensive, and the work not so great but that a good profit may be obtained.

For best results, the orchard should be planted with this treatment in view. Very large trees can not be treated to advantage. When the trees are planted the large roots should extend east and west and those on the north and south removed. It is important that the trees be put down every year from the time they are planted. The work is accomplished by removing the soil from the south and the north sides and forcing the tree to the south, where it is held close to the ground by stakes crossing over the trunk. Mounds of earth are then made over the roots of the trees. The layer of mulching may be increased as the weather gets colder, but should be of such a nature that it will not heat. To keep the buds cool and at an even temperature is the important point.

For fear of late frosts, the mulching should not all be removed till the trees are in bloom, when the work of bees will be needed to aid in pollination. The tree being raised, it must be secured to stakes to prevent the wind from swaying it about.

If the work is all carefully done the operation will have no harmful effects on the trees. Taking it for granted that the life of the tree is shortened, this introduces no serious difficulty. It is not necessary to wait till one orchard is dead before starting another, and young trees are easily obtained.

The cost of putting down trees and staking them up in spring will average two hours' work, or about 25 cents per tree, a small expense for years when peaches can not be raised without some such protection.

Press Bulletin No. 22.—Botanical Department.
January 24, 1899.

Grazing Grasses of Western Kansas.

Kansas is pre-eminently a prairie state. The western half lies in the semi-arid region known as the Great Plains, and the eastern portion is chiefly prairie. In all such regions the grass vegetation largely predominates and determines the general appearance of the flora.

There are 154 kinds of grasses known to grow in Kansas. Some of these are rare and others are of no agricultural importance, while still others are weeds. There are several species that are of importance from the standpoint of grazing, but at this time only a few will be mentioned. In a short time a more complete enumeration and

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description will be issued as a bulletin from the Experiment Station.

BUFFALO GRASS.—This common and well-known grass forms the bulk of the native vegetation on all the uplands of the western half of Kansas. In the eastern part of the state it is less common and is being gradually driven out in many places by other grasses. Buffalo grass forms a short, compact sod, the plants usually being only a few inches high. The color is gray-green. The male and female flowers occur on different plants, which fact has given rise to the impression that there are two kinds of buffalo grass. The male plants produce a flower stalk a few inches high, but the flowers contain only pollen, and no seed is formed. The female flowers are in little clusters close among the leaves, and it is here that the seed is produced. The grass propagates extensively from creeping stems and also from the seed. It is too short to be cut for hay, but it is the staple grazing grass of the plains, for both summer and winter.

GRAMA GRASS.—This is very common over the same range as the buffalo grass, and is found mixed with it, but is not so abundant. Like the preceding, it is a "short grass," not usually growing tall enough for hay. It can be easily distinguished by the flower stalks, which are about a foot high, with two (sometimes one or three) little spikes of flowers. These spikes are about an inch long, one being at the end and the other a short distance below. These spikes turn easily with the wind and form miniature weather vanes. This grass is found thruout the western three-fourths of the state, but increases in abundance westward until in extreme western Kansas, especially south of the Arkansas river, it forms at least half of the sod on the uplands. It is a staple grass for grazing purposes, and, like buffalo grass, it cures for winter use.

A second species of grama grass occurs on stony or sterile hills and forms the chief forage in such regions. It is similar to the preceding, but with shorter flower stalks, and usually occurs in bunches. It is sometimes called black grama.

A third species is sometimes called tall grama or prairie oats. It has a longer flower stalk with numerous short spikes. It occurs thruout the state, on prairie in the east, but confined to ravines in the west. It does not appear to be so much relished by stock as the other two species.

BUNCH GRASS *(Sporobolus airoides).* —There are several kinds of grass that go by the name of bunch grass in different localities.

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The kind referred to here is the common forage grass of the Cimarron valley and the western part of the Arkansas valley. It does not occur on the uplands, and does not extend north of the Arkansas river valley.

TALL GRASSES.—There are several species commonly lumped together under this name. The most important in the grazing regions of western Kansas are the little blue-stem, often called bunch grass in the region north of the Arkansas river, and big blue-stem, or simply blue-stem. These two are common in the prairie region west of the Mississippi river, and are gradually working their way westward.

The conditions best adapted to the buffalo and grama grass are the clay-loam uplands where the sod is closely grazed and well tramped. If the soil is stony or sandy, or too moist, these grasses do not thrive. If not grazed or tramped they can not usually compete with the tall grasses and are driven out.

Press Bulletin No. 23.—Department of Entomology.
January 31, 1899.

The Spring Canker-Worm.

It will not be long before this destructive insect will make its appearance in our orchard and shade trees. A description of the pest and the best means of combating it will at this time be timely, and will undoubtedly assist many in resisting the insect and preventing extensive losses from the same.

The canker-worm attacks a large number of our fruit, shade and forest trees. In the records of the department it has been recorded attacking apple, apricot, cherry, peach, plum, oak, ash, catalpa and elm trees.

It is the larvae, or caterpillars, that injure the trees. Often the trees are entirely defoliated by them. In slight attacks, the leaves are perforated with small holes. But if the larvae, or caterpillars, are allowed to continue their destructive work, they soon devour the pulpy parts of the leaves, leaving nothing of the leaves but the midribs, veins and stems. When the damage has gone this far, it is then that the orchard has the appearance of having been scorched by fire.

The adults of the canker-worms are moths. The males and the females differ greatly in appearance. It is important that one be able to distinguish them. The male has two pairs of wings; the front wings are of a brownish-gray color, while the hind wings are

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of a light gray color. On the other hand, the female is without wings, and is of a brownish-gray color, with a black band along the middle of the back of the abdomen. She might easily be taken for a spider.

