Rock Island

Dry Land Farming in the Southwest

H. M. Cottrell

Rock Island

Rock Island Lines

Rock Island

Published by
Passenger Traffic Department
Rock Island Lines
Chicago

Dry Land Farming
in the Southwest

DAIRYING is the ONE never-failing money-making resource in dry land farming for the family with little capital. The native wild grass is a dependable dairy feed. Kafir and sorghum, when given good treatment, never fail to produce feed crops. These sure feed crops make good silage and for ten dollars outlay and his labor, the dry land farmer can build a pit silo. Buyers of cream pay cash at the time of each purchase. The dry land farmer with a herd of good dairy cows receives a cash income every week through the year, whether the season is wet or dry.

The new settler in a dry land country who takes a herd of milking cows with him can go out the first morning he is in his new home and milk the cows while his wife is getting breakfast. He can separate the cream and begin a steady cash income with the first day in his new home. The regular weekly return from the sale of cream enables the new settler to pay cash for his household supplies and he need not have store bills. The skim milk fed to hens and pigs adds to the profits.

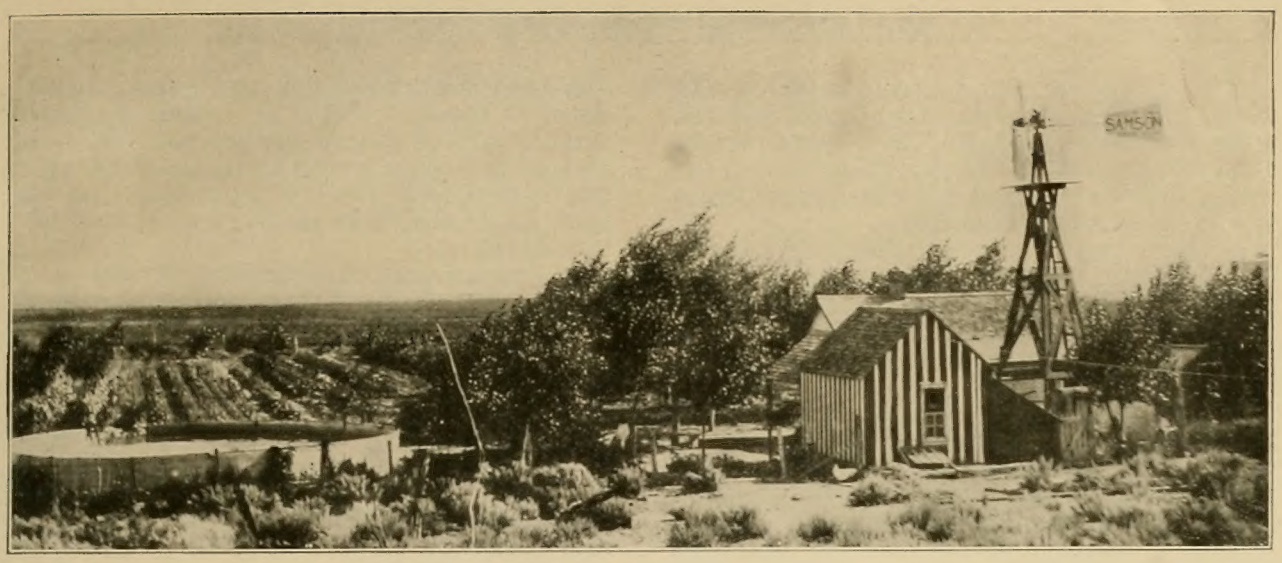
The countless losses and failures in dry land farming in the Southwest have come from attempts to make a living from exclusive grain farming and no stock. A careful dry land farmer in eastern Colorado raised six profitable crops of grain in 18 years. The 1914 grain crop is heavy throughout the Panhandle. The last generally good grain crop in that district was in 1908. The man who depends entirely upon raising grain finds the wait between crops too long. It is particularly hard when the new settler comes at the beginning of a period of dry years. Where the main income is furnished by the dairy cows, the dry land farmer lives comfortably every year. He sows grain only in those seasons when there is ample moisture and the money that the grain brings is a surplus that can be used for investment.

When the dry land farmer has sufficient capital and is not obliged to have a weekly or monthly income, beef cattle, horses and mules are money-makers. Many of the old settlers on the Plains have become wealthy and now have fine homes, some of them are bank directors, from the profits made from raising beef-cattle and horses. Beef-cattle can be finished to top the market on silage made from kafir or sorghum fed with kafir or milo grain and cottonseed meal. The gains are more rapid than the usual gains made in the corn belt.

When you think of dry land farming think of dairying. When you move to a dry land farm take ten to twenty good dairy cows with you. Make your main crops feed crops for the dairy cows. Store the surplus in cheap pit silos. Take good care of the cows and of the cream. You will prosper.

H. M. Cottrell

Agricultural Commissioner, Rock Island Lines



A Dry Land Farm Home.

Dry Land Farming in the Southwest

By H. M. COTTRELL, Agricultural Commissioner
ROCK ISLAND LINES

The Land

THE new settler in a dry land district in the Southwest should have a farm of 320 acres. If he does not have sufficient capital to justify the purchase of 320 acres, he should buy 160 acres and arrange to lease 160 acres of unbroken land.

On the 320-acre farm, 160 should be kept in native grass to be used as needed for a pasture either summer or winter. The native grass has never been appreciated by the dry land farmers. Nine out of every ten of them have a craze for plowing up all the land for which they can secure title. Ninety-nine dry land farmers out of every hundred have from two to ten times as much land under cultivation as they can handle thoroughly. The result is failure after failure to raise good crops, while if such an acreage only as can be well worked is under cultivation, the yields will be good in most years. Many dry land farmers fail because they have 100 to 200 acres per man under cultivation when they have team power sufficient for forty acres only.

A 160-acre native grass pasture is one of the most certain assets of a 320-acre dry land farm. The native grasses have been thoroughly adapted to soil and climate by thousands of years of struggle, in which the fittest have survived. From four to eight acres will furnish feed for a cow through the summer and an equal acreage, not pastured in the summer, will supply a good share of the feed she needs in winter. In a long continued drought the native grass gets short, but always supplies some feed, and the deficiency can be made up by silage.

An Iowa farmer came to eastern Colorado too late in the fall to raise crops. On the farm that he bought was a good native grass pasture that had not been used during the summer. Cows on this pasture as their only feed returned an average of $4 per month per cow. The reason that winter pasture on the dry farming lands is so valuable is that there is so little rainfall during the fall and winter. The grass cures where it grows and there is no moisture to wash away the nutriment. The native pasture deserves good care. It should not be over-pastured and when weeds develop they should be cut.

For the 160 acres used for crops the following arrangement is suggested, subject to such changes as individual conditions make necessary:

60 acres in cultivated crops.
20 acres in hay and forage crops.
40 acres in small grain.
5 acres in home grounds, garden and yards.
10 acres in hog pasture.
25 acres in native grass-reserve winter pasture.
160 acres.

The sixty acres in cultivated crops should be planted to kafir, milo or feterita, depending on the rainfall. No corn should be grown for grain except on the Arkansas Divide, east of Colorado Springs.

The twenty acres for hay should be sown to winter rye, sorghum or millet, as the rainfall and farm work make advisable. Five acres may be sown to sweet clover and it is probable that the amount will be increased after the farmer learns how to raise and feed the crop.

The forty acres for small grain should be sown only in seasons when the soil is in such condition as to force rapid growth after seeding. In other years this land may be summer fallowed by listing and planted to cultivated crops the following spring.

One acre of the five selected for home grounds should be used for a garden and irrigated from the windmill. This acre will supply more vegetables, berries, rhubarb and asparagus than a large family can use through the year.

The new settler on the dry land farm will have to sow rye, winter wheat, rape and sorghum for his hog pasture until he can get sweet clover or alfalfa established. Ten acres, in an ordinary year, is sufficient to pasture five brood sows and their pigs.

On most 160-acre tracts there is a small ravine or some rough land and this can be included in the twenty-five acres reserved especially for winter pasture.

To utilize the crops from a 320-acre farm in the dry land district, one well managed according to this plan, there will be required twenty good dairy cows, five brood sows and 100 or more hens.

Choice cows, well fed, will return $75 a cow yearly from the sale of cream; good grade cows, $50 each a year, and poor ones, $25 each. Twenty good grade cows properly selected will return to their owner $1,000 a year, besides the skim milk and the butter, cream and milk used by a large family.

With ordinary care, thirty pigs can be raised to marketable age from five good brood sows. The farmer can take five for his own use and sell twenty-five. At a fair price these will sell for $300. The last two years they would have brought $375 to $400.

If the dry land farmer will select a good laying strain of fowls and keep only early hatched pullets and one-year-old hens, and make a business of taking care of them, he can make $2 to $3 a hen a year above all cash outlay. The only feed that he will have to buy will be meat, oyster shells and grit. Skim milk will take the place of most of the meat. One hundred hens, rightly managed, will return $200 a year, besides all the eggs, frys and roasters the family wants.

A fair yearly cash income from a 320-acre dry land farm, well managed according to this plan, will be, from cows, $1,000; hogs, $300; poultry, $200; total, $1,500, and a bountiful living for a large family. In poor years the return may be less; in good years, more. There is not an item in this account that cannot be increased by expert management. A skilled dairyman with choice cows will secure $1,500 a year from the sale of cream alone. In seasons favorable to grain, the forty acres of small grain will bring $400 to $600.

A special feature of this plan is that through the sales of cream and butter a weekly cash income is secured throughout the year. The surplus forage crops produced in the good years can be held over to supply the deficiency in dry seasons. The dry land farmer will not be forced to sell them.

This income is based on an adequate equipment of teams and stock and thorough farming. If the equipment is insufficient, or the stock of the wrong type, or the management poor, the returns will be lessened in proportion to the lack. If the farmer is lazy or incompetent, or belongs to the always "unlucky" class, the income may drop any amount down to nothing. Dry land farming is a business that men without farm training should let strictly alone. They can count, with rare exceptions, on absolute failure.

BUILDINGS AND EQUIPMENT FOR A 320-ACRE DRY LAND FARM.

Buildings and Fencing.

Four-room house	$600	
Stable for four horses	100	
Shed for ten cows	100	
Well	150	
Windmill and pump	110	
Water tank (fifteen barrels)	15	
Two pit silos	40	
Barbed wire fence (4½ miles)	245	
Hog fence (half mile)	65	—$1,425

Livestock.

Ten cows	$750	
One hundred hens	100	
Five sows	75	
Three heavy horses and harness	500	—$1,425

Implements and Tools.

Plow (12-inch)	$ 12	
Lister and drill	28	
Lister sled cultivator	18	
Wagon	85	
Disc harrow	35	
Spike tooth harrow	14	
Two-horse cultivator	20	
One-horse cultivator (14-tooth)	5	
Mowing machine	55	
Hay rake	35	
Grain drill (ten discs, press wheels)	100	
Four 40-quart milk cans	14	
Hand cream separator	50	
Tools, milk pails, forks, etc	25	—$ 496
Total		$3.346

Sunday School Rally, Twenty-two Miles from Nearest Railroad Point.

This equipment fences the farm to the best advantage, equips it with ample buildings and with horses and cows sufficient to do good work and secure a good weekly cash income. As fast as the income from the farm justifies it, the herd should be increased to twenty choice cows and to five heavy work horses. If the horses are mares, the colts will add to the income. The poultry can be increased to 400 hens easily by selecting the best of the early hatched pullets for two or three years, and the number of brood sows can be increased to any desired number by the saving each year of the best sow pigs.

WHAT TO DO WHEN CAPTIAL IS INSUFFICIENT.

The buildings, fencing, livestock, implements and tools recommended for the most advantageous equipment of a 320-acre dry land farm require an investment of $3,346, besides the first payment on the land. Many men who hope to build homes on dry land farms do not have so much money.

By using adobe brick, which are home-made, the cost of the house can be reduced one-third, and that of the stable, shed and hen house, one-half. The cost of the buildings will be reduced from $800 to $500, the new settler using in this case his labor and time instead of money.

A small pit silo can be built for a cash outlay of $10. The barbed wire fence can be limited to two miles that is necessary to fence around one 160-acre field, which will cost $110. The hog fence requirements may be cut in half, which will make the cost $35. If badly cramped for money, the new settler can start with five cows, costing $250. He can start with $50 worth of hens and one brood sow costing $15. He should not reduce the expenditure for horses, as horse power is one of the great assets in successful dry land farming. He can rent a grain drill and save $100. With these cuts, a fair outfit can be secured for $2,140. Many farmers have the teams and tools and stock, in which case they could start with $1,000 cash, in addition to the first payment on the land.

Many men who are now "comfortably well off" started on dry land farms with much less, but they had hardships that they would not care to repeat. One of the most successful dry land farmers in Colorado had a one-room shack built on his farm and took his wife and three babies to it with cash assets of $4.60. He worked for neighbors, borrowed implements, got hold of a cow or two, and finally got on his feet and made a good income every year. He is the kind of man that will succeed anywhere.

Another man had the money to put up a small house and a shed. He had two horses and a cow and brought with him a fair stock of farm implements. He started to raise grain only. Drought followed drought. He decided to leave the country and offered his goods for sale. A banker heard of it and sent for the man. The banker told him to stay. The dry land farmer's cow was an unusually good one. The banker said that he would loan the farmer money enough to buy another cow, taking the two for security and to receive one-half the cream money until the note was paid. The farmer reluctantly consented to try the plan, as there was a large acreage of wild grass pasture near his place. He soon paid for the second cow. The banker loaned him money on the same terms to buy two more. Soon the farmer owned four cows and the banker loaned him the money to buy four more. He now owns a good herd and is an enthusiast on the advantages of dry land farming, but his first struggles were harder than most men would endure. A good dairy herd, owned from the start, would have prevented this hardship and given him a weekly cash income.

A mistake that has led to failure with many dry land farmers is paying too much for their land. Land is worth that amount only upon which the net returns equal a fair rate of interest. For example, in sections of the Southwest it is considered that 640 acres in native grass will furnish the feed for twelve months for forty cattle. What is the land worth? Suppose that 75 cents a month per head is charged for pasture, or $9 per head per year. A 640-acre tract brings an annual rental of $360. If money loaned on land brings eight per cent, then $360 is a fair return on $4,440, and this is the worth of 640 acres, a little less that $7 an acre.

Yet thousands of dry land farmers have paid $20 to $30 an acre for raw land of exactly this kind, and have lost all they had because there was no way in which to meet the interest and payments due on the high valuation.

Men who ask high prices for such land base their prices on what it will return when fenced and improved with buildings, water works, stocked with dairy cattle and under a good state of cultivation. The buyer has to make all these improvements and he should get the benefit of the increase in the value of the land which his expenditures make, and not the man who sells the raw land.

There is very little raw dry farming land in the Southwest that is worth, as a producing proposition, more than $10 an acre, and most of it is not worth more than $5 an acre.

The Dairy Cow

THE kind of cows which the dry land farmer milks and uses to consume his feed determines whether he will eke out a bare living or have a comfortable income. The dry land farmers, as a class, pay less attention to the selection of cows that will return good profits than any other farmers in the world. The majority of these farmers think that any cow that has a

calf taken away from her when she is fresh thereby becomes a dairy cow, even though her udder is no larger than a man's hat and her shoulders and loins are thick meated.

I held a dairy meeting in a dry farming district in eastern Colorado and had some good dairy cows to show the audience how to select one. A farmer got up and said that his wife, himself and his children were working harder than people had any right to work, and yet it was a severe struggle to make even a bare living. They depended for their living on a dairy herd. He said that he thought from my talk that he must be milking the wrong kind of cows. He asked me if I would be willing to examine his cows if he and his boy would drive the herd to the meeting. Of course, nothing suited me better.

He brought in the fourteen cows he was milking. One was a grade shorthorn of strong dairy type and would produce at least $75 worth of cream a year. The other thirteen were just cows, cows with small beefy udders, thick backs and small paunches, cows that would each produce $2 to $3 worth of cream a month for a few months after coming fresh, and then become "strippers" for the rest of the year. This herd fairly represents the cows that most dry land farmers are milking.

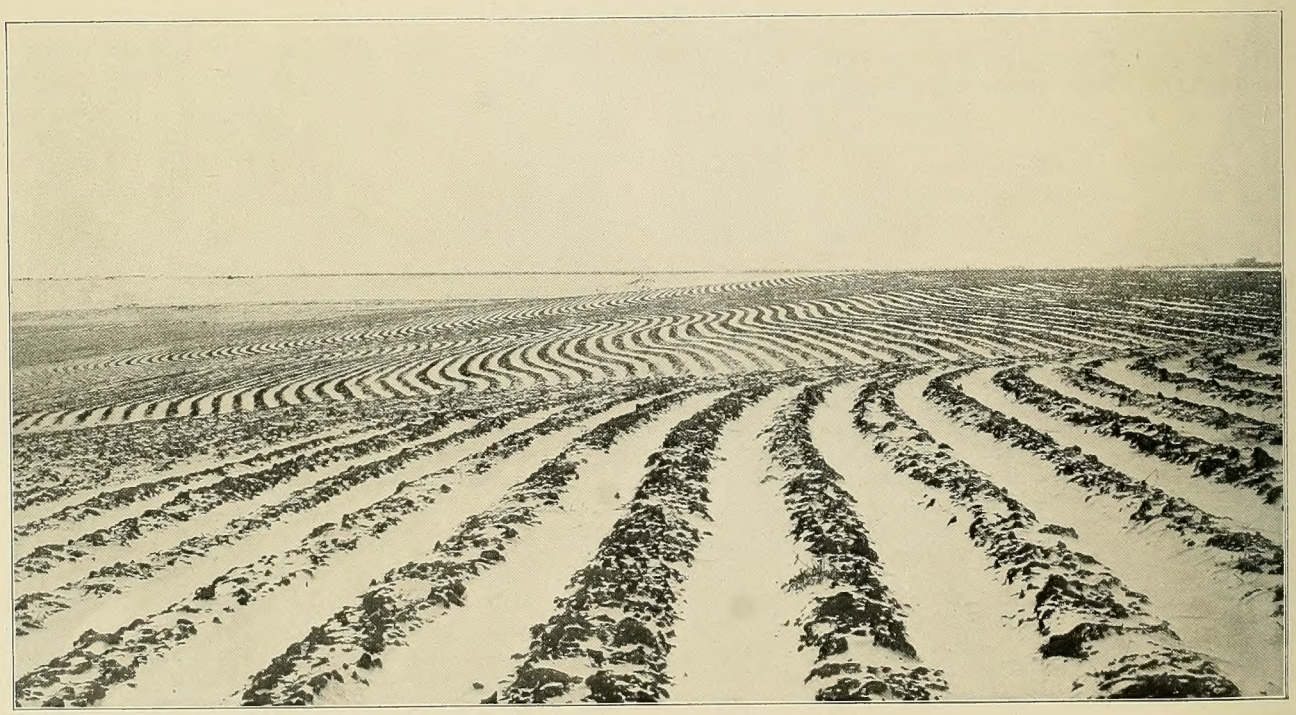
The farmer said that he would fatten his poor cows and with the money that they brought he would buy the right kind. He said that he was sure that with the right kind of cows he could get $1,000 more each year from the feed that he raised.

