THROUGH
THE
LEAVES

JANUARY, 1920
Published Monthly by
The Great Western Sugar Company
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This kind of horses will go a long way toward solving the farm power problem. Who would trade these for a tractor?
GOOD farming ought to be practical, profitable and pleasant, and in its operation I would place the first, as the order of preference—get your work done in season. When you are three leaps behind with your work, it is almost impossible to catch up, the work drags, and the crop suffers.

In good farming the old adage "well begun is half done" is applicable. Proper and timely work and a study of the application of water are all important factors.

Second—In order to obtain the above results with ease and economy, we should think out today a rotation plan, covering a period of years, that will give an equal acreage each year of the crops to be grown, and in making up this crop rotation, we should think of a balance that will keep up the fertility of the soil and a proper distribution of labor and equipment.

In our company farming operations we have not carried out the above suggestions, having varied in the cultivated crop grown from 30 to 60 per cent, which means a fluctuation in the equipment needed and without the proper consideration being given to the future production.

Third—Realizing that a large part of our soils are farmed by tenants, we consider the following suggestions important:

1. Under the present one-year system of rental, the tenant does not have the opportunity to work out any rotation plan of farming, but is simply a "cropper," to do as well as possible for the current year, without thought or care of the condition in which the farm is left. This is one of the causes for the large yearly fluctuation in beet acreages.

2. Get a good tenant and give him a long-time lease and plan with him how to get the most out of the farm for himself and landlord, and still have the farm at the end of the period so that it is equally good or in better shape to produce than it was in the beginning.

Fourth—The margins between the cost of production and the market values of farm products are at this time handsome, but in the near future will be more closely drawn, and we should now get in the habit of economical management—economy in equipment, horse power and labor—all of which can be done through a rotation plan, which will afford a practical distribution of labor.
Fifth—Commercial feeding of livestock on the farm, dairying, running hogs or sheep, can be worked out and in most cases be made profitable, but this depends on the man and the interest he takes in the work. There is no question but that we should produce as much fertilizer to apply on the farm as possible, but such fertilizer must be produced at a profit.

Sixth—Your living conditions are a big factor in the pleasures and success of farming. Our women and children should be credited with more than 50 per cent of our success, and anything toward making their work easier, and their quarters more comfortable with the artistic touch of shrubbery and lawns, is money well expended. The general unrest of the working man today could in part have been avoided if we looked a little more to his welfare.

Seventh—The method of living with regular hours should be considered. In the operation of our company farms we have breakfast at 6:00 a.m. and supper promptly at 6:00 p.m., with the chores done. This plan gives the women folks a chance to complete their work and the men an opportunity to keep up on the topics of the day.

After all, the whole thing is summed up with just one combination—a good farm and a good farmer.

Meteorological Report, Longmont

FOR NOVEMBER, 1918 AND 1919

<table>
<thead>
<tr>
<th>TEMPERATURES:</th>
<th>1919</th>
<th>1918</th>
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<tbody>
<tr>
<td>Mean Maximum</td>
<td>46.3°</td>
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<td>Mean Minimum</td>
<td>15.2°</td>
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<td>Monthly Mean</td>
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<tr>
<td>Departure from Normal</td>
<td>-4.8°</td>
<td>-3.1°</td>
</tr>
<tr>
<td>Maximum</td>
<td>71.0° on 5th</td>
<td>67.0° on 1st</td>
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<tr>
<td>Minimum</td>
<td>-13.0° on 11th, 27th</td>
<td>-6.0° on 23rd</td>
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<table>
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<th>PRECIPITATION IN INCHES:</th>
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<tr>
<td>To Date</td>
<td>10.30</td>
</tr>
<tr>
<td>For Month</td>
<td>1.35</td>
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<tr>
<td>Greatest in 24 hours</td>
<td>0.45 on 26th</td>
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<tr>
<td>Departure from normal for mo.</td>
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<tr>
<td>Departure from normal since Jan.1-4.29</td>
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<table>
<thead>
<tr>
<th>NUMBER OF DAYS:</th>
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<tbody>
<tr>
<td>Clear</td>
<td>20</td>
</tr>
<tr>
<td>Partly Cloudy</td>
<td>2</td>
</tr>
<tr>
<td>Cloudy</td>
<td>8</td>
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The Place of the Sugar Beet Crop in Colorado Farming

H. Mendelson

The census of 1909 gives the acreage of irrigated crops in Colorado, not including wild hay, as 1,221,100 acres, including 106,900 acres of sugar beets.

The county assessor's figures for 1919 show an acreage of irrigated crops of 1,649,700 acres, containing 185,900 acres sugar beets. The irrigated crops necessitating plowing increased during these ten years by 429,000 acres, or 35 per cent.

The beet acreage increased in ten years about 79,000 acres, or about 74 per cent.

The beet acreage, therefore, relatively increased about twice as fast as the total cropped irrigated acreage.

This irrigated acreage is located in 54 out of the 57 counties. Only San Juan, Clear Creek and Philipps County contain no irrigated acreage to speak of. The beet acreage, however, is located in only 20 counties. If the figures for the beet counties were obtainable for the census of 1909, they would probably show that the sugar beet acreage in those counties alone has increased relatively much more than if compared with the irrigated acreage of the whole state.

The census figures of 1909 for the northern beet counties—Adams, Arapahoe, Jefferson, Larimer, Logan, Morgan, Sedgwick, Washington and Weld—give 212,900 acres in alfalfa. The assessor's figures for 1919 in the same counties give 231,900 acres in alfalfa, an increase of only about 19,000 acres, or about 9 per cent. (Considering the much larger number of horses and other animals fed on the farms now as compared with 10 years ago, alfalfa hay naturally would command a higher price.) Therefore, the alfalfa acreage in these northern counties does not show much of an increase, while the beet acreage in these counties alone increased from about 84,000 in 1909 to about 146,000 in 1919, according to the assessor's figures.

Furthermore, as everybody knows, 1919 was an extraordinary unfavorable year. A larger number of acres planted than every before did not come up due to lack of moisture. There were about 182,000 acres planted in northern Colorado, of which 42,000 were not harvested. As it was, the statement can be made that in the spring of 1919 the farmers had a much more favorable opinion of the advantages of raising sugar beets as compared with other crops, than they ever had before.
The reason for this favorable opinion might have been the price alone, although prices of all staple crops like grain and alfalfa were very high. In fact, the wheat price was guaranteed the same as in 1918. **The only two crops with uncertain prices which might influence the beet acreage were the potatoes and the beans not contracted for as seed beans.**

A survey made in 1917 by our fieldmen in the above mentioned northern Colorado beet counties gave a total of 33,000 acres potatoes as compared with the assessor’s statements of 28,400 for 1919, a decrease of only 4,600 acres. However, the fieldmen’s survey showed 59,400 acres irrigated beans in 1917 as compared with 13,600 in 1919, according to the assessor’s statement—a decrease of 45,800 acres. This obviously means that potatoes in 1919 still were quite attractive, while beans decidedly have lost a great deal of their charm. A moderate price and a low yield in 1918 of course were the main reasons for this. The yield of potatoes in 1918 was quite satisfactory, but the price was not. Difficulties with the newly introduced grading and in shipping were disagreeable features of the potato delivery season.

Nevertheless, the potato acreage on the whole was reasonably maintained, showing that in spite of ups and downs of prices, the potato has a rather permanent, though limited, place in the farming system, if the yields are reasonable. It may be expected that if potato diseases happen again as in 1911 and 1912, and the yield becomes rather low, the potato acreage temporarily will be much lower than normal.

From the following summary of the 1919 assessor’s statement and the 1917 survey of our fieldmen of the northern Colorado beet counties, it appears that while the total acreage of irrigated crops enumerated remained about the same, a decrease took place only in potatoes, beans and miscellaneous crops:

<table>
<thead>
<tr>
<th>Crop</th>
<th>Survey 1917</th>
<th>Assessor’s Statement 1919</th>
<th>Increase</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beets</td>
<td>118,300</td>
<td>$146,100</td>
<td>27,800</td>
<td></td>
</tr>
<tr>
<td>Alfalfa</td>
<td>224,400</td>
<td>231,900</td>
<td>7,500</td>
<td></td>
</tr>
<tr>
<td>Grain</td>
<td>230,100</td>
<td>236,500</td>
<td>6,400</td>
<td></td>
</tr>
<tr>
<td>Potatoes</td>
<td>33,000</td>
<td>28,400</td>
<td></td>
<td>4,600</td>
</tr>
<tr>
<td>Beans</td>
<td>59,400</td>
<td>13,600</td>
<td></td>
<td>45,800</td>
</tr>
<tr>
<td>Corn &amp; Sorghum</td>
<td>34,900</td>
<td>46,000</td>
<td>11,100</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>23,300</td>
<td>19,000</td>
<td></td>
<td>4,300</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>723,400</strong></td>
<td><strong>$721,500</strong></td>
<td><strong>52,800</strong></td>
<td><strong>1,900</strong></td>
</tr>
</tbody>
</table>
Beets occupied therefore about one-fifth of all cropped and irrigated acreage in 1919. This, of course, varies in the different districts considerably. Generally speaking, in districts where wheat does particularly well, or where the soil is favorable for raising potatoes, the beet occupies less than one-fifth of the cropped land. Also, where the late water supply is dubious, the beet acreage is rather limited. Where neither one of these conditions prevails, the beet acreage occupies much more than one-fourth of the cropped land. This is particularly true in districts where small farms prevail, and in the Sterling, Morgan and Brush districts.