In early spring the adult moths emerge from their cocoons in the ground. During the day the males may be found resting on the bark of the trees. At the approach of evening they are often seen flying about the trees in large numbers. In some seasons they have been observed about the electric lights in swarms. The female moths are not so active. As they are without wings, they do not travel very far. Upon emerging from the ground they make their way to the base of some tree, up which they make their ascent to deposit eggs.

The eggs of the moth are oval-shaped, yellowish, with a pearly luster, and are deposited in irregular masses or clusters in fruit spurs or at the base of the large branches. The brown leaf masses of the leaf-crumpler are favorite places for the depositing of eggs. The moths seem to prefer to deposit their eggs in concealed or protected places.

Upon hatching out from the eggs, the young larvae, or caterpillars, commence to feed on the young expanding leaves. The small caterpillars are ravenous eaters, and as they increase in size their destructive work becomes more noticeable. The newly-hatched caterpillar is of an olive-green color. The mature caterpillar is about one inch in length, and varies in color from a greenish yellow to a dark brown.

When full grown the caterpillars abandon the trees, either by crawling down the trunk or by letting themselves drop by means of silken threads. Upon reaching the ground, they work their way into it for a few inches, where they construct cocoons, in which they pass into the pupa state. They remain in this state till the following spring, when they emerge as adult moths.

To combat the canker-worm, spray the infested trees with arsenical poisons, such as Paris green or London purple, at the rate of one pound of the poison to 150 to 200 gallons of water. The mixture should be thoroly stirred while the application is being made. All the leaves of the trees should be reached by the poison. If rains should follow soon after the application has been made, spray the trees over again. Do not delay the spraying till the caterpillars are fully grown; for by this time the damage has been done. Spray as soon as the caterpillars make their appearance.

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About the middle of March and from that time on, examine the trees occasionally. The presence of the caterpillars can soon be detected by jarring the branches of the trees, when the caterpillars will drop and hang suspended by silken threads. If the poisons are pure, and the spraying is done thoroly and at the proper time, there is no necessity for any extensive injury by the canker-worm.

When there are but a few trees to be protected, an economical and successful measure is to entrap the female moths, which, as stated before, are wingless and depend upon crawling in order to reach the upper parts of the tree to deposit their eggs. To entrap the female moths, apply a collar of carpet paper or wire netting, with a flange at the lower side, and so fastened to the tree as to admit of no passage-ways at the collar. These traps, or collars, should be attached to the trees by the middle of February, and should be visited several times during the week to destroy the entrapped female moths.

Press Bulletin No. 24.—Farm Department.
February 7, 1899.

A New Crop for Kansas Farmers.

The Kansas Experiment Station has been growing the soy bean for the past ten years, starting with a small patch, and increasing the area until last year thirty-five acres were grown. It is a good drouth-resister, is not touched by chinch bugs, and the beans are richer in protein than linseed meal. With sufficient moisture to germinate them, a crop can be grown after wheat and oats are harvested. In 1896 the yield on ground after wheat was 8 bushels per acre; in 1898, 6¼ bushels. With linseed meal at $25 per ton, these crops after wheat would be worth $6 and $4.68 per acre. When planted earlier in the season, the yield of soy beans is from 10 to 20 bushels per acre. The soy bean not only furnishes a crop rich in protein, but at the same time enriches the soil. Henry Rogler, one of our graduates, reports an increase in large fields of 5 bushels of wheat per acre on land where soy beans had previously been grown, over land that had not been in soy beans.

With dairy cows, soy bean meal takes the place of linseed meal, being somewhat richer in protein, a laxative feed, and softening the butter fat. Not over three pounds per day should be fed to a cow, and the softening effect on the butter may be overcome by giving feeds having the opposite tendency, such as corn, kaffir corn, and cottonseed meal.

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In the winter of 1898, in fattening 7½-months-old pigs, the gains per bushel of feed were:

	Pounds.
Kaffir corn meal	11.7
Shelled corn	12.3
Kaffir corn meal four-fifths, soy bean meal one-fifth	13.9

With pigs 6 months old the gains per bushel of feed were:

	Pounds.
Kaffir corn meal	9.4
Shelled corn	11.2
Kaffir corn meal four-fifths, soy bean meal one-fifth	13.2

With both lots the pigs having soy bean meal made the most rapid growth and were ready for market much earlier.

With weaning pigs the gains per bushel of feed were:

	Pounds.
Kaffir cornmeal	10.4
Corn meal	11.5
Kaffir corn meal two-thirds, soy bean meal one-third.	15.4
Corn meal two-thirds, soy bean meal one-third	15.6

In the fall of 1898 this Station bought of farmers sixty ordinary stock hogs of mixed breeding. The gains per bushel of feed in fattening these hogs were:

	Pounds.
Kaffir corn meal	7.5
Kaffir corn meal four-fifths, soy bean meal one-fifth.	12.0

The hogs fattened with soy bean meal have just been marketed, while those not having it will not be ready for four or five weeks.

The soy bean is an erect-growing plant, 1½ to 3½ feet in height, with stiff stem, having branches thickly covered with pods. Cold weather hinders its growth, and for this reason it is not best to plant until the middle of May; and if the rainfall is sufficient a planting may be made as late as July 1. The ground should be in good tilth, and the weeds thoroly killed just before planting. Plant in drills, the rows 32 to 42 inches apart, dropping seeds 2 inches apart in the row. One-half bushel of seed per acre is required. Cultivate as for corn, using small shovels on the cultivator, and being careful not to ridge the ground. When the pods turn brown, cut either with a self-rake reaper or with a common cultivator rigged up with two horizontal knives bolted to the inner shanks. Put the stalks in cocks, where they should be kept until cured. Thresh with a common threshing-machine. Run slowly and use all blank concaves. The beans may be fed whole or ground.

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We believe the soy bean is worthy of a trial in all parts of this state, and that the trial should not be made on less than an acre; five acres would be better. Hundreds of people have tried planting a quart of seed, with the result that grasshoppers and rabbits harvested these small patches.