The first thing to be looked for in selecting a profitable dairy cow is a large paunch. The more feed a cow can eat and store and turn into milk, the more will she increase the owner's bank account. The dry land farmer cannot afford to buy grain, unless perhaps a little cottonseed meal. He must feed his cows almost entirely on rough, bulky feeds, such as grass, silage, sorghum hay and Spanish peanut hay. A cow to return profits must be able to store, twice a day, a large quantity of these coarse feeds.

The paunch must stand out wide and be long and deep. To allow this, the ribs must be long and well rounded, and there should be a long space between the hip bone and the last rib. Blocky and pony built cows turn their feed into flesh instead of milk and give a good quantity of milk for only a few months. A flat ribbed cow is not profitable, as her paunch cannot spread out enough.

The second thing to look for is a sharp, thin meated back just behind the shoulders. When a cow is in good flesh and has a sharp, thin back, it indicates that she does not change her feed into flesh. When a cow has a smooth round, thickly meated back, it shows that she changes her feed into flesh. With the thin sharp back are usually prominent hip bones and thinly fleshed thighs and shoulders. In an animal that turns its feed into flesh, the hip bones do not show much, as they are covered with meat.

The third thing to look for is a place for a large udder. The udder is the machine that makes the milk from the food materials digested and absorbed by the body. A large, good udder will produce a large yield of milk. Nature never puts a good udder outside the body. A good dairy cow has the flank well arched and is cut high be-



Fall Listing on Hillsides—Holding Snow. Furrows Run on Level on Hillsides to Prevent Washing.

tween the hind legs. These two features indicate a place for a large udder. In a cow that turns her feed to beef, the flank comes down almost straight with the belly line and the flesh between the hind legs comes down well toward the belly.

There are many minor points that an expert studies in selecting a money making cow, but if the beginner will make himself competent to select cows having these three special features strongly developed, he may feel sure of being able to choose cows that, properly fed, will pay well. In every town are several family dairy-cows that give large quantities of milk through most of the year and are hard to "dry up." The owner of each of these cows boasts that his cow furnishes all the milk, cream and butter that his large family can use, and that he frequently has milk to sell. A day spent in studying such cows and in comparing their points with those of cows that give little milk, but are thick meated beef animals, will enable a dry land farmer to select cows that will return to him $75 a cow a year instead of $24 a cow from a "hit and miss" herd.

WHERE TO FIND THE COW.

The most profitable cow is the pure bred of the strong dairy type—a cow whose ancestors for centuries have been selected, fed and handled to produce large yields at low cost. In eastern Colorado most of the expert dairymen keep Holsteins. The Texans generally prefer the Jerseys. Few dry land farmers have either the money to buy these specially bred dairy cows or the experience to handle them.

Most of the dry land farmers will have to be content with common grade cows selected from range herds. In most beef herds in the Southwest will be found one or more choice dairy cows. Usually they are grade shorthorns that have "bred back" to the original shorthorn of one hundred years ago, which was a good milk producer. The cattlemen will generally sell such cows for less money than the smooth, thick meated ones, because such cows are "rough."

A dry land farmer who learns to choose a good dairy cow can, by taking plenty of time, ride around among the beef herds and buy here and there a good cow. A dairy herd can be built up in this way at a low cost that will produce $50 to $75 worth of cream a cow each year. The farmer should always be ready to fatten and sell any cow in his herd that does not come up to this standard and always ready to use this money to buy a good cow.

FEEDING THE DAIRY COW.

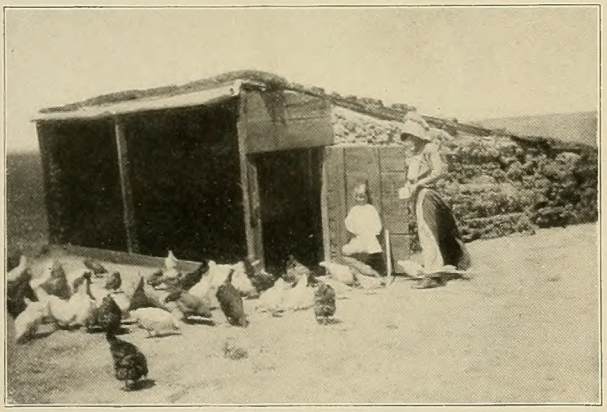
Native pasture and silage should be available summer and winter. The silage should be fed generously at any time of the year when the grass is not sufficient to secure a high yield of milk. In dry times during the summer and at all times during the winter, sorghum hay and the hay from either alfalfa, sweet clover or Spanish peanuts, should be fed liberally. Rye pasture can usually be provided and it makes a good winter feed. In favorable years wheat pasture may furnish nearly all the feed needed for a high yield during the winter. Five good cows fed all they will eat will yield more profit than fifteen half starved.

The daily ration must be balanced between the starchy, heat-making feeds like silage, sorghum hay, corn fodder and millet and the blood- and muscle-making feeds like alfalfa, sweet clover and Spanish peanut hays. Every cow yields a good flow of milk on green, luscious grass. The grass furnishes about three and a half parts of the starchy to one of the blood and muscle-making material. Dry land farmers often say that sorghum hay will "dry up" a cow if she is given enough of it. It will when fed alone, but it may be fed in large quantities to advantage when balanced properly with hay from alfalfa, sweet clover or Spanish peanuts. Cottonseed meal is a convenient feed in Texas and Oklahoma with which to balance sorghum and millet hay and silage.

The Pit Silo

TWO thousand pit silos were made and filled in the fall of 1913 in the dry farming districts served by the Rock Island Lines. The summer was one of the dryest ever known, not only in the dry farming country but throughout the West. Corn and feed crops were burned and dried up through the Middle West. The farmers who dug pit silos were able to save this scorched and withered forage by putting it into the silos. The silage furnished a succulent feed and made the cows give a flow of milk that brought a cash income throughout the winter. These pit silos were built at a total cash outlay per silo of from $5 to $25.

The pit silos and the silage changed the sentiment of the people throughout the dry farming districts of five southwestern states. Any man, no matter how cramped financially, can make a pit silo. Few dry land farmers in a bad year are



A Sod Poultry House in Eastern Colorado.

able to spend $200 to $800 to build a silo above ground. But little feed value can be realized from crops "burned up" by drought when they are saved in shocks. The leaves blow away and the sand and the dirt blow through and through the shocks. The parched and shriveled feed put into the pit silos made money for every man who had them. The conclusion which the men reached was that when they could make money in an unfavorable year with feed scorched by drought, that they could make more money in the average years when good feed is produced by putting it in the silos. The silo would make dry land farms money producers every year.

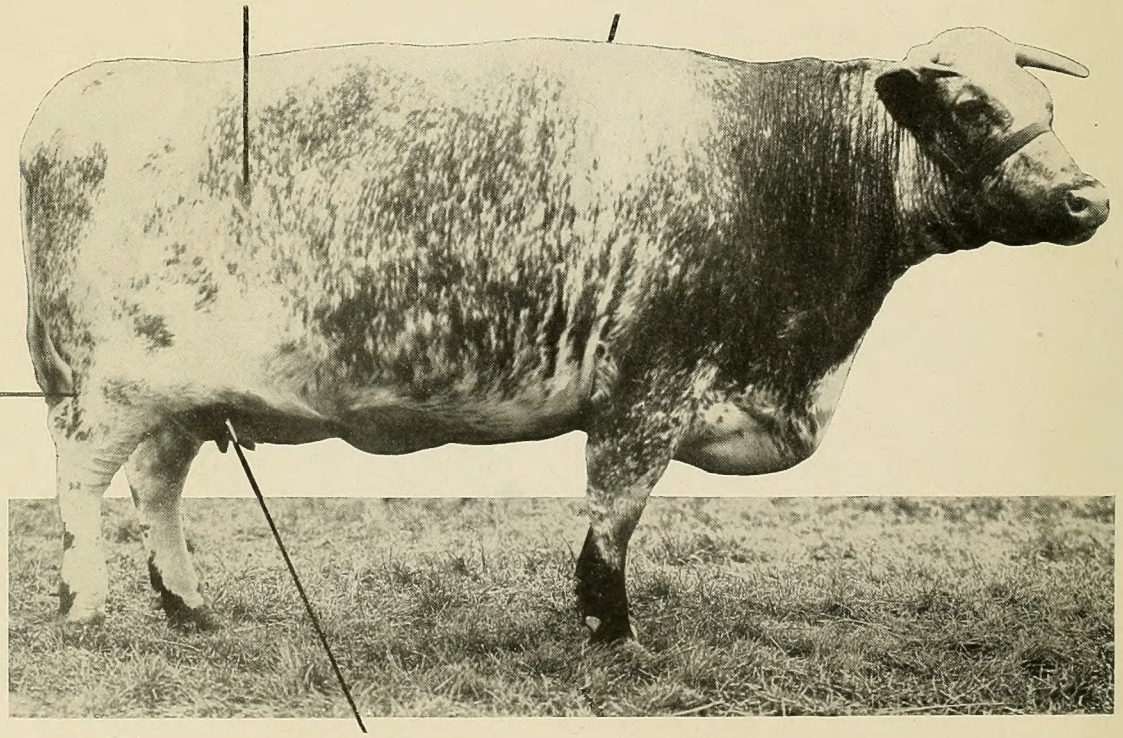
MAKING THE PIT SILO.

Drive a rod or piece of gas pipe into the ground at the center of the silo. Bore a hole in one end of a 2x4 plank and run the rod through the hole. At the other end of the 2x4 drive two heavy spikes. The inside spoke should be set at a distance from the rod equal to one-half the diameter of the silo. The outer spike should be driven one foot farther out. Swing the 2x4 in a circle on the ground and the spikes will scratch two circles, twelve inches apart. Dig a trench two or three feet deep between these circles. Fill the trench with a mixture of sand and cement, using one part of cement to six of sharp, clean sand. Let this set and harden for two or three days. It makes a collar for the pit silo.

It is often advisable to extend this collar two to four feet above the surface of the ground in order to keep storm water from running into the silo. This can be done by using metal lath for a core on which to place the concrete, or two circles of the proper size and height can be made of galvanized iron and used for forms between which the concrete can be placed. As soon as the concrete above ground has set, remove these forms. One set of forms will do for a neighborhood.

As soon as the collar has become well set, dig the silo. Start on the inside of the collar, and as you dig down keep the walls smooth and perpendicular. Any bulge or hollow makes an air space that causes spoiled silage. In El Paso County, Colorado, many pit silo builders saw off the 2x4 used to mark out the silo, so that it will just swing inside the wall as the hole is dug. On the outer end of this 2x4 they bolt a knife made from an old plow share, the front edge of the knife being kept sharp. As they dig down they keep driving down the center rod so this it is always in the center of the silo. With their spades they dig out the earth almost to the silo wall. They then swing the 2x4 around the circle and the knife on the end shaves off the dirt, making the wall smooth and exactly in line.

Dig down six feet, wet the dirt wall thoroughly and plaster it with a mixture of one part cement to two parts of sharp, clean sand, making the plaster three-fourths to an inch thick. The dirt wall can be wet before it is plastered by taking water from a pail and spreading it on the wall with a broom. When the soil is not wet it absorbs the moisture from the cement mixture, drying out the plastering so quickly that it is likely to peel off after a year's use. Dampen the cement plaster twice a day for a week. Cement that dries slowly is tough; when it dries quickly it cracks or crumbles.



Type of Meat Animal.

When six feet of the wall are plastered, dig down another six feet and plaster it and continue until you have reached the desired depth. This method makes scaffolding unnecessary. After the plastering is finished, wet the walls thoroughly and paint them with a mixture of pure cement and water made about as thick as cream. The bottom will need no cement.

These directions are for making a pit silo in dry, hard ground. In sandy ground the plastering may have to be made three inches thick. The plan usually followed is to dig the hole, then use the galvanized sheet iron circle for an inside form, and the earth wall for the outside form. Start at the bottom and fill the space between the iron form and the earth with the cement mixture. Let this set, then raise the form and fill the section above, and so on until the top is reached.

SIZE OF SILO.

A mixed herd will eat about thirty pounds of silage a head a day. If the herd is all mature cows, forty pounds a head a day will be needed. For six months feeding of a mixed herd it is safe to calculate on three tons per animal.

Decide on the number of days that silage probably will be fed, including summer as well as winter, and the number of cattle to be fed. You can then calculate the number of tons of silage needed. The depth of the pit silo should be about twice the diameter. The capacity of silos is as follows:

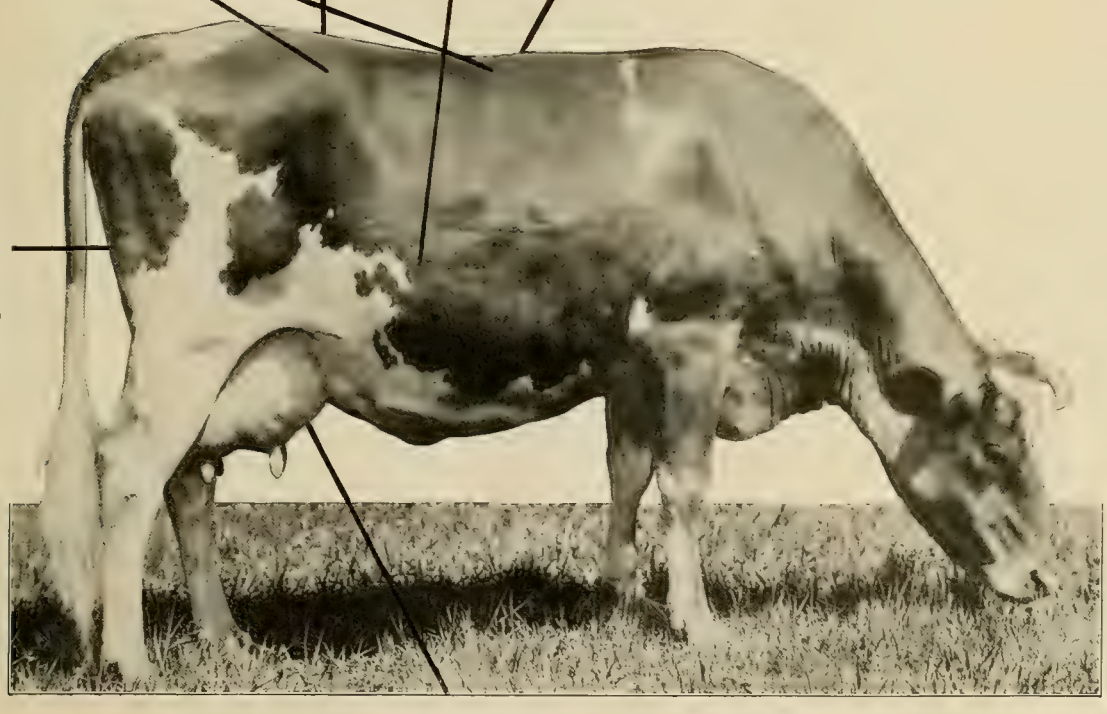
Diameter, feet.	Depth, feet.	Capacity, tons.
12	20	38
14	25	71
16	30	119
18	32	166
20	36	243

Two pulleys attached to a derrick made from three poles, a tub made from half an oil barrel and a rope make a cheap device for hoisting out the silage. A hay track with a box attached to the carrier makes a convenient hoisting apparatus. Ingenious dry land farmers have devised many other handy methods.

THE FEEDS TO GROW FOR SILAGE.

The Kansas Experiment Station in three years' feeding tests with both beef and dairy cattle found that silage made from corn, kafir and sorghum have equal feeding value, ton for ton, provided each is cut at the proper stage of maturity. The corn should be cut when the kernels become well dented and the kafir and sorghum when the seeds become so hard that they cannot be crushed between the thumb and forefinger, but while the leaves are green and the stalks sappy.

The crop to grow, then, is that one of these three, which, on the grower's farm, will probably produce the greatest number of tons per acre. Whichever crop is selected should be planted and cultivated to produce the largest yield of grain. Thick planted crops with little grain lack feed value.



Type of Dairy Cow.

FILLING THE SILO.

The green material should be cut into short lengths, three-fourths to one inch, and this material should be so closely packed everywhere in the silo that very little air can find space between the particles. The closer the green pieces are packed and the less air between them, the better will the silage heat, cure and keep.

The material in the silo will not pack sufficiently close unless it is damp. It should be damp enough so that when a handful is picked up as it goes from the cutter to the silo a little juice can be squeezed out of it. Each piece should be damp all over. It does not pack well when some handfuls are dripping wet and others too dry. Green, sappy corn, just in the roasting stage, has the right amount of moisture to pack well. If the material being put into the silo is dryer than this, sprinkle it with water as it leaves the cutter so that it will become just moist enough. A few feeders wet the silage until it is sloppy. This injures it.

There should be a careful man in the silo as it is being filled to see that the feed is evenly distributed and evenly packed. Keep the stalks, leaves and grain thoroughly mixed all the time clear across the silo. Keep the feed level and evenly packed in the center and along the side. The man should press his feet down hard as he tramps the feed, and when he finds a pocket or hollow place he should fill and tramp it until it is firm as the material around it.

Some men tramp the center hard and neglect the material on the outside. In this case the center settles but little, the outside settles most, contracts and draws away from the walls, letting in the air. Spoiled silage follows. Other men let the material in the center take care of itself and tramp hard along the walls of the silo. In this case the outside settles little, the center much, and the air is drawn into the mass of silage and a lot of it is spoiled. The green material must be tramped firmly throughout the silo.

The dry land farmers feed silage with good results to horses, mules, colts, dairy and beef animals, calves, hogs and poultry. The only precaution necessary is that moldy silage must not be fed to horses, mules and colts. It is likely to kill them.

Beef Cattle

THE dry farming districts of the Southwest offer good opportunities for the man with capital to raise and fatten beef cattle. For the past forty years or more the stockmen in these districts have raised beef cattle by the millions and have sent them to the North and East to be fattened. It has been the generally accepted opinion that cattle could not be finished on dry land feeds to make choice beef. The feeding of silage made from dry land crops with cottonseed meal and kafir and milo by feeders in widely scattered territory has demonstrated that in the dry land country beef cattle can be well fattened at a low cost.