In 1919 we had:

29 delivery stations with 10% or less of the cropped land in beets
52 " " 11-20%
56 " " 21-30%
20 " " 31-40%
7 " " more than 40%

As at all these stations some farmers do not raise any beets at all, the percentage of the cropped land occupied by beets is of course much larger on beet raising farms alone. For instance, a tabulation of 1,893 farms in typical beet districts in 1917 showed an average of 25 per cent of the land in beets. These same farms in 1919 averaged about 30 per cent of their land in beets.

Uniformly in all our districts the smaller farms have a larger percent of their land in beets than the larger farms. For instance, in 1917, 314 beet farms along the C. & S. between Cuthbertson and Boyd showed the following correlations between the total number of cropped and irrigated acres in the farm and the percentage of it occupied by beets:

<table>
<thead>
<tr>
<th>Number of Acres in the Farm</th>
<th>Percent of the Land in Beets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 20 acres</td>
<td>71</td>
</tr>
<tr>
<td>20-39 acres</td>
<td>49</td>
</tr>
<tr>
<td>40-79 acres</td>
<td>33</td>
</tr>
<tr>
<td>80-119 acres</td>
<td>28</td>
</tr>
<tr>
<td>120-159 acres</td>
<td>23</td>
</tr>
<tr>
<td>160-199 acres</td>
<td>23</td>
</tr>
<tr>
<td>200 or more acres</td>
<td>19</td>
</tr>
</tbody>
</table>

This means, of course, that the smaller the farm, the more important is the beet crop to the farmer, and the more of his revenue is derived from beets. The above figures indicate that possibly some farmers are raising a bigger acreage than is advisable from the point of view of proper crop rotation alone.

However, it is clear that when a man's acreage is limited and he is willing to work for the biggest yearly income possible, he will naturally turn to crops demanding a maximum amount of labor, and
at the same time sell for enough to furnish the pay for this extra amount of labor.

Less than 10 per cent of the beet acreage is raised on farms with less than 40 cropped acres per farm.

That the sugar beet at present prices does return enough to pay high wages is evident from the fact that at the highest level of wages ever paid on our farms, the acreage contracted was the largest. In other words, farmers did not consider the high wages to be paid for the extra labor required by the beet crop out of proportion to the prospective returns.

More than one-third of our beet acreage comes from farms with more than 120 cropped acres per farm where unquestionably a good deal of hired help is necessary.

Crops like alfalfa, grain and potatoes need at certain times a great deal more labor than at others. Help that has to be hired only for a few days generally has to be paid at a high rate per day and is not very easy to obtain. For instance, the harvest hands in the grain fields of Kansas obtain a much higher wage per day than help employed by the month.

The sugar beet crop, in the case of the man with insufficient land as well as in the case of the farm help, furnishes employment to people otherwise only partially employed in productive work.

The same statement is true for the horses on the farm. A farm with grain or alfalfa alone has little to do for the horses after September. Where cheap pasture is available, this is not costly. However, in a well developed agricultural district, like northern Colorado, cheap pasture is disappearing fast. Most horses must be maintained on expensive hay. Therefore, while beets demand more hours of horse-work per acre than grain or alfalfa, a certain amount of the acreage of such farms can be planted to beets, without increasing the number of horses necessary. The only extra cost chargeable to beets is then the cost of the grain fed during the hard working days.

In some districts the horses on the beet farms are not sufficient to perform the work required during harvest time. In this case, horses and teamsters are hired from farms not raising beets. This has been a godsend to many a dry farmer, especially when drouth diminished the yields to the point where the year's income was below the year's requirements.

Here again the beet crop furnishes employment for men and horses already in the district, who without the beet crop would not be sufficiently employed.

The fact that some farmers every year hire at current high wages the additional horses required by the beet crop is certainly evidence that in the farmers' opinion the horses and teamsters earn these wages.
Notwithstanding the opinions of some professors, bankers or city business men to the contrary, western farmers generally know what practice pays and what does not pay, if the practice has been followed for some time.

To sum up, the sugar beet crop in our western farm districts allows a fuller utilization of existing equipment of man and horse power.

This statement, although of importance to the economist, may not interest the farmer very much. Just the same all enterprises, no matter how profitable they may be to the individual for the time being, finally can be maintained only if they are conducted on a sound economical basis.

It is certainly interesting, to say the least, to find reasons for the permanency of the beet industry beyond the mere question of profits.

There is no question that at times, and on some farms, other crops return higher profits than the sugar beet. For instance, in 1916 the average receipt per acre of potatoes in Colorado was $186, according to government statistics. In our Northern Colorado potato districts they were undoubtedly larger. During this same year there were 9,730 acres of beets raised at the stations Ault, Galeton, Lucerne, Lowe, Cloverly, Eaton, Gates and Hurick, where most of the potatoes come from. The beets averaged 13.5 tons at these stations, returning about $82 per acre. Of course the net profit from beets did not compare with that from potatoes. In consequence thereof there were only 5,300 acres of beets at these stations in 1917. One-half of the farmers did not raise any beets at all. And yet, the other half did raise beets and potatoes.

The large profits on potatoes were not large enough to convince more than half the farmers that beets should be entirely replaced by potatoes. In the spring of 1919 these same stations contracted for 15,000 acres of beets. The highest acreage ever contracted before at these stations was in 1913 with 13,200 acres following the two disastrous potato years of 1911-1912. According to government statistics, the average receipts per acre of potatoes in Colorado were $39 in 1912 and $35 in 1911.

In these districts the disappointing results of the bean crop in 1917 and 1918 contributed materially to the good opinion the farmers had of the sugar beet.

It is, of course, evident and generally known that the beet crop, while not as profitable as the potato crop in some years, is a safer crop. And even 1919, probably the most unfavorable year in many respects we have had, is not going to prove the contrary.
L. Ogilvy has often expressed the opinion that no farmer should raise more than 20 acres of potatoes, because if the potatoes are good he makes as much money as he ought to, and if they are not good, he cannot afford to lose on more than 20 acres.

A gentleman operating more than 1,000 acres of land in the Greeley district stated that in his opinion no farmer in this district could afford to have less than one-sixth of his land in beets. The above mentioned potato stations have about 64,000 acres, land cropped and irrigated. On this basis they should raise a little more than 10,000 acres of beets every year. The acreage of beets contracted for in these districts has varied in the past from 5,000 to 15,000 acres, although a very considerable number of farmers have raised about the same acreage every year.

Looking at it from the point of view of the potato raiser, it does not seem that a wild fluctuation of the potato acreage, and therefore the potato production, is a very profitable thing, especially as no practical way has been found yet to utilize economically the potatoes produced in good years in excess of normal consumption. A year with good yield and normal prices is always followed by a very much increased acreage the next year, which, of course, in case of a normal yield, is accompanied by low prices and difficulties in marketing.

With the sugar beet the price per ton is at least assured, and no difficulties in marketing can occur.

The wheat crop is another crop that in some districts and some years produces attractive returns.

The labor and water requirements of the wheat crop are of course much less than those of the beet or potato crops—strong arguments at a time of high labor cost and water shortage.

A number of stations in the Longmont and Loveland territory, which had in 1917 a little more than 50 per cent of the cropped and irrigated land in grain, raised in 1916, 17,100 acres of beets out of a total of 73,800 acres cropped and irrigated land. After the violent raise in wheat prices and a good yield in 1916, the beet acreage in 1917 was still 12,100. In the spring of 1919, with a guaranteed wheat price still in effect, 14,470 acres of beets were contracted for in this district.

It is evident that beets in 1919 did not look quite as attractive, yet as in 1916, but still better than in 1917 and 1918—the guaranteed price of wheat for the 1919 crop undoubtedly being one factor. In these districts very few farmers ever anticipate less than 40 bushels of wheat per acre—if the hail does not strike them. Forty bushels per acre at $2 per bushel makes $80 per acre—certainly attractive enough, considering the ease with which it can be gotten and still only one-fourth of the farmers in these districts raise no beets at all.
Here, as in the potato and bean districts, many farmers prefer safety of returns to possible high returns. Even if it must be admitted that the average net returns from beets are not as high as the maximum returns sometimes obtained from potatoes or grain, the net returns must be satisfactory just the same. It is common experience that generally an oil prospect with a gambling chance is easier sold than a guaranteed government bond with 4½ per cent returns. There is enough gambling spirit even among farmers to take a long chance sometimes. Exactly what a farmer makes on beets is hard to tell. Experts claim to be able to figure exactly what each crop on the farm cost to raise. The other day we wanted some land for beet seed in farms already rented for next year and intended for beets. The tenants were promised all the team work on the crop at remunerative wages. We were asked $85 per acre rent under these conditions. Around Brush we were asked $50 per acre on an 80-acre farm, which was to raise beets next year. These figures indicate better than anything else what some farmers think they are going to make out of beets.