Press Bulletin No. 25.—Farm Department.
February 14, 1899.

Alfalfa Hay for Fattening Hogs.

In the fall of 1898 the Kansas Experiment Station made an experiment to test the value of alfalfa hay when fed daily to fattening hogs that were being given all the grain they would eat. The gain greatly exceeded our expectations, and if further experiments show the same results, alfalfa hay will form a regular part of the rations of every well-fed pig fattened in Kansas in the winter.

The hogs fed in this experiment were bought of farmers, and averaged in weight 125 pounds each. They were placed in lots of ten each, in large pens, having for shelter some sheds open to the south. The alfalfa hay used was of the best quality, carefully cured. Black-bulled white kaffir corn was the grain used, the hogs being fed all that they would eat without waste. The hay was fed dry in forkfuls in a large flat trough. The pigs were given more than they would eat, and they picked out the leaves and finer stems, rejecting the coarser stems. One lot of hogs was fed kaffir corn meal dry and alfalfa hay; one lot whole kaffir corn dry; one lot kaffir corn meal dry; and one lot kaffir corn meal wet.

The experiment began on November 24 and lasted nine weeks. By that time the alfalfa-fed hogs became well fattened, and were marketed. We estimated that it would require four to five weeks additional feeding, with ordinary winter weather, to get the hogs that were fed grain alone into good marketable condition. The recent continued extreme cold weather will make the time required considerably longer.

The gains in nine weeks from the different methods of feeding were as follows:

	Gains per hog in pounds.
Kaffir corn meal dry and alfalfa hay	90.9
Kaffir corn whole	59.4
Kaffir corn meal fed dry	52.4
Kaffir con meal fed wet	63.3

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The gain from feeding alfalfa hay with kaffir corn meal fed dry, over the meal alone fed dry, is more than 73 per cent.

The gains per bushel of feed were as follows:

	Pounds.
Kaffir corn meal dry and 7.83 pounds alfalfa hay	10.88
Kaffir corn whole	8.56
Kaffir corn meal fed dry	7.48
Kaffir corn meal fed wet	8.09

Ten hogs in nine weeks were fed 656 pounds of alfalfa hay; and as shown above, for each 7.83 pounds of alfalfa hay fed with the dry kaffir corn meal, the hogs gained 3.4 pounds over those having dry kaffir corn meal alone-a gain of 868 pounds of pork per ton of alfalfa hay. These results are not due to the feeding value of the alfalfa alone, but also to its influence in aiding the hogs to better digest the kaffir corn. The alfalfa hay also gave a variety to the ration, making it more appetizing and inducing the hogs to eat more grain. The ten hogs having grain alone ate 3,885 pounds of dry kaffir corn meal, while the ten hogs having hay and grain ate 4,679 pounds of the kaffir corn meal and 656 pounds alfalfa hay. The hay-fed hogs ate more grain and gained more for each bushel eaten.

In a former experiment at this College, pigs were pastured thru the summer on alfalfa with a light feeding of corn. After deducting the probable gain from the corn, the gain per acre from the alfalfa pasture was 776 pounds of pork.

These facts indicate that to produce pork most cheaply the Kansas farmer must have alfalfa pasture in summer and alfalfa hay in winter.

Press Bulletin No. 26.—Veterinary Department.
February 14, 1899.

Taenia Fimbriata (Fringed Tape-worm).

This is one of the common intestinal worms affecting Western sheep, and causes by far the greatest loss of any parasite affecting this animal in this and adjoining states. In the adult state, this peculiarly ornamented worm measures from three to five inches in length, and about three-eighths of an inch at the middle or widest part of the body, which is flat and tapers gradually toward either extremity. A careful examination will reveal a fringed border of each section, which is characteristic of this tape-worm. Until quite recently, sheep owners were disposed to attribute the

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cause of death to some poisonous effect resulting from feeding upon the loco plant. Recent investigation has shown that this little parasite is responsible for the many ills giving rise to the following:

SYMPTOMS.—Lambs that are badly affected are large-headed, with under-sized bodies and hide-bound skins. Their gait is stiff. They seem to have difficulty in cropping the shorter grass; they also appear to be more foolish than the rest of the flock, standing often as if they intended to attack the dog or their shepherd. Others show evidence of impaired vision or are so affected that they appreciate danger less. In driving, they are to be found in the rear, and show marked evidence of exhaustion. Such symptoms as described gradually become worse, as the worms increase in number and size, until emaciation removes all doubt from the mind of the owner as to the presence of some very obstinate disease.

The constant irritation produced by these parasites in the intestines and other digestive organs so impairs their function that indigestion, with its long train of evils, is the consequence. Lambs and yearlings, being yet undeveloped, require all the nourishment their digestive organs are capable of handling under the most favorable circumstances in order that the desirable development may be quickly obtained. Therefore any cause operating in direct opposition to the proper performance of the various functions of animaI life should be regarded as a direct cause of disease and death.

TREATMENT.—From the present knowledge of the life history of this parasite, we are unable to prescribe specific rules by which the danger could be effectually removed by destruction of this worm and its eggs. The presence of the adult and young parasite thruout the year, and the methods at present employed by ranchmen, are factors directly opposed to any systematic eradication.

Nourishing food, fed liberally to both ewe and lamb; fresh pasture when lambs begin to eat; water free from surface drainage; suitable shelter during the winter months; feeding from troughs and racks; avoiding all accumulation of filth, which harbors embryo and germ of many diseases peculiar to the young—such sanitation will surely bring about desirable results, and we may safely say that the time has arrived for improvement in this direction.

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Press Bulletin No. 27.—Chemical Department.
February 20, 1899.

Sugar Beet Experiments for 1899.