The three years demonstration at the Kansas Agricultural College showing that silage made from corn, kafir and sorghum has the same value, ton for ton, when each is cut at the proper stage of maturity, has opened up a great field for feeders in the Southwest. In western Kansas and Oklahoma an acre of sorghum, well cultivated and put in the silo at the right time, will, in an average year, furnish the rough feed for three stock cattle through the winter, or the rough feed needed in fattening eight steers.

The farmers in western Kansas and Oklahoma by growing kafir or sorghum can secure as many tons of silage per acre with as great a feed value as is now being obtained by the corn growers in the Mississippi Valley. Milo, when acclimated seed is used, is a sure grain crop. Heads of milo ground without the expense of threshing and sprinkled over the silage, makes a ration that will put two pounds of gain per day a head on fattening steers. Three or four pounds of cottonseed meal a day per steer added to the ration will nearly double the gains and reduce the cost.

In western Texas sorghum is a sure forage crop. The red sumac is the variety that has averaged the highest yields. The crop should be cut and put into the silo as soon as the seeds are hard. Large areas can be handled cheaply and well by planting with a two-row lister and cultivating with two-row cultivator. Mile-long rows are practicable on every ranch and help reduce the cost.

The cattlemen of west Texas have spent more money in improving the blood in their herds than the stockmen of any other grazing district. In almost any herd in west Texas the calves at weaning time are equal in form, size and weight to the pure bred cattle of the corn belt. From weaning time on they generally show a steady deterioration in quality so long as they are kept on their home ranches. The feed is dry in winter and often deficient in quality. The yearling in the spring weighs less than he did the fall before and it takes him until the first of July to get back to the weight he had when he was weaned. Sometimes a severe drought cuts off the feed in summer and the cattle become so stunted that they never fully recover.

Silos filled with cane will stop these losses. Summer or winter, whenever feed gets short, silage can always be ready, and with it there never need be a day in the life of a steer in Texas that he does not gain in weight. The Texas stockman can open his silos as soon as the pastures get short, feed just enough silage to keep the stock gaining, and as soon as good pastures come again, seal up the silage that is left and hold it for another time of need. In years of heavy rainfall silage can be stored for years of drought. It is just

as good six years after it is made as in the first season.

Cane will enable the west Texas stockman to fatten his cattle. Milo is a good grain crop in that part of the state, and Texas is the largest producer of cottonseed meal. Milo, ground in the head and mixed with cottonseed meal, and the mixture sprinkled on cane silage, will put three to five pounds of gain a day on a well bred Texas steer.

The dry land districts of the Southwest have great advantage as a feeding country. Dry winters insure dry feed lots. The crisp, dry air gives the fattening steer an appetite that forces him to eat enough feed to make rapid gains. The climate requires only cheap shelter for stock. The character of soil and lay of land enable one man to plant and cultivate a large area. There is an abundance of good water. The silo provides a way to make use of these opportunities.

Most of the men who will settle the plains will be men of much energy and little capital. They will make dairying their main source of income because they will need the regular weekly cash return from the sale of cream. These men will become prosperous and in such financial condition that they will not need quick sales. They will then gradually change their herds from the dairy to the beef type and fatten the beef cattle that they raise.

Under plains conditions, where two or more men work together, 200 beef cattle can be well taken care of per man. It seems probable that the dry land feeder will keep his pasture filled to the limit with breeding cows, using silage whenever the pasture becomes short. The calves will be forced from the time they are weaned and will be marketed at top price when fourteen to eighteen months of age.

Hogs

RAISING hogs is a profitable sideline on dry land farms. Climatic conditions are particularly favorable for handling hogs cheaply. The kafirs—kafir, milo and feterita—are sure grain crops, and ten bushels of either are equal to nine bushels of corn. Hogs will make 500 to 1,000 pounds of gain from each acre of Spanish peanuts and gather the crop themselves. Alfalfa furnishes good pasture where there is water five to ten feet below the surface and sweet clover yields well even on the dryest hills. The skim milk from the dairy cows will push the pigs at weaning. Denver, Wichita, Oklahoma City and Ft. Worth are good markets close to the dry land farming districts, and each needs a hundred times as many hogs as they are getting.

Hog raising has generally been a failure on dry land farms. One class of men have failed because they have kept their hogs in dry lots and fed them grain only. The grain cost more than the hogs were worth, the hogs became unthrifty because they did not have pasture, they got lousy and the dust made them cough so badly that they could not make gains.

Another class of dry land farmers took pretty good care of the pigs until they were weaned and then turned old hogs and pigs together into a scant pasture, fed little or no grain through the summer and were careless about watering. In the fall they had a lot of badly stunted shoats on hand. Some years there was a good grain crop, but it took twice as much grain to fatten the hogs as it would if they had not been stunted. In years when corn failed the farmer had a big

Showing Construction of Pit Silo on Dry Land Farm.

bunch of stunted hogs that he could not sell and for which he had no feed.

Hog raising can be made profitable on dry land farms when it is handled rightly. A few sows only should be kept; two to five are enough to start with. The sows should be prolific, the kind that raise from eight to ten pigs at a litter. The farmer must provide cheap but good shelter at farrowing time and must give the sow such care that she will save every pig that is born. The skim milk should be fed the sows and pigs until the pigs are weaned and then the pigs should get it. A pig should have a little grain every day of his life—one to three pounds each daily until he weighs 100 pounds, and then two to four pounds daily. A pig should have rough feed every day of his life. pasture in the summer and alfalfa or sweet clover in winter. Half the weight at marketing time must have been made from pasture or rough feed if hog raising is to be profitable.

The general management required to make money with hogs is the same on dry land farms as it is in the rain belt. There are two things the raiser has to keep in view all the time, cheapness in shelter and handling and feeding to make the pig gain every day from birth to maturity.

An A-shaped house 8x8x8 feet makes a cheap movable shelter—one house for each sow and her pigs. In cold weather it can be covered with straw or fodder. When pigs are farrowed in cold weather a lighted lantern hung from the roof will keep such a house warm.

A cement feeding floor is very convenient in fattening. A floor 30x40 feet is large enough for a carload of hogs. It should have six inches of slope for each ten feet of width. Kafir or milo in the head can be thrown on the upper side of this floor and the hogs will work the trash to the lower edge as they eat the grain. Hay from alfalfa, sweet clover or Spanish peanuts can be thrown on the upper side of the floor and the hogs will work the refuse from this to the lower side as they eat the leaves and finer stems. It is easy to rake the trash off the floor because it gathers at one side.

Hogs, to thrive, must have pure drinking water at will. One of the most convenient ways to provide this is to mount a barrel on a small sled and attach to the lower part of the barrel an automatic hog waterer, such as any good hardware store can furnish. The barrel and sled can be moved to any field where the hogs are pasturing and the water will be kept fairly clean.

Lice cut down the profits more than any other one thing. Set short posts in the feed lots and pastures. Wrap each post with an old potato sack. Once a week soak the sack with crude oil. A louse bites the hog, he rubs the spot on the sack and the crude oil kills the louse.

Make a hog bath of concrete 8x10 feet and 16 inches deep. Fill nearly to the top with water and add a small quantity of crude oil. The hogs will bathe several times a day and the oil will kill lice and keep the skin healthy. Replace the water and oil as needed.

For worms, take an ounce of Santonin for each fifty 100-pound pigs. Mix thoroughly with slop. Keep pigs off feed from night to the following noon, and then give the slop.

Change feed lots or keep them clean and sprinkled so that dust will not bother the hogs. Large numbers of hogs on dry land farms are kept at a loss because of dust and the coughing that it causes.

FEEDS.

The dry land grain feeds are kafir, milo and feterita. The cheapest way to feed them is in the head without either threshing or grinding. The fat from hogs fattened on these feeds is whiter in color than that from corn fed hogs. Pork from hogs fed these feeds would command a premium if there was enough to create a special brand. A Panhandle hog man two years ago bought 4,000 bushels of milo and bought hogs to fatten on it. The milo fed to hogs brought an average return of $1.05 per bushel. Farmers without hogs sold it at 30 cents a bushel.

In the dryest year ever known in the Panhandle of Texas, a farmer had a large field of Spanish peanuts. He weighed hogs into this field and they gathered the crop themselves. They had no other grain. When they became fat he shipped the hogs, weighing them as they were taken from the peanut field. He received pay for 1,023 pounds gain on the hogs for each acre of Spanish peanuts.

Spanish peanut hay, the tops and nuts cured together, makes a good hog feed. This feed forces the brood sow to give a large yield of milk, it pushes the growth of the young pigs and combines to best advantage with kafir and milo to make rapid gains on fattening hogs. This hay can be kept in well made stacks and used both summer and winter.

At the Kansas Experiment station the writer divided a number of hogs into two equal lots and fattened one lot on kafir and one lot on kafir and alfalfa hay. For each 100 pounds gained by the hogs fed kafir alone, the hogs fed kafir and alfalfa hay gained 173 pounds. Sweet clover and Spanish peanut hay will take the place of alfalfa. When nothing else is available, juicy sorghum hay saves grain and improves the condition of the hogs.

Alfalfa or sweet clover pasture should be furnished every pig on a dry land farm, one to two acres for each sow and her pigs. Until the new settler can get these crops started he can use winter rye sown in the spring, dwarf essex rape, sown as early as the land can be worked, and sorghum.

Hogs need more mineral matter than dry land feeds supply. In timbered regions wood ashes supply this need. but are a curiosity on dry land farms. Soft coal is profitable for this purpose. Dump it in a dry place in the feed lots and let the hogs eat it at will. A mixture of soft coal, fifty pounds, common salt, two an one-half

pounds, and sulphate of iron, three pounds, kept in a shallow box where the rain cannot reach it, is a good tonic to keep before the hogs.

A hog pushed for large gains will eat a pound of soft coal a day and he will thrive in proportion to the coal he eats, provided he is being properly fed.

Hens

GOOD hens, like good dairy cows, are sure producers in dry land farming sections and should be one of the important sources of revenue. A skillful poultryman on a dry land farm can realize $2 a year a hen above the cost of feed. Yet on the majority of dry land farms there is not enough eggs and poultry produced to give the family all it wants, and most dry land farmers claim that chickens "eat their heads off."

The layers in the average flock consist of a number of early-hatched pullets and a few yearling hens. Besides these there are a number of old hens, some of whom ceased to lay years ago, several long-spurred old roosters and a lot of active young cockerels. Such a flock with fair attention will average 60 eggs a year per hen. Get rid of all the flock but the choicest early hatched pullets and the heavy laying hens. The average will increase to 120 eggs a year a hen and the feed bill will be cut in half.

Pullets from good egg laying strains will begin to lay when six months old if they have been

Spanish Peanut Plant.

pushed for growth and development and given plenty of exercise and comfortable surroundings. Such pullets hatched in March or April will start to lay in October and will supply the eggs for the high priced fall and winter markets. Year old hens begin to lay in December and should be laying well in January.

Males should not be allowed at any time with the hens except when the eggs are to be used for hatching. The hens will lay more eggs and produce them at less cost without males than with them. At the New York Experiment Station pullets without a male produced eggs at thirty per cent less cost than pullets kept with a cockerel. Infertile eggs do not spoil in warm weather.

SHELTER.

The general management of the hen to make her lay is the same in the dry land districts as in the rain belt, with one marked exception, that of shelter. People in the dry land districts boast that no matter how hot it gets in the day time, they have to sleep under blankets at night. This shows a wide change of temperature every twenty-four hours between the hottest time of the day and the coldest in the night. In some districts the average change for each twenty-four hours is thirty degrees. This extreme change causes draughts with eastern methods of ventilating poultry houses. One of the sources of heaviest loss comes from injury to the fowls from these draughts—colds, roup and poor laying.

To prevent draughts the dry land hen house should be built tight on the north side, both ends and the roof. The only openings will then be on the south side, and draughts are not possible with openings on one side only. Through a cold winter Prof. W. E. Vaplon had hens thrive in northern Colorado, at an altitude of one mile, in houses with the south front made of wire netting, but there was not even the smallest hole in the other sides, the ends or the roof.

The south front must have sufficient openings to furnish a constant change of pure air without draught. The air is so dry in the dry land districts that severe cold is felt but little and it is easy to make a hen house warm enough. It may be made of straw packed between boards, adobe or lumber.

GRAIN.

Kafir or milo is the staple poultry feed in dry land districts, supplemented with wheat, oats, millet and Spanish peanuts. In cold weather it pays to warm the grain in the oven before feeding.

GREEN FEED.

Alfalfa hay is the best green feed for winter. Sweet clover hay carefully cured is good. Every one who has reported says that silage makes a large increase in the number of eggs laid during the winter. Beets, mangels and cabbage are relished. Rye or wheat pasture is greatly liked in the winter. A hen should have all the green feed she will eat every day in the year.

Meat in some form every day is necessary to secure profits. Many new settlers in the South-

west trap the numerous rabbits and feed the meat from them to the hens. When a hen has plenty of grain, grit and lime in shells, she is not likely to eat too much meat if she has a daily supply of it. When hens have gone a long time without meat they may ruin themselves permanently and never afterwards lay again if given too much at first. A farmer's cow broke her leg. She was killed immediately and skinned and the carcass drawn into the poultry yard. The hens had been without meat for months and gorged themselves. Some of them died, others were sick and none of the flock ever laid well afterwards.

Water.—A dozen fair sized eggs contain a pint of water, and large quantities of water are constantly being used in the digestion of food and the performance of active life.

Water is in ceaseless demand in the hen's body and is as essential as feed. Many well fed hens do not lay because they do not have the water necessary in the formation of the egg. Lack of water is the chief cause of hens on the farm not laying in the winter.

Water must be clean, pure and palatable and within reach of the hen whenever she wants it. She will not drink enough if the water is lukewarm in the summer or when it is mixed with ice in the winter.

Grit.—Grit is the hen's teeth and it must be sharp. Often hens kept on stony places must be fed grit because the pieces of local stone are so rounding that they do not grind the feed well.

Lime.—The egg shell is nearly pure carbonate of lime and lime is found in most of the tissues of the body. It is as absolutely necessary to the hen as air or feed. Crushed oyster shells supply lime cheaply. A hen needs about four pounds a year. In some sections crushed limestone can be used to supply both grit and lime.

The hen house should be kept clean and the hens free from lice and mites. Many dry land houses are not cleaned oftener than once a year and the owners find that hens do not pay. Dust, convenient for a dust bath, whenever a hen wants one, will keep down the lice. Take a quart of kerosene and crush moth balls in it as long as they will dissolve. Use the mixture to paint the posts and nests. The heat from the hen's bodies will vaporize this paint and the vapor will kill the mites. This mixture is very explosive. It must be made out of doors and kept from all exposed flame, as lighted matches and pipes. The hen house should be given an extra cleaning twice a year and whitewashed, the whitewash having a little crude carbolic acid added.

Pork from Milo Fattened Hogs.

The dry land farmer usually neglects the poultry. It will pay him to make a business of taking care of his chickens every day just the same as he makes a business of milking his cows. A hundred laying hens taken care of as recommended in this article will bring more money in a year than the farmer in the western third of Kansas gets from the average 50 acres of wheat.

The farmer new to careful poultry work should start with twenty-five hens of a laying strain. In a year he should learn how to handle 100 hens profitably. At the beginning of the third year he should be able to handle 200 and get $2 a year from each above the cost of feed. Even with 100 hens, the addition of $200 to the cash income of the farm makes it worth while to spend a little time each day in good care. The hens will lay, no matter how severe the drought.

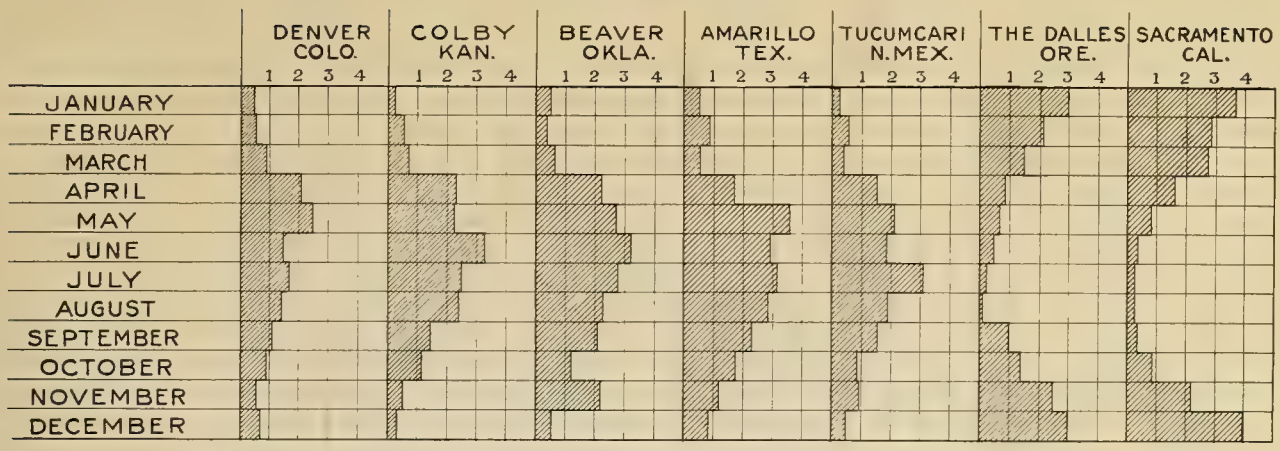


Chart Showing Comparative Monthly Distribution of Rainfall.

The Climate

TO be successful the dry land farmer should adopt a system of farming that with his climatic conditions will furnish a comfortable living in the most unfavorable seasons. He will then make good profits in the average and the best years.

The farmer who is located in a dry farming district and the man who wants to become a dry land farmer, should study very carefully the climatic conditions, as they determine, very largely, the system of farming to be adopted, the methods of handling the soil and the crops to be raised. The study of these conditions should be thorough. Much of the information needed may be secured by applying to the U. S. Weather Bureau, Washington, D. C.

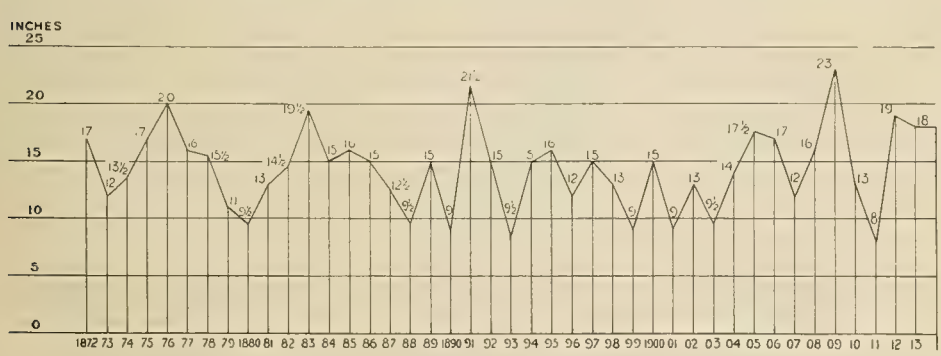
The conditions to consider are (1) average annual precipitation, (2) the variations from the average, (3) the distribution of the rainfall throughout the year, (4) evaporation, (5) temperature, summer and winter, and the length of the growing season.