It is clear that only some farmers are interested in the safety of returns, while others can be induced to raise beets only if the price offered is high enough to warrant the expectation of high returns, and if past experience has shown them that they can raise a high enough tonnage.

It is, therefore, self-evident that if the Sugar Company wants to obtain a maximum acreage in a given territory, the price must be high enough to make the net returns attractive as compared with those obtained from wheat or potatoes or other farming enterprises. And there never has been a time yet when the Sugar Company did not want the maximum acreage.

The net returns from beets might be higher in many cases than what they are. In this connection the farmer naturally thinks of a higher price per ton, while a Sugar Company man thinks of a higher yield per acre. The higher yield per acre is of course still more profitable at a higher price per ton.

It is known to everybody that the yields of individual farmers in the same districts, on the same kind of soil and with equally good water right, differ materially. For instance, at certain stations in the Windsor district in 1918, the fifty-five best returns of 222 farmers averaged 19.2 tons per acre, while the fifty-five lowest ones averaged 12.0 tons per acre. In every uniform district we find that the 25 per cent of the farms with the lowest returns average about 60 per cent of the average yield of the 25 per cent of the farms with the highest returns.
The causes for the low yields are sometimes not controlable; many times they are. The controlable causes are mainly not doing the proper thing at the proper time, and lack of fertility. From the Sugar Company’s farm operations we know what effort it takes to get farm work done in schedule time.

Lack of fertility seldom can be remedied in one year. Everybody presumably knows how to do it by rotation and manuring. The one-year tenant system is one great obstacle to this, as has been explained many times in these pages. An increased use of manure is possible only if the quantity of manure is increased. Generally speaking, in our districts all available feed is fed and very little is normally shipped out. However, the manure is not produced on all farms it is often not well taken care of and not enough bedding is used to produce the maximum amount of manure.

Gradually the amount of feed shipped in is being increased. A great many farmers prefer to feed timothy or wild hay to the horses, and feed the alfalfa to cattle or sheep. Cottonseed cake is also used more and more.

Gradually the corn acreage is increased. In 1917 there were 34,900 acres of irrigated corn in our beet counties; in 1919 there were 46,000. The alfalfa acreage during this time increased only from 224,400 to 231,900 acres.

Corn silage, while always popular as feed for dairy cattle, is being used now for feeding steers.

The by-products from a normal acre of sugar beets, expressed in terms of alfalfa and corn silage, are about one ton alfalfa equivalent to the tops, and in addition two tons silage equivalent to the pulp and molasses.

Of course the uncertainties of the live stock market deter many from going into feeding. Not many farmers will keep on feeding for the value of the manure alone. It is to be hoped that co-operative buying and selling will do away with some of the uncertainties of the operation. Nevertheless, it is true that many farmers have fed every year and on an average have done well, while others trying to pick only the good years have often failed.

There is, however, no doubt that the proper production and utilization of the manure is a very important part of the feeding operation, and as such, can stand a little more attention than it generally gets.

Live stock keeping not involving the speculative buying of feeders every year has not developed very far in our beet districts. Where farms contain large amounts of land not fit for anything but pasture, dairy and other cattle are kept the year around, and the resulting offspring is eventually finished.

A few own mountain ranches and finish their own stock in the
valley. These opportunities are rather limited, and perhaps have not been fully utilized.

Experience has shown that where easy tilth of the soil and climate lends itself to the production of easily salable crops directly usable as human food, livestock raising on the farms is not generally practiced. The recent rise in wool and sheep prices has started some interest in sheep raising. Small flocks of sheep are kept on a number of irrigated farms.

The success of such small flocks depends more on the personal interest the farmer takes than on economic considerations, although at present good profits can be calculated on paper at least.

The hog might be better and more systematically utilized in the grazing of alfalfa lands before they are broken up in the regular rotation. This practice as well as grazing of sheep on alfalfa might manure the land at a less cost than the customary form of spreading manure with a spreader.

However, in our districts where wheat is the prevailing form of grain, there is not enough cheap grain to furnish any considerable number of hogs in competition with corn belt. It is conceivable that the production of such hogs may be made a profitable enterprise.

Another way to increase net returns from beets, or any other crop, is to decrease the farming expenses. The tractor is appearing on many farms. The tractor mechanically is not yet as reliable a machine as an automobile. Inexperienced operators soon roll up astonishing repair bills. On our relatively small farms, some horses always will be necessary.

On our big beet seed farms, the caterpillar type has proven the most practical machine. We started with twenty 40-horse power tractors intended to pull 4 bottoms. Under conditions as they exist, 3 bottoms are all they will average, and plow as deep as we want. We now prefer a larger type of 35-60 horse power, which can pull 6 bottoms on good soil. It is of course clear that up to a certain limit, the larger machine will do more economical work than the smaller one, although the initial cost is very high. A 160-acre farm cannot afford such a tractor. But it is possible that a number of farmers might combine and get the benefit of the economical advantages of a big tractor, provided they can arrange their farming operations so as not to have the plowing done the same day. It would then be possible to employ a competent tractor operator, instead of having to rely upon a number of more or less inexperienced men.

In countries where power plowing has been practiced for a long time, power plowing is done by large contractors, rather than by individual farmers; the same system as we employ now in threshing.

Many farmers are buying trucks today, and more are thinking
of it. A cheap, small truck undoubtedly can be used for many things on the farm at no more cost than the old team and buckboard. It is doubtful whether there is enough business on one farm to warrant the heavy investment in a 3-ton truck. It certainly at present does not appear that under normal circumstances, and with no more than a 2.5 mile haul to the dump, a truck can be profitably used for beet hauling alone. Perhaps here, as in the case of the tractor, a combination of several farmers may utilize such a costly implement economically, where one farmer cannot. Nevertheless, new beet scales will be made large enough from now on to take care of large trucks.

But little progress has been made in the construction of a machine that can take the place of hand labor in thinning, blocking, pulling and topping. The machines demonstrated for the harvesting work are not mechanically perfect yet, in the sense that we call a mower or binder perfect. Nevertheless, work on these implements is being done by many—and should be done—and perhaps eventually something of permanent value will be accomplished.

To sum up, the place of the sugar beet on our irrigated Colorado farms begins to be well established. It occupies a larger part of the irrigated area than before, which simply means that the consensus of opinion of the farmers acknowledges the advantages of the sugar beet as compared with other crops, not to the exclusion of other crops, but within limits set by many practical considerations.

The beet crop allows a fuller utilization of equipment and labor necessary even without the beet crop.

Temporary conditions at times favor an increase of potato or wheat acreage above the normal where experience has shown that these two crops can be grown to advantage.

The bean has not proven to be a permanently profitable crop.

Beet prices cannot be depressed to any point where the net returns from the beet crop do not compare favorably with other crops, even if some farmers consider the safety of the returns from the beet crop as an advantage.

The yield of beets on some farms are not as high as good farm practice could make them.

Better care of the manure already available, an increase of crops which can be profitably fed and an increased importation of concentrates will enable us to manure more acres effectively.

The one-year customary leases are an obstacle to any measures increasing the productiveness of land.

Tractors and trucks as a means of cheapening production are still in the development stage. So are machines for the replacement of hand labor of thinning, blocking and harvesting.
The Sugar Beet Plant—a Living Sugar Factory

W. W. Robbins

The sugar beet plant is a living sugar factory. It is in truth a "plant" in the manufacturing sense. Not only is there provision in this plant for the manufacture of sugar, but there is ample space for storage of the product.

In the manufacture of any article, whether it be a shoe, a watch, clothing or sugar, we must give attention to the following:

1. Raw materials.
2. Structure of plant.
5. Product.

The manufacturer of shoes must consider the source and quality of his raw materials, such as leather, cloth and metal; the structure and arrangement of the factory is all important; the source of energy used in running the plant may be the heat of coal, the energy of running water, or electricity; much attention is paid to the method or process of making the shoes; and, finally, a product is turned out, the character of which depends upon the raw materials and the processes used.

Let us consider the manufacture of sugar in the sugar beet plant under the five headings: Raw materials, structure of plant, source of energy, process, and product.

Raw Materials

The living plant has an inexhaustible and very cheap supply of raw materials for the manufacture of sugar. It utilizes carbon dioxide and water as its raw materials, and from these ever-present substances, manufactures sugar. Carbon dioxide comes from the air, and water from the soil.

Structure of the "Plant"

The living sugar plant or factory is "fearfully and wonderfully made." The large "sugar factory," so-called, which in fact is not a sugar factory, but a sugar extractor, with its complex machinery and processes, is not easily understood by most of us. But, it is simple in its structure and process as compared with the living sugar plant. The one is the handiwork of man, the other the handiwork of the Creator. And yet years of patient study of plants has revealed many of the secrets of Nature. The structure of the living sugar plant and
Fig. 1.—Diagram of Sugar Beet Plant.
The processes in the manufacture of sugar are fairly well known.