The Chemical department of the Experiment Station of the Kansas State Agricultural College will continue the investigation of the sugar beet question in this state next year, but under somewhat different arrangements than those existing in previous years. It is evident that valuable results can not be obtained unless the beets are grown under proper conditions, and that results of the most value will be obtained when several farmers in a locality unite to make a test of the soil and climate of their particular region. Factories ought not to be located at any point until, by careful and repeated trials, the soil has been found adapted to the production of beets rich in sugar, and the farmers after a certain amount of preliminary experience have been found to be willing to undertake such production.

The Department of Agriculture at Washington is planning to supply the experiment stations of the country with sugar beet seed next year, as it has for three years previously. This seed will be distributed by the stations under their own regulations, and analyses of samples of the crop will be made by them. Samples will be sent by mail free of postage when mailed under the official tags which will be supplied. The sole expense to growers will be the planting and cultivation of the crop, and for this they will be amply repaid by the feeding value of the beets, only a few being required for analysis.

The Experiment Station desires it understood, in the first place, that it is not engaged in the distribution of free seeds merely for the sake of saving farmers the expense of buying seed for the production of beets for their own use. The large proportion of previous applicants who have not been heard from since the seed was sent them leads to the suspicion that in many instances this has not been thoroly understood heretofore. Next season seed will be sent to but two kinds of applicants, unless the circumstances are very exceptional. (1) The Station especially desires that, in localities where there is a considerable amount of similar land in a somewhat compact body, which seems likely to be adapted to beet culture, not less than six, and preferably ten or more, farmers combine to make a joint trial. Let them talk the matter up, and make application for seed at once, either jointly or individually. Seed will

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be mailed to them individually, and sent in no other way, as a record must be preserved by the Station of the particular variety of seed furnished each individual. Do not send in the names of people without obtaining their consent. (2) The Station desires to have a number of farmers grow half an acre of beets under the proper conditions, keeping an accurate record of the expense of growing them, and ascertaining with care the yield per acre. This is to learn with greater correctness than the smaller plats permit, the rest of production under our conditions.

The soil for beet culture should be rich, but not recently manured with stable manure; it should be of a loose character, not sunning together badly under heavy rains; should be deeply cultivated, and if available, plowed in the fall.

A copy of the directions for growing sugar beets, which it is expected that all who receive seed from the Station will follow as nearly as possible, will be sent on application. Any desiring seed under the above conditions, should apply at once to J. T. Willard, Chemist of the Experiment Station, Manhattan, Kan.

Press Bulletin No. 28.—Horticultural Department.
February 21, 1899.

Treatment of Winter-Injured Trees.

The recent cold weather has greatly injured the fruit trees in many sections of the state. The peach, apricot and Japanese plum have suffered most. In our orchards of 51 varieties of peach, the trees of 18 varieties appear to be entirely ruined. Twenty-one varieties are killed back to main branches or trunk, in many cases of which the whole tree will eventually die from the injury; four varieties are injured to a less extent but not necessarily very seriously. The varieties showing least injury are Mountain Rose, Elberta, and two seedlings of our own propagation. All the Japanese plums examined in our own and adjacent orchards show serious injury, also all the apricots, while a slighter injury is to be noted on the European and American types of plum, the cherries and the pears. Our minimum thermometer located in the peach orchard has registered below zero as follows: January 30,—8°; January 31, -10°; February 4, 8°; February 5, -5°; February 6, -6°; February 7, -11½°; February 8, -11°; February 9, -17¼°; February 10, -7°; February 11, -21°; February 12, -32½°; February 13, -21°.

Reports indicate that in but few portions of the state the tem-

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perature fell as low as in this section, so it is probable that in the greater part of the state the fruit industry has not received such a blow as it has here. Where trees are merely injured, the real damage done to the orchards will depend greatly upon the treatment given them for this time. Trees that are killed should be removed at once from the orchard. If they can be used for firewood well and good, if not they should be piled and burned to destroy any insects or disease that may infest them. Trees that are partly top-killed are weakened and deadened thruout, and should be heavily cut back, the extent depending upon the degree of injury. In many cases it will be necessary to cut back to the main branches or even to the trunk, but where the injury is less severe the cutting may be confined to the smaller branches of the tree. Tho the branches of an injured tree may not be killed, it is advantageous to cut them back, because the wood that is browned and deadened can never perform its life functions again. It becomes as heart-wood and must be enclosed by a layer of new wood. The quicker we can get this deposit of new wood the better, and the more of it the better. By cutting off the branches of the tree, it is reduced in surface and the new wood is more rapidly deposited on the parts that remain. The energy that is spent in blossoming is also saved to the tree by the severe pruning. It is necessary to prevent the vitality of the tree from dissipating itself in any way, and to husband and apply it so as to restore the tree quickly to its normal process of growth.

Professor Bailey, Cornell University, says upon this subject: "The proper treatment for frozen-back trees must be determined for each particular case; but it should be borne in mind that the injured portion is no longer of use to the plant, whereas it may be a positive detriment by accelerating the evaporation of moisture. The best treatment for plants seriously injured upon the extremities is to cut them back heavily."

Trees treated in this way will rapidly regain their vigor unless the injury is very serious. They will also quickly resume their normal habit of growth and shape. Cutting back the last year's growth in the winter is especially beneficial to the peach, whether it has been injured by cold or not, as its branches tend to grow long and slender, and in bearing fruit near the extremities they break and split and are ruined. Where blackberries and raspberries have been killed back to the ground, the canes should be cut out and burned.

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A difference in opinion exists as to the best time for cutting back injured trees; some growers prefer to have the work done before the leaves open, others choose a later time; but the safest way is to do it early. As soon as the degree of injury is known, therefore, we may wisely begin the pruning. If left till a later time, other work may crowd it out entirely, with the result that the orchard is lost, A saw and tree pruners are the tools to be used. It will be beneficial to carry along a keg of white lead and apply a coat of the lead to the wounds made. This will keep out the air, prevent the wood from checking, and retard evaporation from it. All pruned-off wood should be removed from the orchard and burned.