AVERAGE ANNUAL PRECIPITATION.

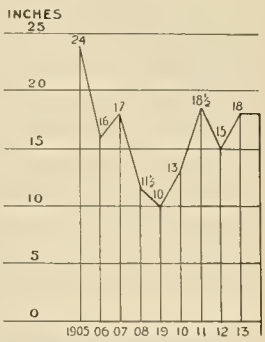
The average annual precipitation in eastern Colorado varies in different localities from twelve to nineteen inches, in Western Kansas from sixteen to twenty-four inches, in Western Oklahoma from twenty-four to thirty inches, in the Panhandle of Oklahoma from sixteen to twenty inches, in Eastern New Mexico from thirteen to sixteen inches, and in the Texas Panhandle from eighteen to twenty-five inches. The average annual rainfall in all these dry land districts is ample to produce profitable yields of feed crops and with good management, good yields of grain. The capable dry land farmer can raise fair crops when the rainfall through the year is ten to twelve inches, provided it is favorably distributed.

VARIATIONS FROM THE AVERAGE PRECIPITATIONS.

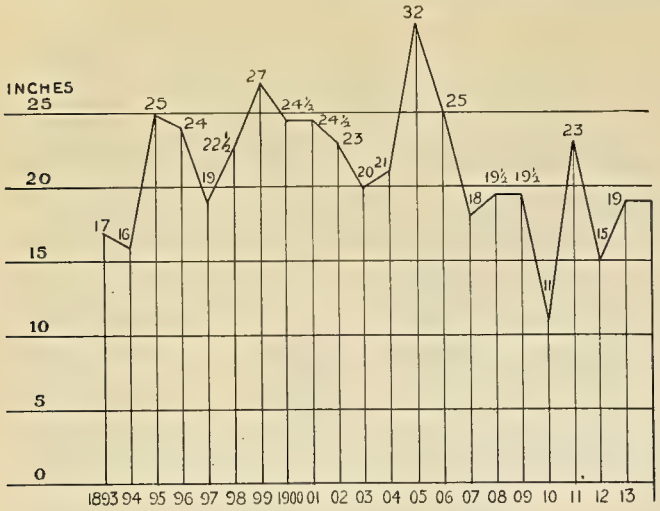
The hindrance to success in dry land farming comes from the wide variations in the annual precipitations. The records of the precipitation in Denver, Colo., have been kept for 42 years and the average is 14.31 inches a year. If this had been uniform through this period it would have been an easy matter to have raised profitable crops every year. In 1909 the precipitation was twenty-three inches and in 1911 was 7.75 inches. The failures in dry land farming come from a lack of ability to operate a system of farming that will adapt itself to these wide variations, where the margin of safety is so narrow.



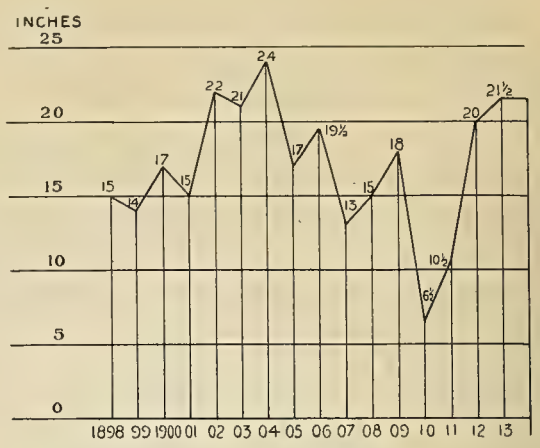
Annual Rainfall, Denver, Colorado.



Annual Rainfall, Tucumcari, New Mexico.



Annual Rainfall, Amarillo, Texas.



Annual Rainfall, Colby, Kansas.

The average precipitation at Colby, Kans., is 17.76 inches. In 1904 the precipitation was 23.73 inches; in 1910, 6.62 inches; in 1911, 10.55 inches. The dry years broke the man who grew wheat only. There were good feed crops every year.

The precipitation at Tucumcari, N. M., in 1905 was twenty-four inches and the new settlers raised good crops of corn. The rainfall dropped to sixteen inches the next year, and the precipitation in 1909 was only 10.33 inches. A large number of farmers lost all they had because they thought 1905 was an average year and they kept on trying to raise crops that required the heavy rainfall.

The average annual precipitation at Amarillo, Texas, is twenty-two and one half inches. In 1905 it was 32.33 inches. The next year it was above normal and thousands of farmers rushed to that district to get rich raising grain. Then came four dry years, the precipitation in 1910 dropping to eleven inches. The majority of the new settlers conducted farming operations on the basis of the heavy rainfall of 1905. Large numbers of them failed, lost all they had and left the country. Feed crops yielded abundantly every year except one and the silos carried the farmers who raised feed crops over the dry year. Every year since that country was first settled good profits have been made from livestock and feed crops have failed but once when handled rightly.

Throughout the Southwest the rainfall is sufficient to not only furnish the farmers a comfortable living, but will enable them to make fair profits above their living if they will follow the system of farming and the methods adapted to the years of low rainfall.

The constant tendency, of course, is to hope each year as it comes will be one with favorable conditions. In wet years the dry land promoters hold forth that the seasons have changed, that the rainfall follows the plow and that there will be no more droughts. The long period through which the rainfall records have been kept at some dry land points, show that settlement and cultivation have caused no change whatever in the rainfall. There are seasons of heavy rainfall and others of light rainfall now, just as there were forty to seventy years ago. The valley of the Nile has been cultivated for 6,000 years with no effect toward increasing the rainfall.

DISTRIBUTION OF RAINFALL THROUGH THE YEAR.

A study of the diagram will show that about three-fourths of the rainfall in the dry land districts of the Southwest occur chiefly in the spring and summer months, the fall and winter months are dry. This condition makes sure those crops which are planted in the spring, and cultivated, such as kafir, milo, sorghum and Spanish peanuts. The dry falls and winters make the growing of winter wheat uncertain and frequently the rains come too late in the spring to start spring grain.

The sure crops under this distribution of rainfall are feed crops that furnish both silage and grain. The dry winters make dry feed lots and the dry, crisp winter air gives a zest to the appetites of all farm animals. It seems that nature has planned conditions in the Southwest for a money making livestock country.

The distribution of rainfall through the year at The Dalles, Ore., and Sacramento, Cal., is shown. In the Pacific coast districts the rainfall occurs almost entirely during the winter months. In the inter-mountain districts the rainfall comes during the winter and spring and the summers are dry. On account of these peculiar conditions of rainfall, a system of wheat growing through the aid of summer fallowing has had an extensive development in Utah and in some of the northwest districts of the Pacific coast. The land is plowed in the fall and absorbs the winter and spring rains. It is well tilled in the summer and in the fall sown to wheat. The moisture held by the summer tillage brings up the wheat and the winter and spring rains make it mature before the summer drought.

This method of wheat growing in alternate years by summer tillage is mentioned because eight or ten years ago it was strongly advocated for the Southwest. It was given many trials in the dry land farming districts in all the southwestern states and proved a failure. Even now the summer fallowing methods used in Utah are often recommended to new settlers in the Southwest by men who are not acquainted with the failures of the past and the difference in the distribution of the rainfall. The summer fallowing methods of Utah and the Pacific coast, when followed in the Southwest, fail to save much of the summer moisture because of the high winds and temperature, unless cultivation is given after every shower, and this makes the soil so fine that in a short time it blows as deeply as it was plowed.

EVAPORATION.

The evaporation of moisture from the soil in dry land districts of the Southwest is heavy and has a strong effect in reducing the effects of the rainfall. No accurate method of measuring this evaporation is in use, but the comparative evaporation of different districts is determined by measuring the amount of water evaporated from an exposed surface of water during the growing season, April 1st to September 30th. The evaporation in inches during the growing season in eastern Colorado is forty-five; northwest Kansas, forty-five; southwest Kansas, sixty; the Panhandle of Texas, fifty-four. In northern Ohio the evaporation is twenty-five inches and in southern Wisconsin, twenty-seven. While the evaporation from the soil is much less, these figures show the strong force of evaporation with which the dry land farmer has to contend and the necessity of thorough work to hold the moisture in the soil.

Evaporation increases southward. Experts estimate that with each increase of three inches in evaporation, an additional inch of rainfall is necessary to secure equal results in crop production. On this basis a rainfall of fifteen inches in Colorado would be equal to eighteen inches in the Panhandle.

TEMPERATURE—SUMMER AND WINTER.

The dry land farming districts of the Southwest have much sunshine, cloudy days are few in winter, the air is crisp and dry. In summer the days are warm, but the nights, almost without exception, are cool. The dryness of the air and the intense sunlight during the winter makes the cold felt much less than in districts having humid air.

The result is that on an average there are more than 300 days each year when it is comfortable to work outdoors. The only annoying feature is the high winds during the spring, and in drought years during the fall. Snowfall is usually light. The average monthly temperature in Denver is, in January, 31 degrees; July, 71.9 degrees; Colby, Kans., January, 28.9 degrees; July, 75.2 degrees; Beaver, Okla., January, 33.2 degrees; July, 80.3 degrees; Amarillo, Tex., January, 33.9 degrees; July, 76.1 degrees; and in Tucumcari, N. M., January, 31 degrees, and July, 68.3 degrees.

LENGTH OF CROP GROWING SEASON.

The average length of the crop growing season, as determined by the average of the latest and earliest dates of killing frosts, is 140 days in northeast Colorado, 150 days in southeast Colorado, 150 to 180 days in western Kansas—the first figure being for the northwest part of the state and the second for the southwest. In the Panhandle the average is 180 days in the northern part, increasing southward to 200 days.

Holding the Rainfall

As the dry land farmer cannot change the rainfall, it is necessary to accumulate as much of it as he can in the soil for the use of his crops. The chief losses of rainfall in the dry land districts are from the run off during storms and from evaporation. The two tillage problems ever facing the dry land farmer are to keep his soil in such condition that it will absorb much of the precipitation as it falls and then to keep the surface soil in such a state as to retard evaporation.

The average rainfall in the Southwest is sufficient to produce good yields of dry land crops, and it is the dry land farmer's business to handle his soil in such a way that he gradually accumulates sufficient moisture to keep the soil moist in dry years to a depth of four to six feet, and in years of good rainfall to a depth of twelve to fifteen feet.

The accumulation of moisture to this extent equalizes the effect of the great variations in yearly rainfall. The stored moisture in the soil acting as a reserve in dry years, the same as a bank deposit is a reserve for a business man.

It is practicable to handle dry land soils in such a way that half of the actual precipitation is absorbed and stored in them. After this has been accomplished, crop failures become rare. It may take several seasons to secure this storage when team power and capital are light.

Deep plowing or deep listing is the most effective way of insuring the storage of the rainfall. Many of the rains in the dry land districts are heavy and dashing. On the unplowed prairie most of the water that falls in such rains runs off immediately into the draws and creeks. Land plowed shallow will absorb some of the water that falls in a driving rain; land plowed deeply will absorb more. Land plowed four inches deep has only half the capacity of absorbing quickly the rainfall as land plowed to a depth of eight inches.

Many of the farmers who read this article will start their dry land farming operations on unplowed prairie land. How deep shall they plow?

Where the man has sufficient power and can stand the expense, I would advise using a Spaulding deep tilling machine that will plow and pulverize the soil the first time to a depth of sixteen to eighteen inches. Very few farmers can stand the expense of such a first preparation. Good judgment consists of doing the most effective work with the power and money available.

The average man will have three good horses and not much money. I would advise him to break the sod first time two to four inches deep, and cut it up thoroughly with a disc harrow. Plant kafir, milo and cane on this shallow plowed sod. The next season break or list the land a couple of inches deeper and the third season stir it two or three inches deeper than in the second year. In this way the soil can be gradually stirred deeper and deeper without excessive cost and better water storage be secured each year.

A large part of the moisture absorbed by the soil is lost by evaporation from the surface unless some means are taken to prevent this loss. The sun and winds carry off the moisture from the surface. As the surface soil dries, the moisture from the lower soil is lifted gradually upward and in its turn is evaporated unless prevented.

Where the surface soil is stirred and kept loose to a depth of two to four inches, this evaporation is largely checked. The loose soil acting as a blanket or mulch to prevent the moisture in the soil below from escaping.

When a crust is formed the surface is made compact and the soil moisture evaporates rapidly. In a field after grain has been cut, the soil is hard on the surface and often moisture equal to one inch of rainfall is lost through this hard surface every week during the hot weather. When a disc harrow follows the binder, the surface soil is loosened and a mulch is formed that checks this evaporation to a great extent.

It was once generally advised to cultivate or harrow the soil from early spring until fall after each rain in order to keep a crust from forming and to keep the surface soil loose enough to form a mulch or blanket. This system has been found to be dangerous. The level surface and the fineness of the particles made by repeated harrowings make the soil easily moved by winds. Thousands of acres in the Southwest and tens of thousands of acres on the Pacific coast have had all the soil blown off as deeply as it was plowed because the surface soil had been kept too smooth and fine. In many cases the blowing did not stop when the depth of plowing has been reached, but kept on moving the raw, smooth subsoil. The surface of cultivated dry land soil must be kept corrugated and rough.

The principle is the same as that governing the flowing of water in mountain streams. In the mountains of Colorado are trout streams so swift that a man cannot hold his arm perpendicular in the water. At the bottom of these streams fish may be seen lazily moving upstream. It seems wonderful that a fish can be so powerfully muscled that he can swim slowly against a current so swift and strong that a man cannot resist it with his arm. When these streams are measured to ascertain the amount of water they will supply for irrigation, the measuring shows that the water near the surface and just below it is moving very swiftly, but that the water at the bottom of the stream where the fish are moving is almost still. The friction of the stones along the bottom has checked the current until the water barely moves. While the dry dry land farmer cannot stop the speed of the winds, he can check their movement and destroy their effect at the surface of the soil by leaving the surface rough or deeply corrugated. The dry land farmer should keep the surface of his cultivated fields rough and corrugated at all times when a crop is not growing on them.

Potatoes—A Good Dry Land Crop.

THE LISTER.

The lister is one of the best implements for keeping the soil rough so that it will not blow, and for putting the ground in condition for accumulating and holding the moisture. As soon as a grain or forage crop is removed from the land in summer or any crop in the fall, the field should be disked immediately. Then as soon as practicable the land should be listed deeply. The listed rows should not be more than three and one-half feet between centers. Three heavy horses with a single lister can cover eight acres a day.

The deeper the lister is run, the better. When run deeply it throws the land into sharp ridges, and this stops the movement of the soil by the winds. The loose dirt that is thrown by the lister on the ridges acts as an efficient mulch to hold the moisture.

The land should be listed early in the fall and kept ridged as listed through the winter. The snow will accumulate in the furrows and as it melts will sink deeply in the ground and be held there. With the average amount of snow, practically all the moisture in it will be held in the listed furrows. Where the surface is level, the greater proportion of the snow is blown off of the cultivated land. Deep furrows hold the water

that falls in the autumn and spring rains until it is absorbed by the soil.

When the winter and spring are unusually dry, the land may be left in the spring just as it is and the seed planted in the furrows. Even in extremely dry years the listed furrows will contain sufficient moisture to make such seeds as kafir, milo and sorghum germinate quickly and make a good early growth.

In seasons of ordinary rainfall, the listed furrows should be run over lengthwise early in the spring with a disc harrow and at planting time the ground should be relisted, splitting the ridges.

When it is desired to summer fallow the land, it can be listed early in the spring, and then alternately be harrowed and disked often enough to keep a crust from forming. When the listing is done early in the spring and the seeding is to be late, it sometimes pays to relist in midsummer, splitting the ridges.

In cultivating crops planted in the bottom of listed furrows, the cultivator shovels should be set to run deep the first two cultivations and to throw but little dirt against the plants. Later cultivations should be shallow. The lister furrows should be filled gradually so that at the last cultivation the surface of the land will be level. Most dry land farmers "lay by" their crops too early. Shallow cultivation should continue until the heads or ears form. Often a shallow cultivation with a one-horse cultivator at the time kafir or milo is heading will break the crust, stop evaporation from the soil and add ten bushels an acre to the yield.

When oats, millet or other sown crops are to be put in, the lister furrows should be leveled with a cultivator or disc harrow before seeding.

The Crops to Grow

THE sure feed crops to grow in dry land districts are kafir, milo, feterita, Sudan grass and sorghum, and Spanish peanuts where they are acclimated. Sweet clover has given good returns where it has been given a careful trial.

Mexican beans make a good cash crop in all years and wheat in wet years. When the moisture conditions of the soil are favorable in the spring, early oats make a profitable crop, especially when cut for hay. Rye in most seasons makes fair winter pasture and when spring conditions are favorable will furnish one to two tons of hay an acre after being pastured.

CORN.

Corn is not a dry land crop except on the Arkansas Divide and in protected mountain districts at an altitude of 5,000 to 6,000 feet. Corn on the plains usually does well when well cultivated until it begins to tassel. The hot, dry winds kill the pollen, no kernels are formed and the crop is a failure. About once in every four to seven years conditions are favorable at tasseling time and a good yield is secured. Then the land agents cover the country to get photographs of as many good fields of corn as possible and lay in a sufficient stock of good ears for exhibition to last through the poor seasons.

On the Arkansas Divide, east of Colorado Springs, a local variety of corn has been developed that is a reliable crop at altitudes of 5,000 to 6,000 feet. The stock is short and has few leaves, making the moisture requirements low. The ear is borne close to the ground. In extremely dry years, the shank holding the ear often starts just above the surface of the soil. This corn is well adapted to altitudes so high as to be too cold for kafir and milo.

In the narrow protected valleys on the eastern slope of the Rocky Mountains, seed from Nebraska and Kansas is planted. It makes a heavy growth and reaches the right stage for silage before frost. The Modern Woodmen of America have a sanitarium and farm eleven miles from Colorado Springs. The farm is at an altitude of 6,000 feet. There were 100 acres of Nebraska corn planted on it in 1913. The yield was ten tons per acre of green forage.

THE KAFIRS.

The permanent prosperity of a large part of the Southwest is dependent upon the intelligent raising and feeding of the kafirs—kafir, milo and feterita. There have been only two failures of kafir in twenty-five years in Kansas and only one failure in twenty years in Oklahoma. The failure in 1913 was due chiefly to the use of degenerate seed and too thick planting. Many of the farmers who planted well bred seed not too thickly secured good yields of grain, while their neighbors raised fodder only.