The sugar beet leaves and stems and roots are made up of thousands of small, microscopic compartments known as cells. Each compartment or cell has its walls, and contains within them various substances, such as water, food materials in solution, and the living substance—protoplasm. Not all cells are the same size and shape. And, not all cells perform the same work. The root hair cells absorb; the cells of the veins and fibrous strands carry water, salts from the soil, and foods; the green cells of the leaves manufacture sugar and other plant foods; the cells of the fleshy root are sugar store houses; and the cells of the flowers produce seeds. Thus there is division of labor in the plant; the different parts are put to different uses.

A rough plan of the sugar beet plant is shown in Fig. 1. Fig. 2 shows the structure of the beet leaf. The leaf is shown in detail because it is the place where sugar is manufactured. Not all cells or compartments of the leaf can make sugar, however; the process is confined to those cells which contain green-colored bodies. These green-colored bodies are shown in the cells of Fig. 2 as small circles. They are called chloroplasts. So, the green cells of the beet leaves are the sugar manufacturing centers. The raw materials—carbon dioxide and water—come to these cells. Carbon dioxide is a gas. It enters the leaf through small pores or openings known as stomata. (Fig. 2.) The gas diffuses through the air spaces between the loosely
fitting leaf cells, goes into solution in the moisture on the wall of each green cell, and then enters the cell. Water, the other raw material, is absorbed from the soil by the root hairs, carried up through the strands of the roots to the veins of the leaves and thence into the green cells.

Energy

In every manufacturing process, energy is required. Carbon dioxide and water cannot be put together to form sugar without energy, any more than can nails and leather and cloth be put together to form a shoe without some form of energy. Plants in the dark cannot manufacture sugar. Plants in the light can. Light or radiant energy is used by the living plant in sugar manufacture. What an inexhaustible supply of energy—the sunlight!

The Process

Will man ever be able to duplicate the processes in the green cells of living plants, and manufacture sugar from carbon dioxide and water, with the aid of sunlight as energy? We should not be too ready to answer “No.” The process is the subject of painstaking investigation. It is a chemical process, certain elements of which are partially understood. But, even should he be able in an experimental way to carry on these processes, it is a long step to the manufacture of the product on a commercial scale as cheaply as the sugar beet can do it.

The Product

Carbon dioxide and water are the raw materials; the green cells of leaves are the compartments in which the raw materials are brought together; sunlight is the energy used; the process is a chemical one; and the product is sugar.

The product contains three chemical elements, carbon, hydrogen and oxygen. They are united in the proportion of 12 carbons, 22 hydrogens and 11 oxygens, which is written \( \text{C}_{12} \text{H}_{22} \text{O}_{11} \).

What does the beet plant do with the sugar manufactured in the cells of the leaf? In the early life of the beet plant a greater part of it is used in building up beet structure—the framework of the “manufacturing plant.” The sugar forms the basis of the other and more complex substances in the plant. There is chemically added to the carbon, hydrogen, and oxygen of sugar, such mineral elements from the soil as nitrogen, phosphorus, potassium, magnesium, sulphur, calcium and iron, and there are built up complex plant products.

Later in the growing season, the beet plant ceases using its sugar supply in building new roots and leaves, and begins to place it in
storage. Of course it has stored much sugar throughout the entire season, but now comes a period of very rapid deposit of sugar in the storehouse. The root is the storehouse. A cross section of the storehouse is shown in Fig. 3.

![Cross-section of Sugar Beet Root](image)

There are a number of concentric rings of growth. Each ring of growth is composed of two regions. It will be noticed that there is a region in each ring of growth in which the tissue is lighter in color, less watery, and more compact (shown shaded in Fig. 3). This region is relatively rich in sugar. It is bordered by tissue which is darker in color and has more water (shown clear in Fig. 3); in fact this region has a comparatively high water content. The proportion of these two regions as seen in a cross section of a beet gives one a general idea of its sugar content.

It is worthy of note that sugar contains elements which come only from air and water. Sugar does not contain elements such as nitrogen, potassium, and phosphorus, which make up the fertility of our soils. True it is that the elements nitrogen, potassium, phosphorus and others are taken up by the living sugar plant, but these elements go into the make-up of the living material; they do not form any part of sugar. Consequently, if beet tops, beet pulp, beet molasses and other residues are returned to the soil in the form of manure, plant foods of the soil have not been reduced to any appreciable extent by the growth of a crop of beets.

A sack of sugar shipped from our shores does not carry one bit
of the soil fertility of the United States to foreign soils. They have received only carbon dioxide from our atmosphere, water from our soils, and our sunshine. They need the last!

But when a cargo of grain embarks for foreign shores, there goes with it the fertility of our farm lands, in the form of nitrogen, potassium, phosphorus and other valuable plant foods.

One hundred pounds of wheat contain approximately 1.87 pounds of mineral nutrients (plant foods), and 100 pounds of wheat flour contain about 0.4 pound of mineral nutrients.

In every 100 pounds of mineral nutrients from the wheat grain there are the following weights of substances:

- Potash: 30.24 lbs.
- Soda: 0.65 lbs.
- Lime: 3.50 lbs.
- Magnesia: 13.21 lbs.
- Iron oxide: 0.60 lbs.
- Phosphoric acid: 47.92 lbs.
- Silicon: 0.73 lbs.

Exports of Mineral Nutrients (Plant Foods or Soil Fertility) in the Form of Wheat and Wheat Flour From the United States

<table>
<thead>
<tr>
<th>Year</th>
<th>Wheat</th>
<th>Wheat Flour</th>
<th>Mineral Nutrients</th>
</tr>
</thead>
<tbody>
<tr>
<td>1910-1914</td>
<td>56,913,000 bu.</td>
<td>10,679,000 bbls.</td>
<td>72,229,000 lbs.</td>
</tr>
<tr>
<td>1916</td>
<td>173,274,000 bu.</td>
<td>15,521,000 bbls.</td>
<td>206,581,000 lbs.</td>
</tr>
<tr>
<td>1917</td>
<td>149,531,000 bu.</td>
<td>11,943,000 bbls.</td>
<td>177,476,000 lbs.</td>
</tr>
</tbody>
</table>

(Plant Foods or Soil Fertility.)

These facts have a bearing upon our national agricultural policies. They have a bearing on our farming policies. They emphasize the value of the sugar beet, and crops like it, in our farming system, and they further point out the urgent need of feeding beet tops, beet pulp and other by-products, and thus returning to our fields the fertility removed by the beet plant. Unlike a grain crop, the sugar beet crop lends itself to a feeding program, in which the soil fertility is not depleted.

As concerns the fertility of our land, we can much better afford to be exporters of sugar than of grains. This applies to the nation as a whole, and to the individual farmer. "It is not the land itself that constitutes the farmer's wealth, but it is in the constituents of the soil, which serve for the nutrition of plants' that this wealth truly consists."
The Newer Knowledge of Nutrition

H. H. Griffin

(Continued from last month)

In the last issue the writer analyzed what Dr. McCollum and his associates had to say in regard to foods of vegetable origin. Fruits are good sources of mineral salts and the sugars, they are highly palatable and exert a favorable influence on the excretory processes of the kidneys and intestines and their use should be liberal. Cottonseed has long been known to contain something toxic to animals and experience has taught that cottonseed meal, a product containing the bulbs, cannot be fed liberally to animals.

It is well known that milk, when it serves as the sole food of the infant keeps it growing normally and in good health over a long period. Discussion has arisen as to whether milk is a suitable food for the adult and as to whether it is the "ideal" food. The cereal grains and most other natural foods contain all the essential food elements, but experience teaches us that the proportions in which they occur in milk are more satisfactory than in most other natural foods. Animals grow well on milk, but it is not easy to find even complex food-mixtures of vegetable foods which will support optimum nutrition in the omnivora during growth. That milk is a complete food capable of supplying all the nutrients necessary for the prolonged maintenance of growth, health and ability to produce and rear young is shown by an experiment conducted by the author. A female pig weighing 17 pounds was removed from its mother and confined in a pen having a board floor and fed nothing but milk for 17 months. This pig, at the end of 13 months weighed 406 pounds and gave birth to 8 living and two dead pigs, and nourished them to a weight of 17 pounds. That it is best to select milk as a monotonous diet during adult life no one familiar with the principles of nutrition will maintain. It is, however, our most important food stuff. This is true because the composition of milk is such that when used in combination with other food stuffs of either animal or vegetable origin, it corrects the dietary deficiencies.
In experiments for testing the food value of proteins of the various natural food stuffs, it was found that the percent of protein retained by the pig was from corn—20, from the wheat—23, rolled oats—26, and milk—63. When taken as the sole food supply for the adult, milk is very liable to produce constipation, and because of its high protein content may lead to the development of bacteria in the intestines. The addition of sugar and starch tends to correct this. The human infant must live largely on a milk diet for the first year of life and should have a liberal amount of milk and eggs during the entire growing period.

Meats

The muscle tissue of an animal consists of highly specialized tissue whose chief function is to produce mechanical work through contraction. It contains but little cellular structure in the sense that the glandular organs do, such as the liver, kidneys, etc. Muscle tissue differs markedly from the seed in only one respect, when considered as a foodstuff, and that is in the quality of its proteins. These are distinctly better than those of the seeds. Therefore, we should not expect to secure growth and normal nutrition with mixtures of seeds and meat, and experimental trials demonstrate this fact. The above mixture needs to be supplanted with respect to sodium, calcium and chlorine, just as do seed mixtures alone. Meats are therefore but partial supplementary foods, when employed with the seeds or the food products made from them, such as wheat flour, corn meal, etc. Such diets could be partially corrected by the liberal use of leafy vegetables, but best with the use of these along with milk.