The process here described will not save all the trees that have been injured, but if done with care it will save many, and those that die after the treatment is given will probably die in spite of it rather than because of it.

Press Bulletin No. 29.—Farm Department.
February 20, 1899.

Milking Scrub Cows.

From January 1 to April 15, 1898, the College bought thirty head of common scrub cows, with the object of testing the value for the dairy of this class of cows when properly handled. These cows were purchased in Lincoln county, cost delivered at Manhattan an average of $34 each, were selected by a farmer who was not a dairyman, and in quality were below the average cows of the state. The cows were shipped from Lincoln county to Manhattan (100 miles) in mid-winter, the excitement and weather causing a serious drop in the milk yield of those that had calved. The first week the average daily milk yield per row was 15½ pounds, the second week 21 pounds.

At the start the cows were fed alfalfa hay and a mixture of two-thirds bran and one-third old-process linseed meal, a ration rich in protein, designed to stimulate the milk flow and to partially overcome the effects from shipping. As soon as the cows were brought to a fair milk flow they were put on a ration of alfalfa hay and kaffir corn grain. This ration produced the greatest flow of milk with butter fat at least cost, but had to be dropped at the end of seven weeks, so that various feed-stuffs could be fed in order to show our dairy classes the effect of various feeds on the texture of butter. The daily grain ration averaged shout eight pounds per cow while on dry feed. While on pasture the daily grain ration

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averaged three pounds of a mixture of four parts corn meal and one part of bran. Alfalfa hay was also kept in a rack where the cows could eat it at will when they were brought in at milking time. The yield held up well thru the fall drouth. For a short time green kaffir corn was fed with the pasture, and the cows were pastured on wheat in the fall until the ground became frozen.

Twelve cows were fresh when received January 5, the rest calving in from one to five months. The records here given are for the twelve, for 1898. The butter fat yielded has been credited at the prices paid each month by the Manhattan Creamery, which were as follows: January, 17½ cents; February, 17 cents; March, 16½ cents; April, 15 cents; May, 14½ cents; June, 13 cents; July, 13½ cents: August, 15½ cents; September, 16 cents; October, 18 cents; November, 18 cents; and December, 17 cents. The feed has been charged at the average retail price in Manhattan for the year: Cost per 100 pounds, corn meal 55 cents, kaffir corn meal 55 cents, linseed meal $1.25, soy bean meal $1, bran 55 cents, cottonseed meal $1; cost per ton, alfalfa hay $4, corn ensilage $1; pasture 75 cents per month. It would pay many Kansas farmers who live distant from market to milk cows, if thru the milk they could obtain the above prices with no additional profits.

RESULTS.—Average yield of milk per cow, 5,707 pounds; best cow, 9,116 pounds; poorest cow, 3,583 pounds. Average yield of butter fat per cow, 238 pounds; best cow, 383.7 pounds, poorest cow, 135.7 pounds. Average cost of feed per cow, $29.20; best cow, $32.80; poorest cow, $26.75. Average value of butter fat per cow, $37.75; best cow, $60.88; poorest cow, $21.39. Average value per cow of skim-milk at 15 cents per 100 pounds, $7.69; best cow, $2.29; poorest cow, $4.83; Average income per cow from butter fat and skim-milk, $45.44; best cow, $73.17; poorest cow, $26.22. Average receipts per cow less cost of feed, $16.25; best cow, $40.37; poorest cow, receipts 43 cents less than cost of feed. Average cost of butter fat per pound, 12.2 cents; from best cow, 8.5 cents; from poorest cow, 19.7 cents. The average price received for butter fat for the year was 15.8 cents. To the receipts given above should be added the value of the calf at birth.

This test shows the difference in value between different cows with feed and care alike. The year's record of our best scrub cow (9,116 pounds of milk; 383.7 pounds butter fat, equal to 451 pounds butter; value of products, $73.17; returns less feed $40.37) is one that many a pedigree dairy cow would be proud of. This cow is of mongrel breeding but has a pronounced dairy form. The poorest cow's form is a good beef type, and her yield of 3,583 pounds of

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milk and 135.7 pounds butter fat was worth 43 cents less than the feed she ate. Is stronger argument needed to induce Kansas dairymen to cull their herds and keep only the best?

This test shows that Kansas cows can be made to give greatly increased yields with proper feed and care. We collected the records of eighty-two herds owned by creamery patrons in one of the leading dairy sections of the state, finding an average annual yield per cow of milk 3,441 pounds, butter fat 104.5 pounds, value of butter fat $19.79. Contrast this with the average for the College scrub herd, milk 5,707 pounds, butter fat 238 pounds, value of butter fat $37.75; and remember that the College herd is much inferior to the average herd of the state.

We attribute the greater yield secured from the College scrub herd to three causes. First, at all times their rations were either balanced or contained an excess of protein—the material which builds blood and milk-while the Kansas cow usually, when on dry feed, has only half enough protein. Second, kindness and shelter. Our scrub cows were petted, comfortably sheltered, never driven faster than a slow walk, and never spoken to in an unkind tone. Third, a full milk yield was secured thru the summer drouth by giving extra feed.

Record of Scrub Herd, 1898.