Kafir can be recommended as the staple feed grain for districts having an annual rainfall of twenty-four inches or upward, and dwarf milo for districts where the average rainfall is sixteen to twenty-four inches. Feterita has not been tested long enough to determine positively where it will be profitable as a main crop. The indications are that it is adapted to sections having less than an average of sixteen inches of rainfall a year.

The year 1911 was so dry that thirteen counties in Kansas produced no corn. Kafir gave a fair yield in every one of these countries. The average returns per acre for the state were: Corn, $7.67; kafir, $15.72. Had the corn growers of Kansas planted kafir instead of corn, they would have been better off in the fall by $62,000,000.

In 1912 the farmers of Kansas raised the largest yield of corn per acre that they had obtained in six years. The average value per acre of corn for the state was $12.12; that of kafir, $13.80.

Kafir made a low average yield in 1913, the second time in Kansas in twenty-five years and

the first time in Oklahoma in twenty years. Yet the value of kafir raised in Kansas was $12,324,-131, and of Milo, $1,189,643, a total of $13,513,774. This is $134,299 more than the value of the corn crop of the state, and there was more than five times as much land planted to corn as to kafir and milo.

In an eight year test at the Oklahoma Experiment Station, Central Oklahoma, kafir produced per acre two and a half times as much grain as corn and more than twice the meat producing value.

VALUE OF KAFIR FOR FEED.

Ten bushels of kafir have the same feeding value as nine bushels of corn, for feeding work horses and mules, growing colts and mules, beef and dairy cattle, both young and fattening, and mature, hogs and sheep. A bushel of kafir is worth more than a bushel of corn for feeding poultry. Milo has the same feeding value as kafir. At the Kansas Experiment Station, in an eleven year test, kafir produced an average yield of grain sufficient to produce, per acre, 487 pounds of pork. Corn produced an average yield per acre sufficient to produce 410 pounds of pork.

The Kansas Agricultural College, by a three year feeding test with both beef and dairy cattle, demonstrated that, pound for pound, silage made from corn, from kafir and from sorghum have equal feeding values, provided each is cut at the proper stage of maturity, and that the choice of which of these crops should be planted for silage depends on which will probably produce the greatest tonnage per acre. Over a large part of the Southwest, kafir will produce a heavier yield than corn. Sorghum will yield more than kafir.

In planting kafir, the black hulled white is the best variety to plant. The dwarf milo should be planted on the plains. No distinct varieties of feterita have been developed, but there are many white seeded sorghums sold for feterita, and these should be avoided.

Dwarf kafir has been grown by several of the plains experiment stations the past two or three years, and the results indicate that it may take the place of both milo and feterita as the staple feed grain for districts in the Southwest having less than twenty-four inches of rainfall yearly. Dwarf kafir is as early as either milo or feterita. On this account it requires moisture for thirty days shorter season than the standard kafir. Its heads grow upright, so that it is easily harvested by machinery. It is low in height, requiring a minimum of moisture for growing stalk. The stalk is thick and short-jointed, withstanding heavy winds well. It shatters little, allowing at least three months' time in which to harvest it after the heads have ripened.

THE SEED.

The best yields of kafir, milo and feterita are produced from choice, home grown seed. Where this cannot be secured, seed should be obtained from as near home as possible.

The character of the stalk has a strong influence on yield. Seed from good heads, grown on plants of medium height, with thick, short-jointed stalks, will produce one-third higher yield than seed from good heads grown on tall stalks with long joints.

A field of well-bred kafir, on good soil, shows the plants of even size almost as if cut to measure. The stalks are stocky and the joints short and the heads long and uniform in appearance. This type withstands the winds and waits long for harvesting without the stalks blowing down. Seed should be selected from fields that show this good breeding and from plants uniform in height and type.

The center or main stem on which the head is formed should extend well toward the tip, usually to within three inches or less of the extreme end of the tip. This is the most important indication of a high yielding strain. If the center stem lacks length the head should be rejected, no matter how good the other characters.

In "run out" strains of kafir, where the yield is low, it is often found that the center stem extends but half way or little more between the base of the head and the tip. With the degenerate type, a thick bunch of seed stems start out from the end of the main stem, making a loose or fluffy head. Reject for seed every head in which the center main stem is short.

Kafir crosses with the sweet sorghums, with broom corn, milo, feterita and the so-called Egyptian corn or desert wheat. These crosses produce a mongrel strain of kafir that cannot be made to yield a heavy crop. Kafir with sprangly or loose, open and fluffy heads is the result of such crosses.

Seed from the right type of head will produce sixty to eighty bushels per acre, where under the same treatment seed from the wrong kind of head will produce but fifteen to twenty bushels per acre.

There is a difference of three weeks in the ripening of different heads of kafir and milo in the same field. In a severe season a difference of five days in ripening sometimes makes the difference between a good yield and failure. The grower should watch his fields closely as soon as the first heads appear and mark by a string or piece of cloth each desirable early head. The selected heads should remain on the stalks until the crop is ripe, when a man can go through the field with a sack and gather the marked heads.

Special attention must be given to the vitality of feterita seed. It heats worse than kafir. With ordinary care in keeping not over one-half the feterita seeds will grow.

Keep the seed in the head until the day it is planted. Hang up the heads, as soon as they are ripe, in a place where they will be left dry and where air will circulate around each head.

Windmill Irrigation on a Dry Land Farm.

A farmer in southern Kansas bought choice kafir seed and tested it just before planting. It germinated well. He had planted part of a large field when he saw a rain coming. He took the seed not planted to the house and put it in a dry room before any rain fell. In about a week the rain was over and the ground dry enough to plant. The remainder of the field was planted, the same machine was used and the rest of the seed dropped. The seed planted before the rain gave a full stand. The seed planted after the rain did not give one-fourth of a full stand. Although kept in a sack in a dry room, it absorbed enough moisture to make it heat sufficiently to kill its germinating powers.

During the germinating period the seed absorbs moisture and begins to heat very easily. Sometimes the heating is sufficient to weaken the vitality only, but not to kill the seed. When this is the case, the growth is weak and uneven. Very often the heating is sufficient to kill the life in the seed, and no stand at all is secured.

Seed that shows strong germination may be kept in a dry place and yet heat sufficiently in twenty-four to forty-eight hours to make it unfit for planting. For this reason it is safest to keep the seed in the head until the day of planting, each morning threshing out enough for the day's planting.

There are two easy ways of threshing kafir seed. Place a head on a board placed across a wash tub and scratch off about half the seed with a curry comb. The seeds that shell off the most readily are the ripest, strongest seeds to plant. Rub a head on a wash board. Most of the good seed will come off quickly. Seed threshed by either of these methods can be cleaned easily and graded by a fanning mill or can be thrown up in a wind that will blow away the chaff.

PLANTING.

On the plains it is advisable to list in the fall the land that is to be planted in the spring. In seasons of dry winters and springs the lister furrows will collect all the moisture that comes from the snow and rain and the winds will keep enough loose soil in the bottoms of the furrows to make a soil mulch that will hold this moisture. If the ground is very dry at planting time the seed may be planted in the bottom of the furrow. Even in extremely dry seasons there will be sufficient moisture in this old furrow to bring up the plants quickly and for a rapid early growth. When there is a good supply of moisture in the spring the lister ridges should be split and the seed planted in the new furrow.

Test the seed for germination before planting and do not plant any seed in which less than ninety seeds out of each 100 grow. Use two to three pounds of good seed an acre in sections having thirty inches average rainfall and about two pounds per acre where the precipitation is less. Make the distance between the rows three and one-half feet.

In central Kansas and Oklahoma, one stalk to each eight inches will usually give the large yield of kafir. In western Kansas and Oklahoma the stalks should be twelve to sixteen inches

apart to secure the most grain. At the Government experiment station, Amarillo, in the Texas Panhandle, the best yields of milo have been obtained by having the stalks seven to eight inches apart in the rows. The average annual rainfall is twenty-two inches. In districts having less rainfall, thinner planting is advisable. At Tucumcari, New Mexico, good yields of feterita were secured in a dry year with plants ten inches apart in the row.

The lister or planter should be set up on blocks and the different gears and plates tested until a combination is found that will drop single grains in a place and not over twice as many to the foot as there should be plants. Cleaning and grading the seed will help to secure even planting.

CULTIVATION.

The kafirs should have thorough cultivation. They seldom receive it. A large proportion of the growers of Kansas, Oklahoma and Texas give the ground little attention before planting, plant any time convenient, regardless of moisture conditions of soil and give less than half enough cultivation. It is surprising even to those well acquainted with the hardiness of these crops that so good yields are secured.

The kafirs should be cultivated at least once after they have reached full height. This cultivation should be so shallow that the little feed roots are not injured.

HARVESTING.

The most common way to harvest kafir is with a corn harvester, cutting the stalks when the grain is ripe. The harvester ties the stalks with twine into bundles and the bundles are set up into large shocks to cure. The common sled cutter is used where a corn harvester is not available.

Where the fodder is not particularly desired, a header attached to an ordinary wagon box is sometimes used. Several growers of kafir in northwest Oklahoma harvest the heads with the regular wheat header, raising the platform up to the highest possible point. Three rows are gathered at a time, the headings being carried as fast as topped into the regular header barges. In these they are taken to the stacks.

A cheap method of separating the heads from the stalks is to take the bundles made from the corn harvester, let them cure thoroughly in the shock. When ready for heading place a heavy log across the top of a wagon box; lay the heads on the log and cut them from the stalks with a broad axe. Two men can head kafir very rapidly in this way, one taking the bundles from the shock and placing the heads on the log and the other standing in the wagon and chopping off the heads.

Another good way is to cut the heads off with a knife, letting the stalks stand.

STORING KAFIR.

Kafir should be headed after the grain has become thoroughly ripe and dry. Kafir heads may be stored in corn cribs the same as corn in the ear. Any time during the fall or winter, after the grain has passed through the sweat, it may be threshed. The grain, as soon as threshed, should be cleaned thoroughly, as dirt and trash make it heat quickly as soon as it reaches a damp climate.

Threshed kafir, no matter how thoroughly dried, is likely to heat when stored in bins, whenever the weather is damp. The heating is particularly bad in the spring, during the germinating season.

Kafir that is thoroughly cleaned, with a fanning mill, so that it is free from trash and dirt, can be kept cool more easily than that which is mixed with even a little dirt. The dirt and trash absorb moisture and hold it and the moisture starts heat in kafir in warm weather and mold in cold weather.

FEEDING.

Ten bushels of kafir have the same feeding value as nine bushels of corn for feeding work horses, beef and dairy cattle, hogs and sheep. Multiply the market price of corn in any locality by ninety per cent and the result will be the feed value, at that time, in that locality, of kafir. Milo and feterita have the same feeding value as kafir and should be fed in the same way.

Kafir is constipating when fed alone and in a few weeks will get animals in such a condition from constipation that they lose their appetites and become unthrifty. Kafir given with a small quantity of any laxative feed, such as alfalfa or peanut hay, can be fed for months with profitable results.

Horses fed kafir heads will do as much work and keep in as good condition as those fed corn. Horses do not do well on threshed kafir. They do not chew the small grains sufficiently and much of the grain passes out with the manure undigested.

SORGHUM.

The sweet sorghums, usually called cane, are among our surest dry land hay and pasture crops. There are three varieties in general use: Orange, early amber and sumac. The orange is the largest growing variety of the three and is adapted to the central districts of Kansas and Oklahoma. The early amber is adapted to all the dry land district of the Southwest except those having twelve inches or less of annual rainfall. The sumac has been used to a considerable extent in the dryer sections of west Texas.

There are three methods of seeding—broadcast, with a grain drill and in rows to be cultivated. The broadcast method is wasteful of seed, but re-

View of Grain Field Near Limon, Colorado.

quires the least attention and is therefore quite common. In districts of thirty inches of rainfall or more one bushel of seed per acre is generally used when broadcasted, and where there is less rainfall, half a bushel. The ground is plowed or disked, the seed sown and covered with a harrow.

When the seed is to be sown with a grain drill, the land is prepared the same as for wheat, and from one peck to half a bushel of seed is sown on each acre, depending on the rainfall.

The highest yields are secured by planting in rows three to three and one-half feet apart, drilling the seed in the rows and cultivating the same as kafir or corn. The ground may be listed shallow. From five to ten pounds of seed are used an acre, varying with the rainfall, the less precipitation the less seed should be used.

When intended for hay or pasture, the seeding should be done so thickly that the stalks will be the size of the little finger and smaller. Sorghum may be planted at any time after the danger of frost is over until the middle of July, whenever the ground contains sufficient moisture to give the young plants a vigorous start.

Sorghum for hay may be cut any time from heading out until the seeds get in the milk. When planted in drills or rows it may be cut and bound into bundles. The bundles are first cured in the shock and then stacked in long ricks like grain.

Drilled or broadcasted sorghum may be cut with a mower set rather high so that the stubble will hold up the forage and let the air dry out the underside. Soon after being mowed it should be raked in windrows. After curing for a day or two in windrows it should be gathered into large cocks holding a wagon load or more. One man should make a small stack of each cock, placing the forage as it comes from the sweep rake so that each forkful will turn rain. Sorghum hay will usually keep well through the winter in such large cocks. It is well to haul part of the sorghum hay to the feed lot and put it in a long rick to be convenient for feeding in case of storms.

Sorghum should be cured so as to keep the leaves green and the stalk juicy. It should not be left out in small windrows until it is bleached. Sorghum hay belongs to the same class of feeds as corn fodder and prairie hay and cannot take the place of alfalfa, sweet clover or Spanish peanut hay. Its great value is secured when it is fed with one of these hays or with a small ration of cottonseed meal.

Sorghum for silage should be planted thinly in rows three and one-half feet apart and be thoroughly cultivated. The seeds should be planted at the distance apart that will produce the heaviest yield of grain. It should be put into the silo when the seeds become so hard that they cannot be crushed between the thumb and forefinger, but while the leaves and stalks are green.

If pastures get short in midsummer, sorghum, after it gets in full head, makes a pasture that will keep cows giving full milk. The cows should be well fed, either with dry feed or pasture, before being turned on the sorghum. The first day they should be allowed on the sorghum only thirty minutes; the second day, 45 minutes; the third day, an hour. After that, the time may be increased thirty minutes each day until it reaches three hours, when it is safe to allow the cows on the sorghum all the time.

Sorghum, when it reaches eighteen to twenty-four inches in height, is often used for pasture for cattle and is usually safe. There is always danger, though, that cyanide poison will develop in immature sorghum, and this is a deadly poison. It is particularly likely to develop in dry seasons when the growth is stunted. In such cases I have known of cattle breaking into a field and getting only a few mouthfuls of the immature sorghum and dying in a short time. The poison evaporates during the process of curing and the hay is safe.

Sorghum planted and cultivated to secure the largest growth of forage and turned under green after the heads have developed is a great improver of dry land soils. Mr. T. A. Borman, editor of the Kansas Farmer, has had a wide experience in this line and says that when a dry land farmer raises ten acres each year to be plowed under, the improvement is so great that in a few years the soil seems as though it belonged to another farm.

Alfalfa

ALFALFA is readily grown anywhere in the Southwest where the average annual rainfall is twenty-five inches or more, the chief difficulty being to get a stand in unfavorable seasons. Where the annual rainfall averages less than twenty-five inches, the problem is harder.

There are tens of thousands of acres, even in districts having twelve to sixteen inches of rainfall, on which alfalfa will pay well. In eastern Colorado there are many "dry" streams in which no water runs except after heavy falls of rain.

Many of these streams have broad valleys in which water in abundance may be secured at a depth of from five to fifteen feet. Alfalfa on such land lives for years, when well started, and produces good yields even in dry seasons.

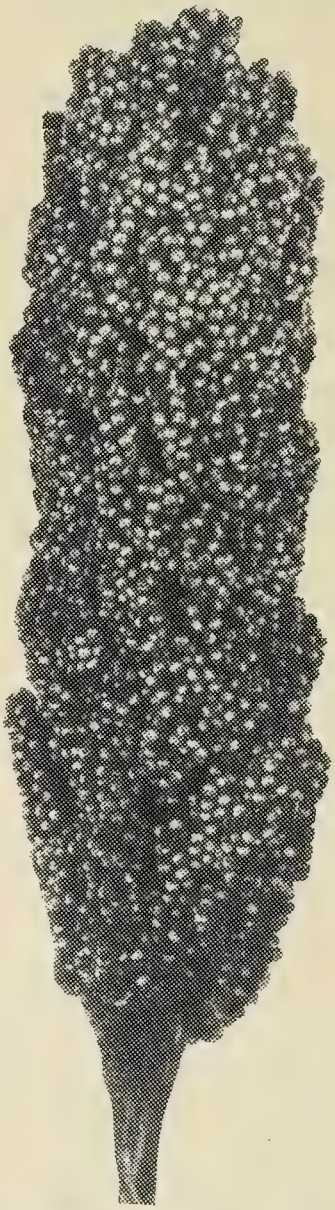
On uplands, where water is 150 to 200 feet below the surface, a stand of alfalfa can be secured in favorable seasons only. In such locations alfalfa grows well in wet years and is at a standstill in dry years. A successful Illinois hog raiser located near Dalhart, Texas, on upland where it was 180 feet to water. He found that in the dry seasons alfalfa would not grow tall enough for hay, but that when pastured by hogs it kept growing sufficiently to make good pasture. He found that in the dryest seasons he could secure ample pasture for 300 hogs by having the pasture divided and changing the hogs every ten days from one division to the other.

Dry land seed is the first requisite for success in raising alfalfa on dry land. Seed raised under irrigation is plumper and is of stronger germinating power, but usually most of the plants die within a year when seeded on dry land. The farmer in the Southwest should get seed raised on dry land in his own district, or get northern grown dry land seed from Montana. Utah seed was especially adapted to dry land conditions until the alfalfa weevil came. Now that seed is unsafe.