Eggs

The egg contains all the chemical complexes necessary for the formation of the chick during incubation, it is therefore to be expected to furnish everything for the nutrition of a mammal. The egg is indeed a complete food, but not one which produces the maximum results when employed as the sole source of nutrition. Aside from the calcium content of the white and yolks of the egg, which is much lower than that of milk, the contents of the egg resemble milk in a general way in nutritional value. The high content of milk sugar in the milk and the almost complete absence of carbo-hydrates in the egg, cause them to differ considerably in the physiological results which they produce on an animal when each is fed as the sole source of nutrition. There are distinct differences in the chemical natures of the constituents of the egg as contrasted with milk. The principal protein of egg yolk, like that of milk, contains phosphorus, but the
fats of milk are phosphorus free; whereas, phosphorus fats are very abundant in egg fats. There is an abundance of lactose in milk; whereas, the egg contains but a trace of sugar. It must be borne in mind that there are two classes of food stuffs so constructed as to correct the deficiencies of seeds, tubers, roots and meat. These are milk and the leaves of plants. Eggs are in some degree to be regarded as comparative to these, but they have not the favorable mineral content. In man it is difficult to correct dietary deficiencies by the use of leaves solely because of the limited capacity of his digestive tracts. Milk in liberal quantities should always be included in the diet of the lactating mother. In many feeding trials with simple combinations of two seeds, one a cereal and the other a legume, it has been impossible to obtain protein in mixtures from vegetable sources which even approximate the value of milk proteins for the support of maintenance or of growth. There is a widespread belief that wheat is superior to the other cereals as food. There is no experimental evidence to show this to be true, the use of it is largely a habit with us. The inhabitants of most all countries have some food to which they are attached, but this is not an expression of a physiological need. Experiments have been described showing that common wheat flour is inferior to whole wheat flour. What we should realize is that none of our vegetable foods or meats are complete and ideal foods. Some are more deficient than others, but the deficiencies are not all alike. It is fallacious reasoning to attempt to compare the money values of certain foods with certain others. We may safely compare the cost of the cereal grains or the legumes with each other or compare the tubers, but it is not possible to compare these with milk or the leafy vegetables.

The results of the study of several representatives of each of the different classes of food stuffs has led the author to the conclusion that while it is not desirable to relegate to the background any of the fundamental knowledge of food stuffs which can be obtained by chemical methods and by digestive studies, the fundamental basis of nutrition can best be imparted to the public through the adoption of a feeding classification of the natural food stuffs on the basis of their function. This idea, together with the knowledge that milk, eggs and leafy vegetables are so constituted as to correct the deficiencies of the other foods should form the central idea in the teaching of the science of nutrition. Dr. McCollum and his associates have designated them as “Protective Foods.”

An examination of any large group of people in the cities will
show that where there is a high mortality from tuberculosis, milk is not being used to any great extent and in any large group where milk purchases are generous this disease is not a menace. Any diet which will not support normal development in the young will not support optimum well-being in the adult. Milk is our greatest protective food and its use must be increased, unless this is done the effects will soon become apparent in the lowering of our standards of health and efficiency.

We are now able to make certain general statements regarding the types and combinations of the natural food stuffs which may be expected to give good results in the nutrition of the animal. First, seed mixtures, no matter how complex or from what seeds they are derived will never induce optimum nutrition. Seeds with tubers or seeds with tubers, roots and meats will not even approximate the optimum in the nutrition of an animal during growth. Second, the only successful combinations of natural foods or mill products for the nutrition of the animal are:—(a) combinations of seeds or other milled products, tubers and roots, each singly or collectively taken with a sufficient amount of the leaves of plants; (b) combinations of the food stuffs listed under (a) taken along with sufficient amount of milk to make good the deficiencies.

The writer of this analysis wishes to call the attention of the reader to the fact that in the results secured by the practical feeder there are many plain evidences of the soundness of the conclusions drawn. Take for example the feeding of poultry: Egg production is very seldom secured by the use of seeds alone; it is only when hens get in addition either milk, worms, meat or alfalfa leaves that satisfactory returns are obtained. An article that appeared recently in some of our daily papers is a verification of the conclusions from the standpoint of the nutrition of man. It was in regard to the health and vitality of that grand old man of France, Clemenceau. It is said he is considered by the medical profession to be one of the greatest living wonders of the age. His diet is given as follows: Upon arising, a glass of milk, a little later macaroni with cheese and melted butter; at noon a couple of eggs, and at evening time vegetables and fruits. Note to what extent dairy products enter into this ration and the absence of our common brewerage—coffee. What a blessing it would be could the American people be brought to realize how our health and vitality would be enhanced were we to spend our money at home for that life-giving product—milk, instead of sending thousands of dollars to distant foreign countries for that health-reducing stimulant—coffee.
Representative Livestock Sales at Denver Yards

The "Record Stockman" publishes each day a list of "representative sales" showing the number of animals, weight and price. The following tabulation is the total number of head reported in such sales and is intended to show the trend of prices for the period November 20th to December 20th:

**FEEDERS**

<table>
<thead>
<tr>
<th>Weight</th>
<th>$9.00</th>
<th>$9.50</th>
<th>$10.00</th>
<th>$10.50</th>
<th>$11.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>800 to 899 lbs.</td>
<td>$9.45</td>
<td>$9.95</td>
<td>$10.45</td>
<td>$10.95</td>
<td>and Up</td>
</tr>
<tr>
<td>Nov. 20th to Dec. 5th</td>
<td>577</td>
<td>1384</td>
<td>287</td>
<td>313</td>
<td>....</td>
</tr>
<tr>
<td>Dec. 6th to Dec. 20th</td>
<td>342</td>
<td>64</td>
<td>28</td>
<td>28</td>
<td>....</td>
</tr>
<tr>
<td>900 to 999 lbs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nov. 20th to Dec. 5th</td>
<td>261</td>
<td>628</td>
<td>942</td>
<td>326</td>
<td>43</td>
</tr>
<tr>
<td>Dec. 6th to Dec. 20th</td>
<td>176</td>
<td>273</td>
<td>1163</td>
<td>15</td>
<td>....</td>
</tr>
<tr>
<td>1000 to 1099 lbs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nov. 20th to Dec. 5th</td>
<td>144</td>
<td>368</td>
<td>119</td>
<td>181</td>
<td>157</td>
</tr>
<tr>
<td>Dec. 6th to Dec. 20th</td>
<td>43</td>
<td>77</td>
<td>96</td>
<td>8</td>
<td>17</td>
</tr>
</tbody>
</table>

Prices dropped a dollar for the second period, $11.50 being the average high figure for the first period and $10.50 for the second. The stock offered in the 800-pound class centered at about $9.35; $10.00 in the 900-pound class and $9.75 in the thousand-pound class. Last month the prices centered at $10.25, with $10.60 for 900-pound stock. A year ago the stock offered centered at $11.75.

**LAMBS**

<table>
<thead>
<tr>
<th>Weight</th>
<th>$13.00</th>
<th>$13.50</th>
<th>$14.00</th>
<th>$14.50</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 to 59 lbs.</td>
<td>$13.45</td>
<td>$13.95</td>
<td>$14.45</td>
<td>$14.95</td>
</tr>
<tr>
<td>Nov. 20th to Dec. 5th</td>
<td>1630</td>
<td>4202</td>
<td>8157</td>
<td>....</td>
</tr>
<tr>
<td>Dec. 6th to Dec. 20th</td>
<td>73</td>
<td>2644</td>
<td>1156</td>
<td>....</td>
</tr>
<tr>
<td>60 to 69 lbs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nov. 20th to Dec. 5th</td>
<td>1310</td>
<td>4567</td>
<td>7551</td>
<td>....</td>
</tr>
<tr>
<td>Dec. 6th to Dec. 20th</td>
<td>122</td>
<td>149</td>
<td>3830</td>
<td>864</td>
</tr>
<tr>
<td>70 to 79 lbs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nov. 20th to Dec. 5th</td>
<td>1354</td>
<td>870</td>
<td>2040</td>
<td>....</td>
</tr>
<tr>
<td>Dec. 5th to Dec. 20th</td>
<td>82</td>
<td>145</td>
<td>....</td>
<td>....</td>
</tr>
</tbody>
</table>

Prices advanced 25 cents during the second period, $14.25 being the average high price for the first and $14.50 for the second, with some sales as high as $15.00.

The sales in ewes were scattered all the way from $5.00 to $7.50, centering at about $6.00.
UGAR beet seed has been raised in the United States for a long time. Sporadically, almost everybody has tried it in the last 30 years, and almost every sugar company is raising some now.

The Utah-Idaho Sugar Company has raised seed every year since about 1892. The writer met Bishop Cutter of Salt Lake City and Mr. Granger, then superintendent of the Lehi sugar factory and formerly manager of the factories at Fort Morgan and Brush, in Germany in 1893, looking over beet and beet seed fields in great detail. However, up to the beginning of the war no attempt was made in Utah to produce any important part of the annual requirements.