Number of cow.	Products.			Cost of feed.	Value.			Receipts, Less Cost of Feed.		Cost of butter fat, per lb.
	Milk, lbs.	Ave'ge test, per ct.	Butter fat, lbs.		Butter fat.	Skim milk, 15c per 100 lbs.	Total.	Gain.	Loss.	
20	9,116	4.21	383.7	$32.80	$60.88	$12.29	$73.17	$40.37	.....	.085
7	7,015	4.43	310.8	30.61	49.26	9.46	58.72	28.11	.....	.098
15	6,509	4.27	277.9	29.20	43.89	8.70	52.59	23.39	.....	.105
1	5,904	4.62	272.7	31.06	43.65	7.97	51.62	20.56	.....	.114
6	6,269	4.09	256.4	29.95	40.56	8.44	49.00	19.15	.....	.113
3	5,864	3.99	233.9	28.93	37.04	7.91	44.95	16.02	.....	.123
10	6,580	3.51	230.9	30.79	37.16	8.87	46.03	15.24	.....	.133
17	5,236	3.97	207.8	28.83	32.92	7.07	39.99	11.16	.....	.138
18	5,023	4.12	206.9	28.97	32.69	6.78	39.47	10.50	.....	.139
11	3,475	5.14	178.6	25.24	28.16	4.68	32.84	7.60	.....	.134
19	3,913	4.14	161.9	27.27	25.41	5.27	30.68	3.41	.....	.168
5	3,583	3.79	135.7	26.75	21.39	4.83	26.22	.....	$0.43	.197
Ave'ge	5,707	4.17	238.1	$29.20	$37.75	$ 7.69	$45.44	$16.25	.....	.122

Price of butter fat per pound: January, 17½ cents; February, 17 cents; March, 16½ cents; April, 15 cents; May, 14½ cents; June, 13 cents; July, 13½ cents; August, 15½ cents; September, 16 cents; October, 18 cents; November, 18 cents; December, 17 cents.

Cost of feed per 100 pounds: Corn meal, 55 cents; Kaffir corn meal, 66 cents; linseed meal, $1.25; soy bean meal, $1; cottonseed meal. $1; bran, 55 cents; alfalfa, $4 per ton; ensilage, $1 per ton; pasture, 75 cents per month.

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Press Bulletin No. 30.—Veterinary Department.
February 24, 1899.

Lice on Animals.

These wingless insects are found parasitic on all animals. Cattle are unfortunate in being the most common victims of lousiness. Sheep are rarely affected. We meet with this disease most frequently during the winter months, in neglected, half-starved, dirty animals. Young animals are especially liable to be infected. Sometimes, however, even well-kept cattle suffer severely.

So-called lice are either true lice *(Haematopinus)* or bird lice (*Trichodectes*). The former have a slender, often spindle-shaped body, a pointed head, grayish-blue color, and suck blood. The *Trichodectes* are broader, have a squareish head, brown color, and have biting mouth parts, living on hair and epidermal scales. *Trichodectes* are usually found on neglected, unthrifty animals with long, shaggy hair and dirty, scaly skin. They usually disappear as soon as the animal's condition improves. True lice, on the other hand, occur also on thrifty animals.

Every species of domestic animal has its own specific louse, or lice (horse louse, ox lice two kinds, pig louse, goat louse, dog louse. etc., and *Trichodectes* of the horse, ox, sheep and dog). The louse of one species of animal can not exist permanently on another species.

SYMPTOMS.—Lice always give rise to a troublesome itching, causing the animal to rub and scratch the infested portions of the body. The hair is rubbed off, or drops out, the exposed skin becomes inflamed, scaly, and even covered with extensive eruptions and large raw, bleeding surfaces, giving the animals an extremely distressful and unsightly appearance.

Lice seem to prefer the region of the neck and mane, the back, root of tail and, in cattle, the base of the horns, in pigs the region between the hind legs.

The presence of lice and their nits attached to the hair is sufficient evidence regarding the nature of the trouble.

TREATMENT.—There are many remedies for destroying lice, e.g., arsenic, mercurial ointment, hellebore, tobacco decoctions, the seeds of Delphinium staphysagria (stavesacre), creolin, carbolic acid, lysol, train or fish oil, etc.

The following are of especial merit:

1. Mercurial ointment, diluted with a little oil, is very effective on horses and pigs. It is applied in small quantities to the affected parts only. It must not be used on cattle.

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2. A tobacco decoction (one pound tobacco and three gallons boiling water, allow to stand for half an hour) with or without the addition of two pints of vinegar, is very effective; but often produces nausea in horses and cattle.

3. Five per cent solutions (three teaspoonfuls to a pint) of creolin or lysol, in water containing 20 per cent of alcohol, well rubbed in with a stiff brush, is very effective.

4. The remedy which has given the most satisfactory result to the writer is kerosene emulsion, made as follows: Kerosene, two gallons; common or whale oil soap, one quarter pound; water, one gallon. Heat the solution of soap and add it boiling hot* to the kerosene; then churn the mixture for ten minutes. Dilute the emulsion with twenty gallons of water and apply with a spray pump. If no spray pump is at hand, drive the animals, if many are to be treated, into a narrow chute and apply the emulsion with a common watering-can, being careful to treat all parts of the body.

Select a mild, sunshiny day for the operation. In the course of four days or a week repeat the application in order to destroy those lice that have, in the meantime, emerged from the nits. Where the animals have been kept in stables or pens do not neglect to give these places the same treatment; they are just as lousy as the animals, and if not treated they will soon reinfect the animals. Finally, avoid conditions favorable to future infections, by giving animals proper care and keeping them in a vigorous, thrifty condition. For long-haired animals (calves), shearing might be recommended. Weak, run-down animals may require special nursing to recover completely from an attack of lousiness.

* Note.— Be sure to have the water boiling hot when you add it to the kerosene, and churn it thoroly, otherwise you will have trouble in making a good emulsion; which, when made right, should have a creamy appearance.

Press Bulletin No. 31.—Botanical Department.
March 6, 1899.

Potato Scab.

In Kansas one of the most serious diseases attacking the potato is the scab. Every spring this Department receives numerous inquiries as to methods of prevention. To answer these inquiries the present bulletin is issued.