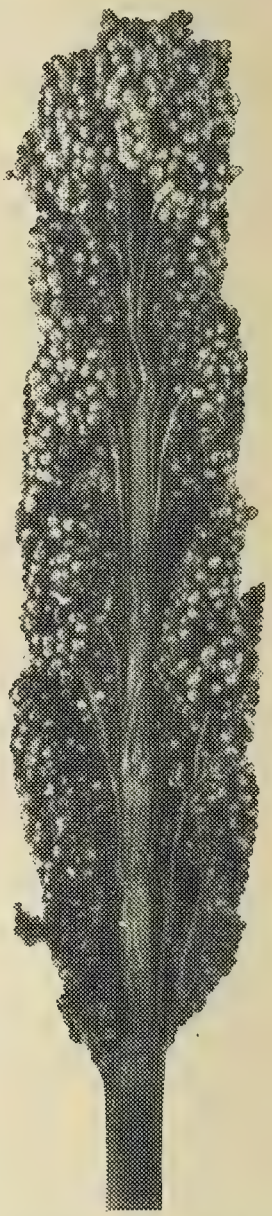
Land that is to be seeded to alfalfa must be plowed deeply and pulverized as thoroughly as for a garden and then allowed to become well settled. Previous to this final preparation, it should be handled so as to kill all the young weeds. Alfalfa fails almost every time it is seeded in mellow ground. The soil should be moist to a depth of four to six feet. It is a waste of time and money to sow alfalfa seed unless the soil conditions are right. The dry land farmer should get the seed bed in good condition and then if he finds there is not sufficient moisture he should wait till another season. In one district in western Kansas alfalfa has made many farmers wealthy. One of the most successful of these men tried sowing afalfa for seven seasons in succession before he got a good permanent stand.

Where the subsoil is stiff, alfalfa will often grow well for two or three years and then begin to die. The rots grow down five or six feet into the raw, stiff subsoil, weaken and die. When the stand becomes too thin to yield profitable crops, the alfalfa should be plowed up and one cultivated crop grown on the land. While this crop is growing, the alfalfa roots will rot, making the soil loose, and air and water will follow the decaying roots. The land in this way becomes subsoiled and mellow to the full depth of the roots. Then reseed to alfalfa. The roots from the second seeding find it easy to grow down through the soil prepared by the first roots and are then strong enough to keep growing and make a permanent stand.

Most dry land farmers give up after a few attempts to get alfalfa to grow on sandy land. The secret of success is to get the land compact before seeding and keep it firm until the alfalfa covers the ground. Mr. Frank Rockefeller succeeded in getting a permanent stand of alfalfa on several hundred acres of land in southwest Kansas on land so sandy that it drifted badly when the wind was strong. Mr. Rockefeller fed cattle on the field that he wished to seed to alfalfa in the spring, scattering the feed so that all the land was well tramped. He raked the trash off the land in the spring and drilled in the alfalfa



Typical head from field yielding 80 bushels an acre.



Interior of head from field yielding 80 bushels an acre. The center or main stem extends well toward the tip and has five joints.

without stirring the soil in any way. In the fall he had large patches of alfalfa alternating with spots of sand burrs. The following winter the cattle were fed on the places where alfalfa had not caught, giving the soil another tramping. The trash was burned off in the spring and alfalfa seed drilled in without stirring as before. The second fall there was a good stand of alfalfa on most of the land and only a few patches of sand burrs. Cattle were again fed on these places the next winter, and they were reseeded as before. Usually in three years a full stand of alfalfa was secured even on very loose soil.

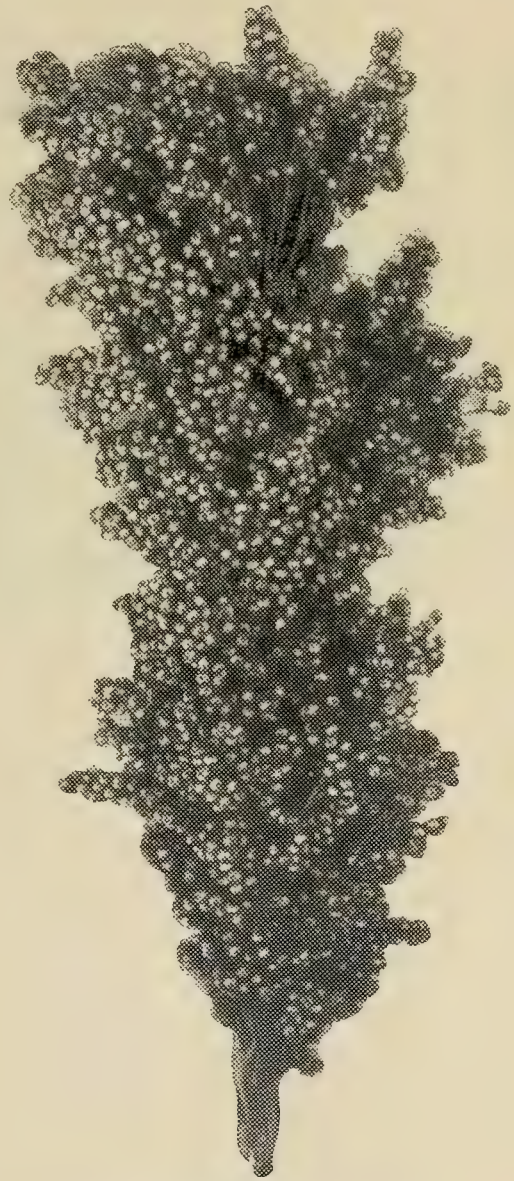
The time to sow alfalfa on dry land is any time between April 1st and August 31st, when the soil is in the right condition.

The best results are secured by sowing with a grain drill, using 8 to 12 pounds of seed an acre. The seed may be mixed with an equal quantity of bran or corn chop to make the machine distribute it evenly. It should be sown alone. So called "nurse crops" use the moisture that the young plants need.

When alfalfa is sowed in the spring it is usually necessary to mow it two or three times during the summer to keep out the weeds, with the mower set high. It should not be pastured the first year.

The only pest that damages alfalfa is the gopher. The alfalfa grower should make it his business every spring to destroy the gophers. Take large raisins and put in each one a small crystal of sulphate of strychnine. Go into the field where the gophers are working, taking a wagon rod and a spade handle sharpened at the lower end. Locate the runs by prodding with the wagon rod, when one is found open a hole from the surface of the ground to the run with the sharpened spade handle and drop a poisoned raisin into the hole. Close up the holes. Go over the field in the same way a second time in about ten weeks. This method will generally free the field of gophers until the next spring.

Interior of head from field yielding 15 bushels an acre. The center or main stem has but two joints and the long seed stems that form the tip start midway from the butt.



Typical head from a field yielding 15 bushels per acre.

Sweet Clover

SWEET clover has been tried on a number of dry land farms in the Southwest and the results secured indicate that it will become a regular crop. It grows vigorously in a dry year on dry hard clay land. It will produce fair yields of hay on high land where the rainfall is too light for most crops. Its roots grow deeply and decay quickly when the land is plowed, adding a large amount of decaying vegetable matter to the soil. This is a great need in dry land soils and one difficult to supply with other crops. Sweet clover has a marvelous effect in making hard, stiff soils mellow. A few years ago a western farmer undertook to plow some heavy gumbo land. It was so hard he had to have a man ride the beam to keep the plow in the ground. He seeded the land to sweet clover, broke it up in a few years and it was so mellow that it was hard to keep the plow from running beam deep.

White sweet clover has generally given the best returns. It grows erect from three to eight feet high. When young, the plants are often mistaken for alfalfa, but can be distinguished by the bitter taste of the leaves.

Sweet clover must have a firm, solid seed bed. A stand is seldom secured on newly plowed mellow land. E. G. Finnup, of Garden City, Kans., finds a good method of securing a stand to be to sow ten pounds of seed broadcast in February and let the cattle tramp it into the ground. This is for sandy land. When this method is not practicable he seeds with a grain drill, setting the machine to drop single seeds three-fourths of an inch apart in the row.

Beginners find that it takes from 15 to 20 pounds of hulled seed per acre to get a good stand. and a larger quantity of unhulled seed. After men have learned exactly how to manage the seeding on their own farms they generally sow eight to twelve pounds of hulled seed per acre.

Most growers prefer hulled seed. Many of the seeds have a hard flinty covering through which the moisture does not penetrate the first few months after seeding sufficiently to induce germination. Wherever fall or winter seeding is practiced about half as much seed is used as in spring planting. It is probable that the weathering the fall and winter-sown seeds get softens the hard seeds so that they grow in the spring.

Second Cutting Rye for Hay in Foreground and Windmill Irrigation of Trees and Shrubs in Background. A Dry Land Farm In El Paso County, Colorado.

Sweet clover, like alfalfa, will not thrive unless its roots are supplied with the bacteria that form nodules. In districts where considerable sweet clover or alfalfa is grown, the soil is usually well inoculated with these bacteria through the work of wind and washing. Where the soil is not inoculated it is necessary to inoculate either the seed or the soil.

Three hundred pounds of soil taken from a sweet clover or alfalfa field is needed to inoculate each acre. It may be drilled in or sown broadcast and harrowed in. Sunlight kills these bacteria and the soil used for inoculation must not be exposed to sunlight. It should be distributed over the field either on a cloudy day or after sundown and be covered at once.

Another method is to make a syrup of glue and warm water and sprinkle it over the sweet clover seeds until they become sticky. Then sift

the dirt from a sweet clover or alfalfa field that is growing vigorously over the sweet clover seeds until each seed becomes covered with dust. Dry the seed in the dark and sow immediately.

A large proportion of the failures with sweet clover are due to sowing on too mellow seed bed or lack of inoculation.

Sweet clover sown in the fall or winter may be pastured heavily through the next season. If not pastured it will usually furnish two good cuttings of hay, yielding through the season from two to five tons per acre. The second season two cuttings of hay may be secured or one cutting of hay and a seed crop, or the sweet clover may be pastured until midsummer and afterward yield a crop of hay or seed.

Sweet clover sown in the spring is usually ready to pasture in ten to twelve weeks. When not pastured too hard, a crop of hay is often secured the first fall. Sweet clover plants live but two years. Re-seeding is necessary every second year in order to keep the land in sweet clover. When properly handled the sweet clover reseeds itself and maintains a continuous growth for many years. To insure the self-seeding of sweet clover, the mower must be set to cut five or six inches above the ground. There will then be enough of the lower branches left uncut to keep up reseeding regularly. Sometimes when the sweet clover is sown on weedy ground it becomes necessary to clip the weeds before the clover takes full possession. The mower should be set so as to cut five or six inches high in order not to check the sweet clover. Where sweet clover is pastured through the season a sufficient number of lower branches usually escape the stock to provide for a continuous reseeding.

Sweet clover for pasture must be short and succulent to be relished by stock. Stock does not like coarse woody stalks five to eight feet in height. Sweet clover is one of the first plants to appear in the spring and when the animals are turned on it early while the plants are tender they will soon be found eating it greedily. When it is desired to pasture sweet clover that has attained a large growth, it is best to mow it and turn on the stock when the new growth becomes well started.

Sweet clover should be cut for hay before coming into bloom. If left to bloom the stems become woody and a large proportion of the leaves shatter off. Sweet clover is rather more difficult to cure than alfalfa. It seems to be less damaged by rain while in the process of curing than alfalfa.

The most important factor in cutting sweet clover for hay is to leave a stubble five or six inches in height. The branches start from the stem and a sufficient length of stem must be left to allow enough branching to make a good yield in the succeeding crop.

Sweet clover makes a good pasture for horses, cattle, hogs, sheep and poultry and the hay ranks next in value to alfalfa.

Spanish Peanuts

THE Spanish peanut has a wonderful ability to adapt itself to a variety of soils, rainfall and climates. In 1911, in Texas and Oklahoma many yields of forty bushels per acre were made with forty-five days without a drop of rain during the growing season. In the same year in New Mexico, twenty-five bushels per acre were grown with a period of sixty days during the growing season without rain. In northwestern Illinois, the same year, a heavy crop was harvested after a drought of forty days.

In 1913, in Oklahoma, on thousands of acres, Spanish peanuts matured a crop of fifteen bushels an acre during a period of eighty-eight days with but one rain.

The great value of the Spanish peanut to the Southwest is as a sure feed crop. An acre will put 500 to 1,000 pounds of gain on hogs, the hogs gathering the crop themselves. It produces a heavy flow of milk in suckling sows and a rapid growth of pigs after weaning. It makes the most delicious flavored meat of any feed grown. It is one of the best feeds for making dairy cows give high yields. It is worth more than alfalfa to feed fattening steers and is good for growing cattle. It is a good sheep feed. It is one of the best feeds for horses and mules doing heavy, slow work. It forces a heavy flow of milk in mares suckling colts and makes rapid growth and size in growing draft horses and mules.

Under favorable growing conditions the Spanish peanut will mature in ninety days from planting. When checked by drought or other unfavorable conditions, it may take from 100 to 120 days from the time of planting to maturity.

The Spanish peanut has a small pod with two small nuts in each pod. The stems grow upright, making it easy to harvest them for hay. The base of the plant is thickly clustered with pods and they cling well to the vine in harvesting. This is a great advantage. The Spanish peanut is the variety generally grown for making peanut butter, salted peanuts and peanut oil.

It is of vital importance to plant seed adapted to the climate of the field, where the crop is to be grown. Seed grown in the south, with a long warm season and forty-five to sixty inches of rainfall, cannot produce the best yields in dry farming sections where the rainfall is twelve to twenty-two inches, nor in the north where the season is short. Yet many persons buy peanut seed without knowing where it was raised and then condemn the plant as not adapted to their localities because the crop was a failure.

Seed grown in western Oklahoma is preferable where the rainfall is less than thirty inches, and it is absolutely necessary to produce a good crop where the annual precipitation is twenty-two inches or less. It is also adapted to high altitudes and to northern climates.

In testing Spanish peanuts for ripeness of seed, break the shell carefully into two pieces. When the seed is thoroughly ripe, the inside of the shell will be brown and covered with darker brown spots or pits. When the peanut is not matured, the inside of the pod will be covered with a white lining nearly smooth. Such seed is not safe to plant, as it will not grow if the soil and climatic conditions are not favorable at planting time.

In the dry land farming sections, peanuts are planted shallow with a lister. The ground should be thoroughly warm before planting to secure quick germination. In Central Texas, New Mexico, Oklahoma, Kansas and Colorado, Spanish peanuts are planted in rows three feet apart, single pods, soaked and unshelled, being dropped twelve to fourteen inches apart in the rows.

When a large acreage is planted, special peanut planters are used. With a small acreage the planting is done with a drill or a lister, taking blank plates and having them bored to fit the seed and the desired distance. The soaked seed must be planted in moist soil. When planted in dry soil, the soil absorbs the moisture and the seed is ruined. One bushel of seed in the shell will plant an acre of Spanish peanuts of the thickness given.

Where moles are troublesome sprinkle a little kerosene over the pods just before planting.

The peanuts need frequent shallow cultivation. The cultivation should begin as soon as the rows can be followed and should be continued at frequent intervals to the time of blossoming. After the pods begin to form, the vines should not be disturbed. Any cultivator suitable for shallow cultivation of corn is suitable for cultivation of peanuts.

The cheapest way to harvest peanuts is to cut and cure the vines the same as alfalfa and then turn hogs into the field to gather the nuts.

Pull the vines and cure the tops and nuts together in cocks the same as alfalfa. The hay is the richest grown. Work horses hold their flesh while fed nothing but this hay. The nuts take the place of grain and the tops the place of hay.

The hay made from tops and nuts cured together is one of the best feeds for forcing cows to give a high yield of milk.

In northwest Kansas and in eastern Colorado it is advisable to plant a small acreage to Spanish peanuts and select the seed from the first plants to ripen until an acclimated strain is developed.

MEXICAN BEANS.

The Mexican bean is a good dry land cash crop throughout the Southwest. It stands drought well and enriches the land on which it grows in the same way as clover and alfalfa. The California pink bean has been grown to a considerable extent in Eastern Colorado during the past few years, and may become the rival of the Mexican.

Mr. W. H. Lauck, Colorado Springs, County Agriculturist, El Paso county, Colorado, has paid special attention to the raising and marketing of Mexican beans on dry land farms. He furnishes the following information:

The ground to be planted to Mexican beans should be plowed well in the fall. A good seed bed is necessary. The land should be disked once or twice in the spring before planting, to kill the weeds.

Beans should be planted in El Paso county from May 20th to June 10th to get good results. When planted earlier the beans ripen unevenly and shatter readily. Eighteen to twenty-two pounds should be planted to the acre in rows thirty to thirty-six inches apart, depending on the tools for cultivation. A good bean should be placed every four to six inches in the row. It is a good plan to harrow ahead of the planting. Some producers use a corn planter with special plates and others use the regular corn plates.

After planting, no cultivating or harrowing should be done until two large leaves appear on the plants. Then harrow carefully to get good results and kill weeds. Cultivate three inches deep, using fenders to prevent covering the plants.

Mexican beans should be cultivated four times during the season, but should not be cultivated early in the morning when the dew is on the plants, or after showers, because if it is done rust or leaf blight will start.

After the second cultivation the beans should be hoed. If there are many weeds. a good hoeing followed immediately by cultivation will kill them. Dirt should be thrown on the weed stubs. Don't cultivate too close to the plants after blooming.

An ordinary sod plow with the rods taken off and the shear sharpened makes a good bean cutter. The plants can then be piled with a fork. One method of harvesting that is popular is the use of a sled having knives extending from each side runner. Rake with horse rake if there is a large acreage to be handled. The beans should not be allowed to get too ripe before cutting or they will shatter easily. After raking, stack before threshing and allow time for a sweating process.

To destroy bean beetles use a spray of lead arsenate paste, three pounds to fifty gallons of water. Weevils may be kept out of threshed beans if the beans are stored in close woven sacks. A cheap bean grader may be made from small mesh wire cloth and should be used to clean the crop of pebbles, dirt and sticks.

The Mexican bean is one of the legumes or nitrogen storing plants and should have its place in crop rotation on every dry land farm. Larger crops may be produced if the ground is properly handled after beans have been harvested. The Mexican bean crop is the cash crop of the dry land country.

Listed in Fall to Catch Snow and Stop Soil Movement.

Wheat

ALL small grain is uncertain on the plains of the Southwest. In western Kansas during twenty-five years, two counties have made an annual average of less than five bushels of wheat an acre, and twenty-two counties have made an average of less than eight bushels. Eastern Colorado has had only seven profitable crops of wheat in twenty-eight years. The yield of both wheat and oats is good throughout the Panhandle of Texas this year—1914. The last general good yield of small grain in the Panhandle was in 1908—a period between good crops of six years.

One of the best farmers of eastern Colorado has never raised less than fifteen bushels of wheat an acre; his yields have run from this to thirty bushels an acre. He says that every wheat crop that he has raised has been profitable. But in eighteen years he has seeded and raised only six crops. This farmer depends on dairy cows and live stock to furnish his living and the steady profits. He keeps a close watch on the moisture of the soil. In years when there is sufficient moisture in the soil to insure a good crop of wheat, he prepares the land thoroughly and sows wheat. In years when the moisture conditions are not favorable, no wheat is sown.