Several California seed-houses in the nineties produced commercial seed without pronounced commercial success. The American Beet Sugar Company also made extensive experiments in Southern California.

The Department of Agriculture, during Secretary Wilson's time, interested itself in beet-seed raising, and has been doing some work ever since. Previous to this time beet seed has been experimentally raised at Schuyler, Nebraska, and Sterling, Kansas.

Colonel Morrison had been raising beet seed at Fairfield, Wash., since 1900. In 1905 the Department of Agriculture established a station on his farm and conducted all the scientific work until about 1910. The seed produced was very good, but the enterprise was a commercial failure. The department also conducted some experiments in co-operation with the Experiment Station at Brookings, South Dakota, later at Madison, Wisconsin, again at Rocky Ford, Colorado, and now at Fort Collins, Colorado, and in Utah.

Official publications of the department reveal very little of what has been done, although some of the individual investigations from time to time have published interesting details.

Dr. Townsend, of the department, at one time started the development of a single germ beet seed. As far as the public knows not much is being done along this line.

The Experiment Station at Logan, Utah, also has done considerable work, and has published a number of scientifically interesting data.

An enterprising Polish firm, Buszinski & Laczinsky, started the
PLATE 2

Upper Picture—Making the Trench. Lower Picture—Throwing Pulled Stocklings Into the Trench
PLATE 3—Unloading Stocklings From Wagon Into the Trench
PLATE 4—A Trench Filled With Stecklings. Ready to Cover
production of commercial seed in 1912 in Utah and Idaho under the management of Mr. Winterhalter, and is still carrying on the work.

After the outbreak of the war in 1916, a number of sugar companies organized the United States Beet Seed Company, raising large acreages of seed in Utah and Idaho. Up to this time this is also under the management of Mr. Winterhalter.

The Great Western Sugar Company raised beet seed for the first time in 1902 at Loveland.

In 1909 they started the investigation of beet-seed raising and beet breeding at Billings, Mont. The operations were gradually expanded and are now being carried on in Colorado, Nebraska and Montana to the extent that the total expenditures now involved in this enterprise are close to a million dollars annually.

The land is partly owned and partly rented. The farms are located as follows:

- Mouth of Platte Canon near Littleton.
- Longmont.
- Loveland.
- Fort Collins.
- Windsor.
- Eaton Farms near Woods' Lake.
- Wyeth Farm north of Eaton.
- Brush.
- Fort Morgan.
- Sterling.
- Scottsbluff, Nebraska.
- Hardin, Montana.
- Billings, Montana.
- Hesper, Montana.
- Edgar, Montana.
- Fromberg, Montana.
- Belle Fourche, South Dakota.

We have in these farms about 13,500 acres cropped and irrigated lands. It takes about one horse for every twenty acres, and one tractor for every 500 acres to do the necessary work to farm this land, raising from 3,000 to 4,000 acres seed beets and stecklings.

The beets for the production of seed this year are of course produced in the previous year, and are called "stecklings." The seed from which the stecklings are raised is produced from specially selected beets, resulting in our breeding operations. It costs from $1.00 to $1.50 per pound to produce this seed. It is planted like other beet seed on specially well handled and fertilized ground. The beets are, however, not thinned. It is important to keep these stecklings growing under the most favorable conditions. They are kept irrigated long enough to have the soil still moist at harvest time.
PLATE 5—Upper Picture: 4-Foot Row of Stocklings, Containing 24 Beets. Lower Picture: A Row of Stocklings, With 4-Foot Pocket Rule in the Middle.
PLATE 5—Upper Picture: 4-Foot Row of Stocklings, Containing 26 Beets. Lower Picture: A Row of Stocklings, With 4-Foot Pocket Rule in the Middle.

PLATE 6—152 Stocklings Grown on 50 Feet of Row. Topped and Cleaned. They Would Yield at the Rate of 22 Tons per Acre.
PLATE 7
Upper Picture—Plowing the First Furrow Into the Trench. Lower Picture—First Covering of the Trench With "V"
A day or two before harvesting the tops are mowed with the ordinary mower (Fig 1). Three or four rows, twenty or twenty-five rows from the side of the field, are then pulled by a riding Giddings puller, and are thrown by hand on the neighboring unpulled rows. Where the beets have been removed a trench is made by various methods. For instance, we go up and down with a plow, throwing the furrow out, and deepen it with a road grader (upper part of plate 2). The beets already pulled are then thrown by hand into the trench, and the twenty to thirty rows on each side of the trench are pulled and thrown in by hand or with forks—as far as they can be conveniently handled by this method (plate 2, lower figure). In addition to this, some of the pulled beets farther away from the trench are loaded on beet wagons and unloaded by fork into the trench (plate 3).

By this method we fill one trench with the beets from 40-60 adjoining rows. The trench is filled to about the level of the field (plate 4).

How close these stecklings grow and, nevertheless, develop into good looking small beets can be seen from plate 5. Plate 6 gives another picture of all the beets harvested from 50 feet of row. These beets topped and cleaned would have yielded about 22 tons per acre. However, many of the small beets would have fallen through the screen at the dump and the percent of tare would have been very high.

The first dirt is thrown over the trench with a plow (plate 7, upper picture). More dirt is moved over the trench by an ordinary V. As long as feasible, plowing a furrow and moving dirt by the V or a road grader alternates, until finally it is necessary to use the elevator grader (plate 8).

The trench is covered quickly as soon as filled, heaping the dirt one or two feet high on the sides and covering the top only lightly—just enough to prevent sudden frost from hurting the top layer of beets. The beets usually heat a little in the beginning and the covering must not be enough to prevent this heat from escaping. In order to be sure to get all beets siloed before the frost touches them we begin this work between the 20th and 25th of September and aim to have everything in the silo before October 10th. The final covering of two and a half to three feet of dirt must be finished before November 10th.

We obtain about 550 lineal feet of trench from every acre siloed. The cost of the harvesting and siloing alone is around $70 per acre.

If the beets were healthy when placed in the silo, were not touched by frost and are surrounded by moist dirt, they keep perfectly. The mass of stems and leaves siloed with the beets does not affect them. They are normally as crisp in the spring as they were in the
PLATE 8—Final Covering of Trench With Elevator Grader
Beet Seed on Hardin Farm, Billings, Montana
PLATE 9—Upper Picture: Digging Stecklings Out of the Trench Previous to Planting. Lower Picture: Making Furrow With Subsoiler Attached to Alfalfa Cultivator Frame
PLATE 10—Upper Picture: Stecklings Ready for Planting, Trimmed to Proper Length. Lower Picture: Distributing Seed Roots Over the Field.
fall. Often stems and leaves stay quite green through the winter. If the beets get too warm they are inclined to sprout, which is not desirable.

The planting season in the spring begins as early as the seed bed can be prepared, which is usually the last week of March in Colorado, and a little later in Montana. The seed bed is prepared with as great care as for factory beets. Virtually all land intended for seed beets is fall plowed. The spring work then consists of spring-tooth harrowing, double discing, and leveling, or whatever the condition of soil makes necessary.

The siloes in the spring are uncovered by tractors drawing road-graders or elevator graders, so that the top of the trench is level with the field. The beets are then dug and thrown out of the trench with spades and forks (plate 9, upper picture). They are then sorted by hand, rotten and misshaped beets removed, and those too long trimmed with knife to the proper length (plate 10, upper picture). The selected beets are forked into beet wagons and hauled to the field where they are needed. Great care is taken that the beets are left no longer exposed to the drying influence of air and sunshine than necessary, to prevent any undue wilting.

Meanwhile on the fields where the planting is to be done rows three feet apart are marked with a 2-row subsoiler attached to the frame of an alfalfa cultivator. This tool makes a slit in the soil deep enough to receive subsequently the seed beet (plate 9, lower picture). As soon as this is done the beets are distributed along the rows by men with aprons filled with beets from the wagons arriving from the siloes (plate 10, lower picture).

Following the distributers are men who stick the beets upright in the soil, so that the crown is just a little below the surface of the ground (plate 11, upper picture).

Immediately afterwards the beets are rolled by an implement designed by John Maier (plate 12). This consists of two very heavy beveled cast iron wheels attached to the frame of a beet puller. The implement is driven over the row of beets, so that the wheels pack the soil firmly on both sides of the beet. There are chains attached to the frame, dragging the earth partly off the row, so that beets are not unduly covered. Ditchers also are attached to the implement so that the field can be irrigated immediately after planting.

The field is also rolled in addition by a Western Land Roller (plate 11, lower picture).

The finished field appears on plate 13.

The total man labor necessary to finish all these manipulations is about 70-80 hours per acre. In addition, it takes about 20 horse hours and some tractor work.

It is necessary to finish the planting of seed beets as early as
PLATE 12

Presswheel Roller for Seed Beets. Designed by John Maier
PLATE 13—Field of Seed Beets Immediately After Planting
possible. This year it is intended to do it in 12 working days. At Windsor, for instance, we will have to plant 35 acres per day. This means that we will have to use about 250 men, 70 horses and 2 tractors every day. It is obvious that it takes some very good supervision to handle such a force. The success of the beet seed crop depends largely on the quality of work done during the planting.