Scab is a germ (bacterial) disease. The germs attack the substance of the tuber, disfiguring the surface with rough spots and

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cavities. Scab is produced only when germs of the disease effect a lodgment upon the tubers during their formation. This may come about from their presence on the tubers used for seed or from their presence in the soil where scabby potatoes have been previously grown.

PREVENTION

If possible use ground in which potatoes have not been grown, or at least where the disease has not appeared. Use smooth tubers for seed. If the tubers, tho smooth, have been at any time mixed with scabby potatoes, or if one wishes to be surely on the safe side, the seed tubers should be treated with a chemical wash which will destroy any adhering germs.

For this purpose corrosive sublimate is probably the best. Mr. Galloway, of the Department of Agriculture, says: "For the treatment of potato scab a solution of corrosive sublimate has given the best results. This should be prepared by dissolving 2 1/4 ounces of corrosive sublimate in about two gallons of hot water, and after an interval of ten or twelve hours diluting with thirteen gallons of water." (Farmers' Bulletin No. 15, page 6.)

The liquid should be placed in a wooden vessel, such as a barrel or large tub. Earthenware would do, but metal vessels of all descriptions must be avoided, as they would be at once attacked by the solution. The whole potatoes can be placed in a gunny sack and immersed for the required time, about an hour and a half. After being taken from the solution they are spread out to dry and planted in the usual manner. If the tubers are dirty they should be washed, or at least freed from adhering soil before treatment. Scabby seed should not be used, because it is difficult to reach and kill all the germs in the cavities. Corrosive sublimate should cost about 15 cents an ounce.

In case it is necessary to plant upon ground infected with scab, it has been recommended that the furrows be sprinkled with the solution in which the tubers were soaked.

Some investigators suggest sulphur, but as all have not been equally successful with this, we do not at present recommend its use. Professor Halstead, of the New Jersey Experiment Station, publishes the following: "After the seed is cut, dust it with the sulphur, and if the planting is done with a machine it is possible to add the sulphur in the hopper of the machine. In this way both the sulphur and its application will cost but a dollar or so per acre." (Halstead, N. J. Rep. 1895, page 282.)

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CAUTION.

Corrosive sublimate is a poison and should be kept out of the reach of children and animals. For the same reason, all the tubers treated should be planted. The new crop of potatoes will be entirely free from poison.

Press Bulletin No. 32.—Veterinary Department.
March 9, 1899.

Blackleg (A).

PREVENTION.

Blackleg exists in nearly every county in this state, and prevails in certain districts to an alarming extent. Previous to 1896 it does not appear that any cattle were lost from this disease; at least the average stockman did not regard an occasional death as significant of any infectious disease; consequently this subject received very little attention. During the past few years, however, due principally to literature upon this and many other infectious diseases affecting the domesticated animals, the stockman has become better informed, and has learned to associate certain known causes with losses sustained, and in this way is enabled to report with comparative accuracy upon the existence and prevalence of some of the most common diseases.

Within the last few months carefully prepared statistics have been obtained from some of the best informed cattle owners in every county in Kansas, which show that this disease not only exists, but prevails to an alarming extent in more than two-thirds of the counties. That the disease germ of blackleg has rapidly multiplied and spread over the greater portion of this state is shown by the testimony received, which gives the figures upon which the calculation is based. As our report is not yet complete, no attempt will be made to quote the exact percentage of cattle lost during the last three years; but so far as replies have reached us, the evidence is conclusive that this disease has caused at least 5 per cent loss, or equivalent to 80 per cent of all that have died between the ages of 4 and 12 months. These reports further show that more have died from blackleg during the past year than during any previous year. Now, when we consider that many thousand calves have been vaccinated against this disease, and most of them belonging to herds that have suffered from the ravages of this trouble, it is rational to assume that a greater percentage would have died had not preventive precautions been used. The evidence obtained

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from other states where blackleg is prevalent confirms the statistics gathered from various parts of this state. Not only in Kansas, but elsewhere, we find that there has been seemingly an increase in the death rate, equal in proportion to that, sustained by the ranchmen of Kansas.

The applications for vaccine represent more than fifty counties and over twenty-five thousand head of young cattle. As the disease germ can only spread from one pasture to another by certain means of transportation, we find it located here and there, and often in restricted areas. The period of invasion, however, often extends thru many days, and cattle that have had access to infected pastures may not show any signs of disease for several weeks, during which time they may change hands and carry the disease germs to other places heretofore uninfected. The disposition on the part of some people is to sell just as soon as they discover that something is wrong with a lot of cattle, so in this way several farms may become infected by one single bunch of calves. View this question from every standpoint, and we can not fail to observe that every opportunity is offered for rapid distribution of this disease germ, and as this germ is very hardy, being able to resist the heat of summer and the severe freezes of winter, the conclusion is that blackleg has been gradually increasing. Our remedy lies in preventive measures, which will be considered hereafter.

Press Bulletin No. 33.—Veterinary Department.
March 14, 1899.

Blackleg (B).

TREATMENT—PREVENTION.

Blackleg is characterized by its rapid and almost invariably fatal course. As is the case with all similar diseases, the public is imposed upon by unscrupulous quacks who make and sell all sorts of sure cures for blackleg. The principal characteristic of all these so-called remedies is that they fail to do what is claimed for them. We mention some of the remedies below, viz: The internal use of salt, hellebore, asafoetida, nitre and sulphur; the application to and under the skin of pink tablets, ointments, elder-pith, onions; surgical operations like setoning, roweling, nerving, bleeding, the running of animals, etc.

It is a fact that, in some instances, the use of some of these remedies is followed by a decrease in the number of deaths, and sometimes animals stop dying altogether, as if by magic. But these

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are single observations and they prove absolutely nothing. We can find just as many similar instances where no treatment whatever is followed.