The irregularity of the rainfall on the plains prevents wheat raising from being profitable every year, and the methods of farming generally followed make wheat unprofitable in many years when good farming would secure good yields. Two years ago, in a district of western Kansas where wheat has been almost the only crop for thirty years, sixty-five square miles of the land blew off as deep as it had ever been stirred. Farms that had been sold for $20 an acre and had good buildings and were well fenced, were abandoned. Their owners went to other districts to work by the day. I investigated every farm in this blown district and I found that some farmers did not own a plow, and one wheat field that had not been plowed for twenty-seven years. The last time that a field had been plowed in that section was nine years before the severe blowing occurred.

Each year the surface of the ground in wheat stubble had been pulverized with a disc and the wheat seed drilled into the disked land. An investigating three years ago in the Panhandle of Texas, showed that many farmers did not own a plow.

Nineteen hundred and eleven was extremely dry in most districts from the Rocky Mountains to the Atlantic Coast. Wheat was generally a failure throughout the Southwest. That year the Kansas Experiment Station harvested four and one-half bushels of wheat per acre on land that had been disked only and thirty-five bushels an acre on land that had been listed deep early in July and then cultivated or harrowed every ten days until seeding time.

Where wheat is to be sown on land from which grain or some other crop is removed in June or early July, the ground should be thoroughly disked as soon as the first crop is harvested. When wheat is to follow wheat or oats, the disc harrow should follow the binder or be run immediately after the shocking is finished. Early in July the land should be listed deeply so that the furrow slices will thoroughly cover the ridges. Then every ten days or two weeks the listed land should be worked with either a two-horse cultivator or a disc harrow. This tillage should be managed so that the ground will become level by seeding time. The wheat should be seeded with a grain drill, sowing not over forty pounds of Turkey Red per acre. When there is not sufficient moisture in the fall to make seeding advisable, the land can be relisted late in the fall and kept in ridges through the winter.

Land in silage crops and well cultivated is usually in ideal condition for seeding to wheat

in the fall, after the cultivated crop has been put in the silo. It needs no preparation. The wheat can be seeded with a disc drill.

RYE.

Rye is a paying dry land crop to sow when there is moisture enough in the fall to bring it up quickly. Sow forty pounds per acre. It may be pastured through the fall and early spring. It should be cut for hay when the grains reach the milk stage. In a year of fair rainfall, rye treated in this way will yield from one to two tons of hay per acre.

Fall rye sown in the spring will furnish hog pasture through the summer.

OATS.

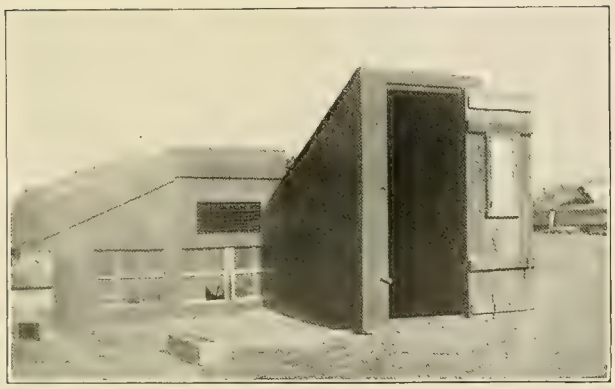
Oats as a grain crop is even more uncertain on dry land than wheat. In seasons of average spring rainfall, oats make one of the best dry land hay crops. An early variety should be sown —Kherson or early Champion or similar kind. They will often make a good hay crop in seasons when the moisture is insufficient for varieties, ripening two to four weeks later. In seasons like 1914, oats yielded paying crops of grain.

Cut the oats for hay when the grains are in the milk stage and cure in cocks with as little exposure as possible to the sun.

MILLET.

Millet is a quick growing crop. Common millet matures in the shortest time and therefore draws moisture from the soil for the least period of time. German millet yields the most and is preferred when there is an average supply of moisture. Common millet is one of the best drought resisters. Northern seed produces much the hardiest plants. The foliage of plants from southern seed is heavier. Sow fifteen to twenty pounds of seed to the acre.

Cut before the seeds get hard. It is a good plan to start cutting as soon as the heads become fully developed.



Dugout Chicken House.

Continued feeding of millet to horses some times causes incurable lameness. It is fairly safe to use for horses when cut early and only one feed a day is given of the millet hay and some other forage at the other feedings. Millet is chiefly valuable as a cattle feed.

DWARF ESSEX RAPE.

This is one of the best "catch crops" for hog pasture. In dry land districts it must be sown as early in the spring as oats, or in the fall after the hot weather is passed. When Dwarf Essex rape is sown early it will get a good start and is a fair drought resister. Sown in May or June, midsummer droughts are likely to kill it. It may be sown about the middle of September if the ground is moist and then will usually make good hog pasture until January 1st. It withstands hard frosts and I have seen it alive and fresh in Colorado under a light snow.

Drill in rows two or three feet apart, using three to five pounds of seed an acre, and cultivate thoroughly until a vigorous growth is secured.

Sudan Grass

SUDAN GRASS seems to be the hay plant that the Dry Land farmers of the Southwest have needed so long. It has been grown six years in the Panhandle of Texas, yielding a ton of hay an acre in dry seasons and four tons an acre in years of good rainfall. It has done well in the dry lands of Kansas, Oklahoma, eastern Colorado and eastern New Mexico.

Sudan grass is considered to be the original type of wild sorghum and is often called the "mother of all the sorghums." Like the sorghums and the kafirs it is a vigorous drought resister and will wait a long time for rain. During a prolonged drought it stops growing and stands still, but it lives. When rains come it makes a quick and heavy growth, seeming to have accumulated energy while it waited for rain.

The hay is much like that made from sorghum except that the stems are finer, about the size of a lead pencil, the hay therefore containing a greater proportion of leaf than that made from cane. On account of the small stalk the crop is easy to cure into hay and keeps well when stacked. The plant holds its leaves well which gives it a marked advantage in windy weather and when it is necessary to delay cutting.

It does not thrive where the nights are too cool. In 1914 it yielded well in eastern Colorado at an altitude of 5,500 feet. It will probably be found unprofitable at altitudes so high as to prevent sorghum from growing well.

It is the general opinion of conservative growers that Sudan grass will take the place in the Southwest of millet and of considerable cane. Its one serious defect for the Southwest is that it crosses readily with the sorghums, kafirs and

Sudan Grass.

broomcorn and unless care is taken this characteristic will result in mongrel seed of all these crops on farm where all are grown.

Sudan grass is adapted to any soil that will grow cane or any of the kafirs profitably. On lands that will give a heavy yield of cane, a heavy yield of Sudan grass may be produced. On lands that will produce light yields of cane, a small crop of Sudan grass may be expected.

List the ground early in the spring. When the ground becomes warm, relist, splitting the furrows. Make the furrows at planting time shallow.

Plant in rows 30 to 36 inches apart, dropping single seeds 6 to 8 inches apart in the row, using an ordinary kafir plate in the seed box.

Cultivate often and shallow. The roots grow near to the surface and deep cultivation after the plants get well started will cut off a large portion of the roots and reduce the yield. Cultivate to keep the land level. The cultivation may be done with the ordinary two-horse corn cultivator, using small shovels or with a one horse cultivator having small teeth. Cultivate until the plants cover the ground so that the weeds will not grow.

The largest yields are secured by cutting the plants when they first come in bloom. The best quality of hay is produced by cutting the plants when they come in full bloom.

The crop is handled the same as millet in making hay. Cut and allow the leaves to become partially wilted but not dry. Rake in large windrows, cure in large cocks and then put in stack or barn.

Where the crop is desired for seed, let it stand until the first heads are fully ripe, then cut with a grain binder and shock and stack the same as wheat or oats.

Sudan grass has the same enemies as sorghum—chinch bugs and grasshoppers.

At Chillicothe, Texas in a season having twenty-two and nine-tenths inches of rainfall well distributed, Sudan grass made four cuttings of hay, one ton per acre at each cutting. The same season millet yielded one ton of hay an acre and sumac sorghum six and a half tons of cured forage per acre. At Spur, Texas, in a season of fifteen inches of rainfall, Sudan grass yielded one and a half tons of hay an acre.

In 1913, a year of severe drought, Sudan grass yielded 1½ to 2¼ tons of hay an acre in Eastern Colorado and in the Panhandle of Texas.

The Well

As soon as a man has selected land in a dry farming section, he should dig or bore a well and erect a windmill. He should do this before he builds a house. His family can live comfortably several months in a tent in any dry farming section of the Southwest and should do so until a water supply is secured.

In many parts of the Southwest there is sheet water at about a uniform depth, usually 100 to

225 feet. When a well reaches the sheet water an ample supply of water is certain. In other sections the underground water seems to exist in the form of thin streams, with none under most of the land. In such sections of the southwest a well may furnish so much water that a large windmill cannot pump it dry, and another well 100 feet distant furnish no water at all. In one place on the plains, sheet water in abundance is found at a depth of about 200 feet. There seems to be a break in the water-holding strata along a certain line, and beyond this no water has been found even at a depth of 500 or more feet. The territory where no water has been found has been settled and depopulated several times. New men visit the country, see the wells and comfortable homes on the lands above the sheet water, and think they can get the same kind of wells on the other land.

Dry land farmers for miles have been getting good supplies of water at a depth of 200 feet. A new settler took a homestead about a mile further out on the prairie, but on the same level, and feeling sure that he too could get water at the same depth, put up a house and a good stable and other out buildings, broke his land and put in his crops. Then he dug a well. He bored down 100 feet with no indications of water. Another dry farmer being certain that he could get water at the same depth as other farmers in the same township, erected good buildings, fenced and broke his land, and planted crops. In the meantime he had to have all the water hauled eight miles for the house, the teams and the cows. After the crops were well along, he started a well. He sunk two deep wells without finding water, and ran out of money. The next year he sunk a deep well and got water so alkaline that even the cattle could not drink it. The third year he got a good well, but a half a mile from his buildings. Another farmer put up his buildings first and then dug a well, and the water was so salty that it could not be used. Later another well was dug in the pasture half a mile from the house, and good water found.

These instances are given to emphasize the importance of getting a plentiful supply of good water before any other expenditure is made. First, without water the farm must sooner or later be abandoned. Second, the buildings should be near the well, and to be sure of getting them there, the well must be secured first.

THE WIND MILL AND RESERVOIR.

As soon as a good well is secured, it should be equipped with a pump and a wind mill. Most dry land farmers make the mistake of getting a wind mill too small in size. The wheel should be twelve or fourteen feet in diameter.

All dry countries are windy, and a wind mill can work most of the time. There are still days, some times several still days in succession, when a wind mill will not work. If the farmer can afford it, he should get a galvanized iron tank that will hold at least four days' supply of water.

The wind mill should be kept running day and night, summer and winter, when there is sufficient wind. All the water should be pumped into the storage tank and an overflow be provided at the top of this tank to carry the surplus water to a dirt reservoir.

A convenient size for this reservoir is seventy-five feet square and eight feet high. The bottom of the reservoir should be on the level with the ground outside, so that all the water can be used. The walls and bottom should be built of clay well tramped down while being made. The top of the earth walls should be eight feet wide for a reservoir of this size, and the walls on each side should extend out two feet for every foot in height.

Milo on Left, Feterita on Right—Farm of Panhandle Agricultural Institute, Goodwell, Okla.

The water may be taken out of the reservoir by a wooden pipe eight inches square, the opening closed with a wooden slide. Every four feet along the wooden pipe a collar should be placed, six inches wide, and the earth packed solidly along the pipe and along these collars. If the collars are not used, the water from the reservoir will gradually follow along the outside of the pipe, and finally wash the earth away.

With a good well, a wind mill with a large wheel, a tank and a reservoir, the dry land settler is sure of water close at hand. With a reservoir he can be certain to have a garden that will supply the family table bountifully, and allow him to sell $100 to $200 worth of produce every season.

It may seem hard at first to spend the amount of money needed to secure this equipment, but as it insures success, the new settler should make this his first expense. Three-fourths of the people who have abandoned dry land farms in the past ten years would have stood by their homesteads, and later have become prosperous if they had, when they first settled, secured a water system like the one described.

IRRIGATING THE DRY LAND GARDEN.

The wind mill should be run day and night the year round. In the winter time the water should be used to thoroughly soak one-half the garden. Whenever the reservoir becomes full, the water should be run out over this part of the garden. By using winter irrigation, the wind mill will enable the farmer to get large yields from twice the area. If the ground is thoroughly soaked during the winter, and earth mulch put on early in the spring, good crops can be raised by thorough cultivation, without any irrigation during the summer. On the winter irrigated land, plant in rows, three feet apart, all the ordinary crops, such as lettuce, radishes, peas, beans, beets, sweet corn and flowers; at a greater distance cucumbers, cantaloupes and watermelons.

The ground for the garden should be plowed deep and worked and reworked with a disc harrow and smoothing harrow until it is fine and mellow. Everything, no matter how small it grows, should be in rows extending the whole length of the garden. Do not plant garden truck in beds or short rows on a dry land farm. If you do not want lettuce enough to take a whole row, put in as much as you want and plant the rest of the row in radishes or peas or beans. Cultivate the garden well every week, using one horse and a small shoveled cultivator. A farmer does not usually have time or inclination to do much hoeing.

When the plants need water, plow a small furrow six inches wide, three to four inches deep near each row. Run lengthwise through this furrow a smooth round post. This will smooth the bottom of the furrow, and the water can be distributed better. Run a ditch from the pipe coming out of the reservoir to the furrow and turn enough water out of the reservoir to make a stream as large as the ditch. A little experience will teach you how long to run the water in each furrow. After one row has had water enough, turn the stream into the ditch along the next row.

J. C. Childs in His Field of Beans in El Paso County, Colorado.

Water should not come in direct contact with the plants. If the soil is well soaked, the moisture will gradually find its way to the roots. In hot summer days, water will go nearly twice as far if applied after sundown.

The next morning after the garden has been irrigated, it should be thoroughly cultivated to fill up the ditch and make an earth mulch to retain the moisture. Usually, if sufficient water has been used and the soil has been handled right after irrigating, the crops will not need water oftener than once in ten days or two weeks. A little water and much cultivation secures the best results.

THE GARDEN.

Mr. A. R. Pierce, seedman, Pueblo, has lived for thirty-two years in Colorado and has paid especial attention to the garden crops and the varieties that are best adapted to dry land districts. His advice has enabled many dry land farmers every year to secure productive gardens. His recommendations follow:

"On one side of the garden set a row of early Richmond cherry trees, using two-year-old trees and setting them fifteen feet apart in the row. Between the cherry trees, starting three feet from the tree, set year old rhubarb roots. Set the roots in soil that has been well mixed with rotten manure. Set them three feet apart. Two dozen rhubarb plants will be sufficient for a large family.

"Set a row of wild goose plum trees fifteen feet from the row of cherry trees. The plum trees should be set ten feet apart, using two-year-old trees.

"Next set one row of Bederwood strawberries, the length of the garden, placing the plants six-

Alfalfa in Rows on a Dry Land Farm.

teen inches in the row. The Bederwood needs no other variety to fertilize the flowers.

"Between the plum trees set two-year-old asparagus plants one foot apart. Fifty plants are enough to start with.

"Between the cherry or plum trees, as most convenient, set one dozen gooseberry bushes. Use two-year-old plants and place them four feet apart. Also one dozen currant bushes, set the same distance in the row. Radish, lettuce and onion sets may be planted in any vacant spaces between these plants and trees the first two years. One dozen horse radish roots may be set out eighteen inches apart in the row.

"Raise in a hot bed, or buy for early planting, plants of tomatoes, cabbage, peppers, and cauliflower. Set for first use one dozen dwarf Champion tomato plants, eighteen inches apart in the row and one dozen each early Acme and Beauty tomato plants thirty-six inches apart in the row.

"In March set two dozen plants early Wakefield cabbage and later one hundred plants of Copenhagen market cabbage. This is the best second early and late cabbage for dry land farmers. Set cabbage plants twenty inches in the row.

"Set one dozen Cayenne pepper plants and one dozen Mango pepper plants eighteen inches apart in the row.

"One dozen plants early Snowball cauliflower twenty inches apart in the row, and treat the same as early cabbage.

"One hundred plants of late Giant Pascal celery eight inches apart in a trench with well rotted manure.

"Peas—Sow as soon as can be planted, Early Alaska, one pound; Gradus, one pound and two weeks later, Everbearing, one pound. One pound of seed peas is sufficient for fifty feet of row.

"Beets—One ounce New Eclipse is sufficient for fifty feet of row. The young beets can be thinned to supply greens first and young beets for cooking. After thinning, the beets left can be gathered in the fall for winter use.

"Mangels—Sow one pound of Golden Tankard and one pound of Long Red. Treat same as beets.

"Carrots—One ounce Half Long Danvers.

"Lettuce—One five-cent package will sow twenty-five feet of row. One package Black Seeded Simpson and one package Big Boston.

"Radish—One package each of early Scarlet Globe, Cincinnati Market and Long White Vienna. In July sow one package of Black Spanish winter radish with turnips. This radish will keep all winter.

"Turnips—Sow as early as the ground can be prepared one package of Early Flat Dutch. Sow in July one ounce Purple Top Globe.

"Onions—For early green onions plant two inches apart, two pounds onion sets. Sow as soon as ground can be worked one-half ounce Austrian brown and half ounce Early Red Globe.

"Parsley—One package Moss Curl.

"Parsnips—One package of Hollow Crown will sow fifty feet of row. Sow where the plant can remain in the ground until spring. Parsnips are delicious when dug in the spring after remaining all winter in the ground where they grew!

"Beans—Plant as soon as the ground gets warm, one-half pound each Burpee Stringless, Green Pod, and one pound Prolific Black Wax. Thirty days later make a second planting.

"Sage—One package.

"Dill—One package for dill pickles.

"Sweet Corn—Plant at one time one pint each White Australian, Extra Early Adams and Golden Bantam. This will give a succession. A little later plant two pints of Stowell Evergreen.

"Cucumbers—One package each New Early Fortune and Arlington White Spine. Plant six to eight seeds in a hill, thin to three or four strong plants in a hill. Make hills five feet apart.

"Cantaloupes—One package Blinns Rust Resistant, and one package Burrels Gem. The sweetest, most delicious flavored cantaloupes raised in the world are those grown on newly broken prairie sod.

"Watermelon—One package Rocky Ford and one package Klecklys Sweet.

"Pumpkin—One package Sugar pumpkin for pies. Field pumpkins as desired. Watermelons and cantaloupes may be planted side by side, as they do not cross. Cucumbers, squash and pumpkins must each be planted by itself.

"Squash—One package each Hubbard, Pike's Peak and White Bush. Plant in hills four feet apart, six to eight seeds to the hill. Thin to three or four strong plants to the hill. One pound Summer Crookneck squash seed will plant an acre and will give a large quantity of choice feed for fattening pigs.