It is most important that the newly planted beet is in close contact with the moist soil. If the soil is naturally moist, or rains follow immediately after planting, no further action would be necessary. This is, however, rather the exception in our dry climate. Therefore, we have to irrigate every acre of seed beets as soon after planting as possible (plate 14). This packs the soil around the beet better than any implement. Of course, this irrigation is followed immediately by cultivation, to preserve as much moisture as possible.

Beets seldom get hurt by frost at this stage, and, therefore, there is not much danger of planting too early. Beets begin to throw out seed stalks when the soil and air reach a certain temperature. The number and size of seed stalks formed depends upon the quantity of fine roots developed in the previous period. This means that years with a slow, gradual increase of temperature produces good yields of seed, while on the other hand if the temperature rises quickly to a high level as in 1919, the yield is rather mediocre.

Beet seed is kept cultivated with corn cultivators as much as is necessary until the stalks are too high to allow horses to walk between them. They are also, of course, supplied with sufficient moisture to keep growing up to the time the blossoms appear. Beet seed grows very rapidly. Sometimes during cool, cloudy weather in June a stalk will grow two inches in one day. In 1918 we had some severe damage by webworms. Some fields were eaten down to the beet. When the webworms appeared we just had finished irrigating the field. Sprayers had no traction, and the horses could not walk in the mud. In addition to that, rains washed the Paris Green off the leaves every day. So we were practically helpless. We now have several sprayers built with very high wheels which can go through the seed fields without damaging the tall stalks. Some of our fields in 1919 had to be sprayed twice.

Beet seed begins to bloom about the middle of June, and a field usually finishes its crop in about 20 days. If the field is in healthy condition the odor is noticeable a long distance away. The odor is not particularly pleasant. When walking through a blossoming field one soon becomes covered with masses of yellow pollen. The individual blossoms open early in the morning.

Beet seed is generally ready to cut in the early part of August. To the novice it usually looks too green to cut, but an examination
PLATE 14—Irrigating Seed Beets After Planting
PLATE 15—Beet Seed Field Ready to Cut
PLATE 16—Best Seed Ready to Cut
of the seeds will show that they are in the thick dough stage when
the stalks are quite green. Given a few hot summer days fields turn
brown very quickly and are then too ripe for cutting as the seed
shatters badly when the very much matured stalks are cut. Plate 15
shows what a mass of vegetation grows on a good beet seed field.
These and the following pictures were taken in 1919 at Fort Collins.
Plate 16 shows a little more detail of individual stalks.

The beet seed is cut by hand with a corn knife and placed in
loose bundles on the earth (plate 17). These loose bundles are shocked
without tying (plate 18) in rows far enough apart to drive teams
through.

According to the weather it takes two to three weeks before the
seed is ready to be stacked. We generally load the shocks on sleighs,
to avoid as much lifting as possible, which always shatters some
good seed.

Later the seed is threshed at a convenient time with an ordinary
threshing machine, slightly modified.

The seed coming from the threshing machine contains from 15 to
25 per cent impurities, sticks, leaves, chaff, etc.

It is cleaned in special cleaning plants by first running the seed
through a separator similar to the one used for grain. This removes
the very light and very fine particles and the coarsest sticks.

Finally the seed is run over a revolving canvas apron, running
over a table at an angle. The round seeds roll off the apron and are
sacked, while the sticks adhere to the apron and are dropped at the
end of it.

What remains of the beet after the seed crop is taken off is of
very little value, if the crop was good. The beets which failed to
throw out seed stalks are of some value. Those that have born seed
are very woody. Plate 20 shows the skeleton of a seed beet after the
crop has matured, showing the woody tissue.

What is commonly called beet seed is, in reality, not the seed,
but a husk containing from one to five real seeds. Plate 21 shows a
cluster of three blossoms, later forming one beet seed ball. The
blossom is shown about 36 hours after it opens. Soon after opening,
the pollen bags discharge their pollen early in the morning. The
stigma, the female part of the blossom, is not ready to receive the
pollen at this time. This is the case about 36 hours after the pollen
is discharged, when the three lips of the stigma are covered with a
sticky fluid. This arrangement prevents each blossom from becoming
fertilized with its own pollen. Soon after fertilization has taken place
the real seed included in a capsule begins to form. This seed, as
shown in the picture (plate 22), has the shape of alfalfa seed, but
is of smaller size. It has a brown, thin shell and about the same
composition as cotton seed. That is, it contains a considerable quantity of oil, and, like all seed, of protein. The real seed forms about 20 to 25 per cent of the weight of the ball.

Even if beet seed is raised under the best conditions, not all balls contain germinating seed. Seed containing more than 90 per cent germinating balls is very scarce. Commercial seed seldom contains more than 75 per cent germinating balls.

The seed balls vary greatly in size on each plant and in different fields and years.

Very large seed balls with a high percent germination often do not furnish as good a stand as seed with smaller seed balls and a lower percent germination, for the simple reason that we are planting the same number of pounds, regardless of whether or not the seed is large or small. Large seed contains about 18,000 balls per pound. If we plant 18 pounds per acre we are planting 324,000 balls per acre, or 12.5 balls per foot of row. Now if 80 per cent of them germinate, we plant 10 germinating balls per foot. Small seed contains about 30,000 balls per pound. Planting 18 pounds, we plant 540,000 balls per acre, or 20.8 balls per foot of row. If only 60 per cent of these germinate, we plant about 12.5 germinating balls per foot of row. With our uneven seed beds we have the better chance to strike a spot favorable to the germination of the seed the larger the number of germinating balls per foot of row planted. It never has been proven that the larger seed furnishes larger or better beets. Normally, beet seed is not expensive, and could be obtained in large quantities. It would have been an easy matter to improve the quality by sifting alone, but results have not warranted this practice.

The beet grows wild around the coast of the Mediterranean, and on Greek islands. This wild beet is usually an annual, that is, it goes to seed the first year. The seed drops off when ripe, and beets grow around the stalk of the old beet (plate 23, upper picture). Some of the beets do not go to seed the first year, but act as biennials. Their roots are usually small and have pronounced strong side roots, although they may contain as much as 16 per cent sugar (plate 23, lower left picture). The yield per acre, however, would be rather small.

The present sugar beet is the result of many years breeding operations. When the presence of crystallizable sugar was discovered in beets, about 130 years ago, it also was soon found that white beets contain more sugar than red or yellow ones. Therefore, the use of colored beets for sugar making purposes was abandoned in a short while. We have today only one variety, with partly pink skin, which compares with the white beet. The beets at the beginning rarely contained more than 8 per cent sugar, while now 16 per cent is considered normal, although in some unfavorable years and in some
BeeF Seed Blossom
about 36 hours after opening

Sugar Beet Blossom
3 days after opening, containing 3 seeds
unfavorable localities they do not test as high as that. Every year, also, there are some fields of much lower percentage than normal.

The beets of one field averaging 16 per cent sugar also vary greatly. In a field of this kind probably only 20 per cent of the beets test between 16 and 17 per cent, while 40 per cent of them test below or above. The range of the sugar percentage of individual beets from such a field probably will be between 10 and 20 per cent.

A systematic attempt to improve the quality of the beet was made only after an instrument was invented, allowing the determination of sugar in the beet with speed and accuracy—namely, the polariscope. This instrument played the same role in the development of the sugar beet as the Babcock tester and the milk scale in the development of high-producing cows.

Up to 30 years ago, with the limited knowledge of the laws of heredity, a system of mass selection was employed. That is, a large number of beets was tested every year. A small number of the highest testing ones was selected and planted in a separate field, far away from any other beet seed. The seed harvested from these selected beets was then used to produce the stocklings from which later the commercial seed was raised.

Gradually it was found that a high-testing beet does not necessarily produce descendants of high quality. Therefore, it was found necessary to harvest the seed from each high-grade beet separately, and plant the seed from each beet separately in test fields in the following year. By this method it is found that some beets do not transmit their desirable qualities to their descendants, while others do. All the descendants of one beet not averaging up to the standard set are then entirely discarded, regardless of the fact that some individuals among these descendants test very high.

Of course, the most desirable quantity is not alone a high percent of sugar, but a high yield of sugar per acre. In fact, the latter is important enough to sacrifice some quality for it, as long as the maximum of both cannot be obtained at the same time. In other words, a variety yielding 10 tons per acre with 17 per cent sugar and 1.7 tons of sugar per acre is not as profitable to farmer and factory as a variety yielding 12 tons per acre with 16 per cent sugar and 1.92 tons sugar per acre, even if beets are paid for on a flat scale.

All countries where a persistently good farming system prevails show an increase in the yield of sugar per acre and sugar percent over periods of 10 years. It is claimed by some that this is largely due to improved agricultural methods rather than being the result of breeding. Those engaged in breeding claim a large part of the credit. Presumably both deserve some credit.