We know that thrifty calves are more likely to be attacked with blackleg than unthrifty ones, and that, once attacked, the former seem to have the least chance of recovery. It has, therefore, been suggested to observe care not to let animals get too thrifty; this is easily done, either by resorting to the time-honored but now slightly out-of-date practice of bleeding, or by giving purgatives, or by actual starvation. If any one sees economy or profit in this procedure he is advised to follow it.

We believe in prevention. The cause of blackleg in calves is twofold: First, a natural susceptibility of the animal to acquire the disease; and second, the blackleg bacillus, a microscopic vegetable parasite belonging to the bacteria, the excitors of most of the common infectious diseases.

Blackleg is caused by the blackleg bacillus and by no other germ. On the other hand, the blackleg bacillus causes blackleg and no other disease. By controlling this bacillus we would have one solution of the question of prevention.

Blackleg is a wound infection disease, i. e., it is produced by infection thru a wound, by the entrance of the blackleg bacillus thru a wound in the body tissues. This wound may be in the skin or in the mucous membrane of the digestive tract (mouth, stomach, intestine).

Blackleg bacilli are found in two places—in the bodies of dead or diseased blackleg victims, and in certain low, damp soils, usually bottom lands. In both places these germs grow and multiply. Infected soil, or food plants grown on such soil, serve as means to carry the germs into the animal's tissues. Wounds or bruises in the animal's skin or digestive membranes, be they ever so slight, serve as ports of entrance for the bacillus. The hoofs of animals and their coats of hair, even their droppings, carelessness in attendants serve to carry the germs from place to place.

These statements point out two possible methods of prevention:

1. Changing animals from infected fields (usually low places with rich soil) to non-infected grounds (high, dry places).

We can further prevent the spread of the disease by burning the dead bodies of animals that died of blackleg, avoiding the practice of burying such carcasses, which amounts practically to planting the disease germs for future harvests.

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2. The disease can, in a measure, be prevented by proper feeding. Feeding digestible grasses and root crops, avoiding rough cornstalks and other coarse, hard foods which can produce small internal or external wounds or abrasions and thus provide a port of entrance for the disease germ. The germ always enters the body thru a wound. Suckling calves do not have these opportunities for wounding their delicate mucous membranes, and it is a well-known fact that they are rarely afflicted with this disease. However, this is not the only explanation for that fact.

So much for prevention by guarding against an invasion by the blackleg bacillus.

In the next bulletin we will discuss susceptibility.

Press Bulletin No. 34.—Farm Department.
April 7, 1899.

Get Ready for the Drouth.

June 4, 1898, the College herd of thirty milking cows was being well fed on twenty acres of tame grass pasture from which an early crop of hay had been cut. June 19, this pasture not furnishing sufficient feed, forty-two acres of prairie-grass pasture were added; and August 19, these two pastures getting short, eleven acres of tame grass meadow were added; making seventy-three acres of pasture. With this amount it became necessary, the latter part of August, to begin feeding green kaffir corn to keep up the flow of milk.

Contrast the College record, seventy-three acres of pasture for thirty cows, supplemented with green feed from the latter part of August, with that of a patron of the Manhattan creamery, who, having no pasture, turned his cows into a dry lot, cut green alfalfa and fed it to them, feeding ten head all they needed thru the summer on four square rods less than two acres.

It pays to keep dairy cows supplied with full feed thruout the summer. From July 5 to August 16 the College herd on full feed dropped 4½ per cent in daily milk yield, while eight herds in the vicinity of the College dropped 39 per cent in milk yield because short pastures were not helped out with other feed.

A drouth may be expected some time in every summer. When it comes the milk yield goes down all over the country and the price of dairy products goes up. Not many dairymen can add more pasture when the drouth comes, and the Kansas dairyman who can

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not should without fail provide for feed to supplement short pastures, so as to insure a good milk flow when prices are the highest.

If the pasture does not became too scanty the milk flow may be kept up by feeding grain, but for most dairymen this is too expensive. Liberal feeding of either green alfalfa or alfalfa hay helps out short pasture, and both are cheap feeds where the dairyman has them. The cheapest and most convenient feed for summer drouth where the dairyman has a silo is silage. The soil may be uncovered and the silage fed whenever other feed it short. If rains come and the grass again is sufficient feed, cover up the silo and wait for the next drouth or for winter.

Many dairymen have neither grain, alfalfa, nor silage, and should put in crops this spring that will supp]y green feed when the drouth comes. Plan to-day. Green wheat, green oats and green millet are good, but last only a short time. Begin cutting these crops as soon as the first heads appear and continue until the stalks begin to harden. Sweet corn comes early, and is a good milk-producing feed, but the yield is too small. Field corn, kaffir corn and sorghum are the most profitable green crops for the Kansas dairyman who does not have alfalfa.

Below are given the average dates at which the various crops are available as green feed for dairy cows on the College farm:

Alfalfa—May 20 to September 30.
Wheat—June 1 to 15.
Oats—June 15 to 30.
Sweet corn—July 15 to 31.
Field corn—August 1 to September 15.
Sorghum—August 1 to September 30.
Kaffir corn—August 1 to September 30.
Wheat—Fall pasture until ground freezes.

Many write asking how many acres of each crop is needed. The season, soil and thoroness of cultivation affect the yield so much that we can not answer these questions. Green crops are most needed in dry summers, and in estimating the acreage required for a herd, plans should be made to have an ample supply for a very dry year. In a good year the surplus can be cured for winter. With these considerations, we have made the following estimate of the number of acres of each crop required to feed our thirty cows for the period during which the crop is available: Alfalfa 10, wheat 3, oats 3, sweet corn 3, field corn 4, sorghum 3, and kaffir corn 3.

Kansas Farmer Company, Topeka, Kans.