FLOWERS.

"Sow one package each, four o'clocks, bachelor buttons, candytuft mixed, cosmos, California poppy, gillardia, hollyhocks double mixed, nasturtiums, petunias, phlox, sunflower, sweet peas mixed, sweet William and zinnia. If the seed is sown in broad beds near the house it will be an easy matter to water the plants and with this selection or even part of the number there will be a constant succession of brilliant blossoms. Flaming bush makes a beautiful plant for the borders.

"A row of Russian sunflowers on all sides of the garden are attractive and the seeds make good chicken feed.

VINES.

"A vine covered porch adds much to the charm and comfort of the home. Before the trees get large enough for shade a lattice can be made starting from one side of the house. This will afford a shady place in which to prepare the vegetables for dinner and under which to eat supper on warm summer evenings. The Japanese hop vine is a quick grower. One package will be enough seed to cover a large porch. Morning glory and wild cucumber vines are both good for the porch. These should be planted in the fall and will start earlier in the spring if left in the ground all winter.

"For permanent vines the Virginia creeper and clematis are hardy, vigorous growers and very attractive. Set two year old plants."

German Millet, Oklahoma.

TREES.

The Russian olive stands extreme drought and heat well and is always attractive. Plant the seed. It may be grown as a hedge or thinned out and trimmed and grown as a tree. The black locust is the tree generally planted on dry land through the Southwest. It grows well even in dry years and the thick foliage is a rich dark green. The wood is very durable for fence posts. With all its good qualities and popularity it is not likely to be a long-lived tree, as it is apt to be attacked by borers when twelve or fifteen years old.

The white elm and green ash are among the best dry land trees and if they can be given a little water each season, will grow for a life time. The cotton wood when it can have some water is a quick grower. A few mulberry trees are very attractive to the birds.

H. N. Wheeler, forest expert of Colorado, gives the following advice: The wind break should consist of eight or ten rows of trees planted from twelve to fifteen feet apart, and the trees in the row from six to eight feet apart.

The best varieties to plant for this purpose are Russian olive in the outer row and in the other rows white willow, cotton wood (preferably the native species), Russian mulberry, choke cherries, honey locusts and evergreens, particularly the western yellow pine and the red cedar.

Around the house and in the door yard may be set lycium (matrimony vine) which will cover dry soil and prevent blowing, flowering currants, thimble berries, buffalo berries, dogwood, hawthorne and sumac. Close to the house and by the outbuildings plant Engleman ivy, the native Colorado woodbine, clematis and any other native vine wished.

The majority of these trees and shrubs will do fairly well without irrigation. However, much more satisfactory results will be obtained by irrigation and other shrubs can be grown which will add materially to the beauty of the home. These include lilacs, snowballs, elder berries, spiraeas and roses.

MANURE.

Manure is usually wasted on dry land farms, though the land needs it even more than that in the rainbelt.

Manure adds to the decayed animal and vegetable matter in the soil, increasing its holding capacity for water. Where much manure has been added to the soil and it has become thoroughly decayed and mixed with the soil, the soil will absorb and hold twice as much water as soil devoid of it.

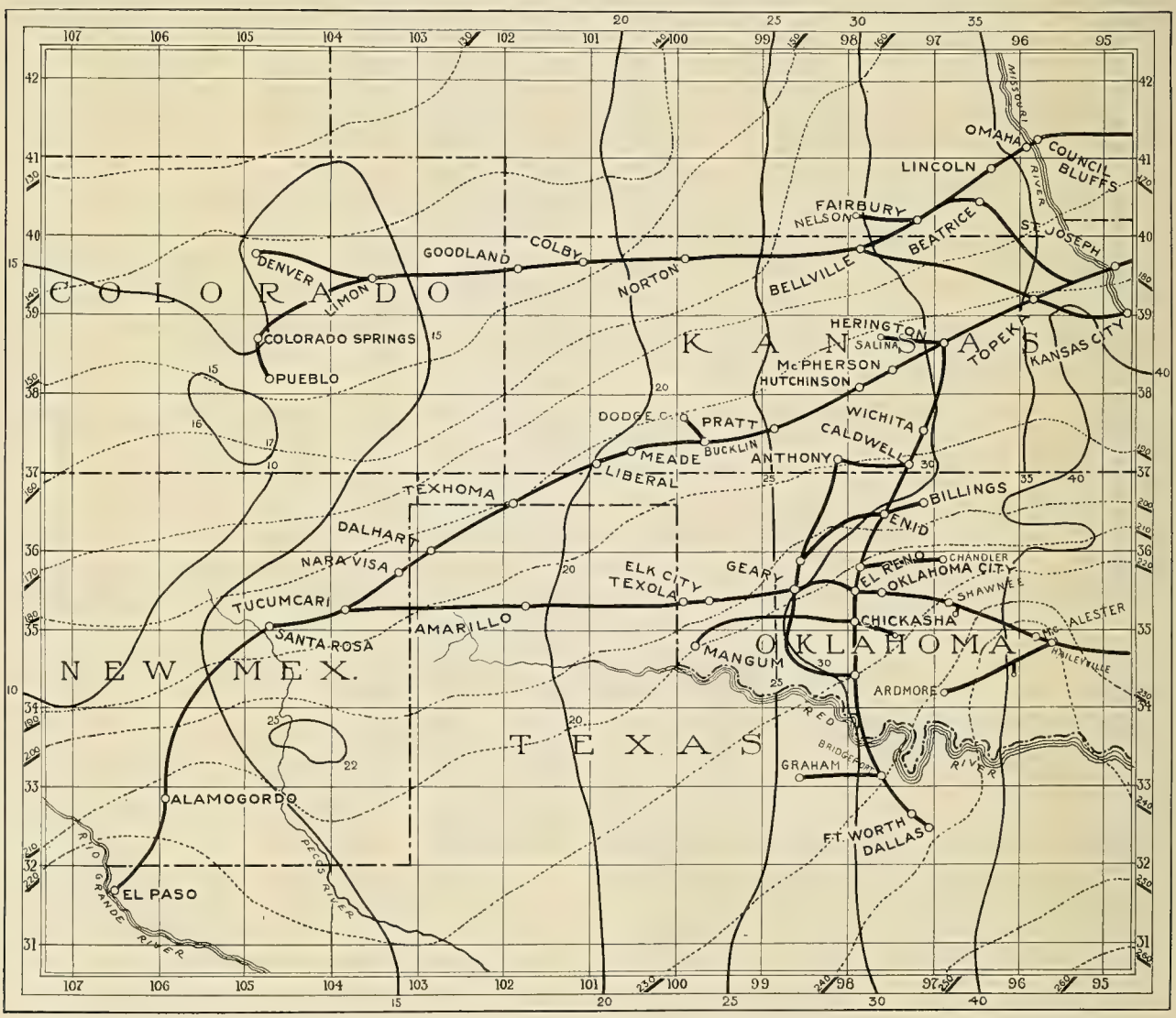
After it becomes well decayed and closely mixed through the soil, manure greatly improves the mechanical condition of the land. It makes hard lands more mellow and loose sandy soil more compact. The manure, of course, is needed to furnish food for the growing plants.

The best way to apply manure on dry land fields is as a top dressing on small grains or forage crops like alfalfa and sweet clover. The manure should be applied as a top dressing during the fall and winter. The fertilizing materials which it contains will be absorbed by the soil without injury to crops and most of the coarse stalks will decay and much of them be absorbed. Twenty loads to the acre can be used with safety.

Manure applied in this way adds to the fertility of the soil and acts as a mulch to hold the moisture in the soil.

On ground that blow badly heavy applications of coarse manure or even straw to fields of growing wheat will frequently stop the blowing. Where the wind is strong it is a good plan to run over the coarse manure as fast as it is spread with a weighted disc harrow, the discs being set nearly straight. This will tie down the trash in places with soil and help to hold the top dressing against the wind.

A manure spreader is one of the dry land farmer's best tools when he has the money to pay for it. This machine spreads the manure so much more evenly than it is possible to spread by hand.



Map showing rainfall and length of growing season in portion of great plains area served by Rock Island Lines

Dotted lines show number of days between least killing frost in spring and first killing frost in autumn, as compiled from U. S. government reports. Black lines show average annual rainfall in inches, as compiled from U. S. government reports.

Hogs and Alfalfa Near Amarillo, Texas.

Personal

I HAVE written the articles in this booklet for the dry land farmers of the southwest along the Rock Island Lines because I know what they can do. My father moved his family to Kansas in 1875 when I was a small boy. He located on an upland farm that had been abandoned because its previous owner could not keep body and soul together on it. We brought our seed with us from Illinois and of course the crops generally failed. At that time the crop failures in eastern Kansas were as frequent as they are now in eastern New Mexico.

We milked cows and when the drought killed the crops, the prairie grass supplied enough feed for a fair yield of milk. Every week my mother drove seventeen miles to town and sold the butter for 10 cents a pound. Think how we would have prospered had present prices prevailed!

The first brood sow was bought on credit from a man whose crops had failed and he sold her because he had nothing to feed her. We paid for her with butter money. We had rye bread all one winter, because all other grain failed, and we had to go twenty miles to a grist mill to have the rye ground for toll.

Kafir and milo were unknown and nobody knew anything about the science of saving moisture. We had to grope in the dark and tried more things that failed than we did those that succeeded. When we found anything that paid we stuck to it. Always the dairy cows and the prairie grass furnished an income. We milked scrub cows because we could not afford any other kind. It was ten years before we felt able to even buy a pure bred bull. But every cow that we milked was a profitable one. My father was a good judge of cows. We lived in a range country of beef cattle. He would ride around among the herds of beef cattle until he found a cow of strong dairy type. Usually she had some Shorthorn blood. The beef men were glad to sell us such cows because they were not as smooth as the other cattle.

After we learned how to handle the soil, got well bred acclimated seed and the calves grew up into a good sized herd, we gradually dropped dairying and changed the herd to beef cattle, making the income from steers, pigs and horses. It was the dairy cows though and the prairie grass that put us on our feet.

On that upland farm, once abandoned and where "nobody could make a living," my father furnished a good home and a comfortable living. Every one of his nine children were graduated from the Kansas Agricultural College, their expenses paid from the income from that farm.

For nine years I had charge of the field and feeding work of the Kansas Experiment Station, making a specialty of raising drought resisting crops and feeding them to get the greatest returns in meat and milk. During that time I visited thousands of dry land farms in Kansas, studying their owners' methods and the successes and failures. For four years I had charge of the Farmers' Institute of the Colorado Agricultural College and spent much time every year with the dry land farmers. Since becoming agriculturist of the Rock Island Lines, I have had the opportunity to meet hundreds of successful as well as unsuccessful dry land farmers in Colorado, Kansas, Oklahoma, Texas and New Mexico and watch their work.

In all these years and in every place in the large area that I have studied, the dairy farmer who intelligently selected and fed the right kind of cows and whose chief crops were drought resisting feed crops, has succeeded. The man who depended upon grain has failed. Most of the dry land country of the Southwest has been settled and depopulated four times—the grain growers rushing in by thousands in wet years and dragging out "broke" in dry years. Every one of these periods has left an increase in the farm population because the men who raised live stock and not grain alone made money every year, wet or dry, and they stayed.

With this personal experience and these years of observation of dry farming in five states I know that the average 320-acre tract in the dry farming districts served by the Rock Island Lines is sufficient, when managed rightly as a dairy farm, to make a comfortable living and to furnish a good and regular cash income for a large family.

H. W. Collell

Agricultural Commissioner, Rock Island Lines.

Kafir Field in Western Oklahoma.

To Farmers and Homeseekers

The services of the Agricultural Department of Rock Island Lines are available to farmers in our territory, or to those intending to settle in the country contiguous to our lines. This department is in charge of Prof. H. M. Cottrell, formerly connected with Kansas and Colorado agricultural colleges, who has been familiar with conditions in the Plains region for many years. He is the author of the following standard agricultural bulletins, which may be had free on application to the undersigned:

How to Double the Yield of Corn.
How to Make Money Dairying.
How to Double the Yield of Potatoes.
How to Make Poultry Pay.

He also supervises the issuance of the Southwest Trail, our monthly agricultural journal, which takes up each month a separate subject of interest to farmers in our territory, or those intending to become producers. This paper is sent free on application.

Descriptive state pamphlets are available free on the following sections: Arkansas, Louisiana, Oklahoma, Texas, New Mexico, Colorado, Missouri and Kansas. Correspondence invited regarding the farming opportunities in these states. Address all communications to

L. M. ALLEN,
Passenger Traffic Manager,
Room 718 La Salle Station, Chicago, Ills.

PASSENGER REPRESENTATIVES

Amarillo, Tex., C. R. I. & G. R'y.....J. I. Johnson.....General Agent
Atlanta, Ga., 411 Peters Bldg.....H. H. Hunt..District Passenger Agent
Boston, Mass., 288 Washington St.....S. L. Parrott, Gen'l New England Agt.
Buffalo, N. Y., 297 Main St.....R. S. Graham, District Passenger Agt.
Burlington, Iowa.....N. L. Cook..City Pass. & Tkt. Agt.
Cedar Rapids, Iowa, 4th St. and First Ave.John G. Farmer,Gen'l Agt.Pass. Dept.
Chattanooga, Tenn., Patten Hotel Bldg..O. Collins...Trav. Passenger Agent
Chicago, Ill., Adams and Dearborn Sts....L.H.McCormick, Gen'l Agt.Pass.Dept.
Cincinnati, Ohio, 38 East 4th St.....H. I. McGuire, Dist. Passenger Agent
Cleveland, Ohio, 515 Hippodrome Bldg....F. A. Haas..District Passenger Agent
Colorado Springs,Colo.,2 Pike's Peak AveR. S. Torrington, City Passenger Agt.
Dallas, Tex., C. R. I. & G. R'y, Cor. Commerce and Field Sts.....A. E. Dove....City Passenger Agent
Davenport, Iowa.....S. F. Boyd.....Gen'l Agt. Pass. Dept.
Denver, Colo., 16th and California Sts.....G. W. Martin.....General Agent
Des Moines, Iowa, 401 Central Life Bldg.Hal. S. Ray...Asst. Gen'l. Pass Agent
423 Walnut St.....Geo. R. Kline..City Passenger Agent
Detroit, Mich., Majestic Bldg.....C. C. Gardner..Dist. Passenger Agt.
El Paso, Tex., E. P. & S. W. System.....Richard Warren.....General Agent
Fort Worth, Tex., C. R. I. & G. R'y, 5th and Main Sts.....V. N. Turpin....City Passenger Agent
Hot Springs, Ark.....W. M. Anderson, City Passenger Agt.
Indianapolis, Ind., 615 Merchants Bank Bldg.....J F. Powers...Dist. Passenger Agent
Kansas City, Mo., Cor. 9th and Main Sts..C. W. Jones, Gen'l Agent Pass. Dept.
Leavenworth, Kan., 424 Delaware St.....J. M. Allen.....General Agent
Lincoln, Neb., 1141 O. St.....F. H. Barnes...City Passenger Agent
Little Rock, Ark., 2d and McLean Sts..C. B. Sloat...Asst. General Pass. Agt.
111 W. Second St.....P. C. Richardson...City Pass. Agent
London, Eng., 29-31 Cockspur St., S. W...Alex. Jackson..Gen'l European Agt.
Los Angeles, Cal., 519 S. Spring St.....J. L. Stanton, District Passenger Agt.
Memphis, Tenn., Peabody Hotel.....F. M. Griffith..Dist. Passenger Agt.
Minneapolis, Minn., 201 Metropolitan Life Bldg.....Gaylord Warner,Asst.Gen'l Pass.Agt
410 Nicollet Ave.....W. L. Hathaway..Dist. Pass. Agent
Nashville, Tenn., 241 N. Fourth Ave.....P. S. Weever.....Dist. Pass. Agent
New York,N.Y.,1238 Broadway,Cor.31st St.K. E. Palmer, Gen'l East. Pass. Agt.
Oakland, Cal., 1226 Broadway.....P. A. Ziegenfuss..Frt. & Pass. Agt.
Oklahoma City, Okla., 1009 Colcord Bldg.Fay Thompson..Div. Passenger Agent
Omaha, Neb., 1323 Farnum St.....J. E. Utt.....General Agent
J. S. McNally..Div. Passenger Agent
Peoria, Ill., Rock Island Depot.....H. I. Battles.....General Agent
Jefferson Hotel.....Warren Cowles..Div. Passenger Agt.
Philadelphia, Pa., 1019 Chestnut St.....H. M. Brown Dist. Passenger Agent
Pittsburgh, Pa., 527 Smithfield St.....J. R. Cahill...Dist. Passenger Agent
Portland, Ore., 111 Third St.....M. J. Geary..Gen'l Agent Pass. Dept.
Pueblo, Colo., 226 North Main St.....J. E. Whitley..City Passenger Agent
Rock Island, Ill.....F. H. Plummer.....Ticket Agent
St. Joseph, Mo., 6th and Edmond Sts....J. J. Goodrich..City Passenger Agent
St. Louis, Mo., 1225 Central National BankC. C. Anderson Dist. Passenger Agt.
Bldg., 703 Olive St.....W.J.Hennessey,City Pass.& Tkt. Agt.
St.Paul, Minn., 379 New Robert St.....R. L. Trisler...City Passenger Agent
Sacramento, Cal., Cal. Fruit Exchange Bldg.....J. D. McGill.....Frt. & Pass. Agent
Salt Lake City, Utah,404-5 New WalkerBk.R. D. Staley...Traveling Pass. Agent
San Francisco, Cal., 691 Market Street,F. W. Thompson..Gen'l Western Agt.
Hearst Bldg.....C. A. Rutherford...Dist. Pass. Agent
Seattle, Wash., 712 Second Ave.....Geo. P. Cave.....General Agent
Spokane, Wash., 412 Columbia Bldg.....W. S. Williams.....General Agent
Topeka, Kan.....C. E. Bascom....City Passenger Agent
Waterloo, Iowa.....C. A. Barton.....Agent
Wichita, Kan.....Z. E. Brooks...City Passenger Agent

OFICIALS—ROCK ISLAND LINES

Rock Island

W. J. LEAHY - - - - - - - - General Passenger Agent, Chicago
GEO. H. LEE - - - - - - - - - General Passenger Agent, St. Louis
J. A. STEWART - - - - - - - - - General Passenger Agent, Topeka

H. M. COTTRELL - - - - - - - Agricultural Commissioner, Chicago
A. T. STEINEL - - - - - - - - General Immigration Agent, Chicago

Rock Island

L. M. ALLEN, Passenger Traffic Manager
CHICAGO

V-822—26M. 1-15

HILLISON & ETTEN CO., CHICAGO