At any rate, whatever differences exist between different varieties of beet seed, they are much smaller than differences due to growing
PLATE 23
Upper Picture—Seed Stalk of Annual Wild Beets, Surrounded by Beets Grown From Scattered Seed. Lower Picture—Biennial Wild Beet and Annual Wild Beet Going to Seed the First Year
(Photo by Harry B. Shaw)
条件。也就是说，同一种甜菜种子在同一个地区和年份可能会在一些农场上每英亩产19吨，含糖量17%，而在其他农场上每英亩产11吨，含糖量15%。

因此，通过改进耕作方法而非育种可以更实际地提高产量。最好的育种的赫里福德牛不能在不足的饲料下变得肥壮。

甜菜种子作物作为一个整体非常敏感于许多影响，产量波动很大。有些农场每英亩产量高达2,000磅，而有些农场则低至300磅。种子的质量受产量影响不大。来自每英亩产1,000磅的田地的种子往往比来自每英亩产2,000磅的田地的种子更好。

许多问题必须解决才能生产出与工厂甜菜一样容易且可靠种植的甜菜种子。需要相当大的土地来生产甜菜种子，因为不是所有农场都具备水、土壤和肥力等所有要求来生产优质的甜菜种子农场。

必须进行大量的试验才能找到合适的耕作方法并适应现有的机械来种植甜菜种子。组织问题需要解决。一个1,000英亩的农场，需要一个最大设备的人员和工具，与普通的农场是完全不同的。

如果没有自家种植的甜菜种子，行业当然无法种植足以满足正常糖需求的面积。不

Working Against Odds. Covering Silos When Ground is Covered With Snow and Thermometer Registers Below Zero
The Fourth Boulder County Corn Show

W. W. Robbins

OR the fourth time the farmers of Boulder County came together to take stock of the year's corn crop. Agricultural leaders from within and outside the county were in attendance. In fact, the Boulder County Corn Show has become, within four years, one of the chief agricultural events of the year in our state. The show is an indicator of the progress which Colorado, and Boulder County in particular, is making in the growing of corn. Furthermore, it indicates the splendid possibilities which lie before us.

A comparatively few years ago, we were expressing doubt as to the possibility of growing corn here. We soon passed to the stage in which we believed that, although it could be grown in a limited way for ensilage, the maturing of seed was practically out of the question. Finally, we are forced to the conclusion that there are a number of corn varieties which can be grown to maturity with commercial success, and we have come to realize that corn has taken its place as one of the chief field crops of the state.

The skepticism regarding the growing of corn here is reflected in the remarks overheard at the recent Corn Show. For example: "Was that corn grown in Boulder County?" "Jones, did you ship that corn
in from Iowa?" "I didn't know you could grow such corn in Colorado."

Of course, northern Colorado requires a short-season, early-maturing corn. There has been an impression that early-maturing, shallow-kernel corn is low-yielding as compared with a late-maturing deep-kernel corn. It was pointed out by Professor Kezer, the judge of the exhibits, that experiments go to show that there is practically no difference between the two groups in yield of grain per acre.

The leading Boulder County corn is Minnesota No. 13. This is an early-maturing corn. Chiefly through the efforts of County Agricultural Agent H. H. Simpson and the Boulder County Farm Bureau, this superior variety has been pushed to the front. Through careful selection, and the registration of fields, the county is now producing a large supply of first-class Minnesota No. 13 seed corn. In fact, the demands for this seed far exceed the supply.

The incorporation of corn in our cropping system is of two-fold advantage: (1) It gives us another cultivated or cleaning crop. (2) It makes possible more feeding on the farm, looking toward the maintenance of our soil fertility.

The exhibits at the show fell into two groups: Those by the adults, and those by the members of the Boys' Corn Club. It is not only interesting, but significant to know that a boy, Bernard Buster, took sweepstakes for the best ten ears, and also had the champion ear of the show. This same boy captured first premium for the best crate of corn, and first for the best ten ears in the Boys' Club exhibit.

Those who have attended each succeeding Boulder County Corn Show stated that there has been very noticeable improvement in the
Fig. 3.—First premium Yellow Dent corn, grown by Mr. J. E. Manchester.

Fig. 4.—First premium White Dent corn, grown by St. Vrain Dairy Company.
quality of the exhibits. This indicates that better corn is being raised and that growers have a better understanding of what types of ears are desirable for our purposes. It is worthy of note that there was conscious selection of the smooth type of Minnesota No. 13, which is earlier than the rough type, and which is the ideal toward which we should work.

The auction sale of crates of corn brought out a very significant point. The crates represented carefully selected ears from both registered and unregistered fields. All are familiar with the registration plan. The Boulder County Farm Bureau has appointed a seed registration committee. In registering a field the committee must be satisfied that the seed used in planting the field is pure, and the field itself must be located at least 20 rods from any other variety of corn.

At the auction sale, a sharp distinction was made by the bidders between corn from registered and unregistered fields. Crates from registered fields sold for as high as $9.00, whereas, those from unregistered fields sold for $2.50 to $3.00, even though the general appearance of the corn as to type and the germination were much the same. This state of affairs marks progress. It shows that growers realize the value of, and want, good seed, regardless of its cost.

All crates of corn were tested as to germination, and the germination percent attached. In testing, one kernel was taken from each ear. County Agricultural Agent Simpson found it necessary to withhold from sale four crates because of the low germination test. The corn apparently was as good as the average of the lot, but the germination test was only 37 per cent. This fact emphasizes the need of the individual ear test every year in selecting seed corn. Generally speaking, this has been a fair seed year. Most corn is testing high. But, as the above shows, here and there one will find corn which is running low in germination. The only safe plan is to test every ear of seed corn every year. For this purpose use the soil or sawdust flat, or the rag-doll.

There was an entire absence of flint corns at the show. This is evidence of a recognition of the superiority of the dent varieties for our conditions, and also it shows the work of the county agent and Farm Bureau in their efforts to standardize the corn crop in the county. There were more exhibits of the one variety Minnesota No. 13 than all other varieties put together.

Yellow Dent corn, chiefly Minnesota No. 13, is apparently the leading and most desirable corn for a greater portion of the farming area of Boulder County.
Experiments with Different Rations with Dried Molasses Pulp as Basis

D. L. Parker
Scottsbluff, Nebraska

Weather conditions, ranging from 35 degrees below zero to 54 degrees above combined with a Chinook wind, and back to 20 degrees below, all within the short period of 60 hours, have been almost enough to wreck the schedule of our dried molasses pulp cattle feeding experiment. The main difficulty has been in supplying the daily ration of beet tops. Even though the tops were properly piled, the drifted snow and frozen crust have proven to be serious obstacles, this condition while not constant from year to year, is in itself a splendid argument in favor of the siloing of beet tops.

Despite adverse weather conditions and a necessary lessened daily allowance of beet tops both pens of cattle are showing up well, and while perhaps the gains in fat are not so rapid, a consistent gain has been maintained.

The 110 head of 2-year-old grade Herefords are now cleaning up the following:

<table>
<thead>
<tr>
<th>Feed</th>
<th>Daily Dry</th>
<th>Matter</th>
<th>Protein</th>
<th>Carbo-Hyd.</th>
<th>Fats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dried mol. pulp...11.0</td>
<td>10.164</td>
<td>.649</td>
<td>7.480</td>
<td>.066</td>
<td></td>
</tr>
<tr>
<td>Alfalfa</td>
<td>8.0</td>
<td>7.312</td>
<td>.848</td>
<td>3.120</td>
<td>.072</td>
</tr>
<tr>
<td>Beet tops, 50% dry...12.0</td>
<td>6.000</td>
<td>.624</td>
<td>2.592</td>
<td>.072</td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>31.0</td>
<td>23.476</td>
<td>13.192</td>
<td>.210</td>
<td></td>
</tr>
</tbody>
</table>


At the end of the first 60 days period this ration will be modified by an increase in the daily allowance of dried molasses pulp and the addition of cottonseed cake.

The 50 head of so-called 3-year-olds—which are really four and fives—possibly one or two sixes—and all of which show strong New Mexico or Arizona dogie ancestry, are cleaning up the following:
### BALANCED RATION

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dried mol. pulp...........</td>
<td>16.0</td>
<td>14.784</td>
<td>.944</td>
<td>10.880</td>
<td>.096</td>
</tr>
<tr>
<td>Alfalfa....................</td>
<td>6.0</td>
<td>5.484</td>
<td>.636</td>
<td>2.340</td>
<td>.054</td>
</tr>
<tr>
<td>Beet tops, 50% dry..18.0</td>
<td>18.0</td>
<td>9.000</td>
<td>.936</td>
<td>3.888</td>
<td>.108</td>
</tr>
<tr>
<td>Totals ...................</td>
<td>40.0</td>
<td>29.268</td>
<td>2.516</td>
<td>17.108</td>
<td>.258</td>
</tr>
</tbody>
</table>

Nutritive Ratio—1:7.0. Total Digestible Nutrients, 20.204 lbs.

This ration will also be modified in the same manner as that of the 2-year olds at the end of the first 60-day period.

An accurate record is daily tabulated and at the end of the feeding period when sales returns and dressing percentages are available, we believe that the detailed information compiled as to costs per 100 pounds gain for each feed stuff, will be of great value to our growers in planning the feeding of beet tops, alfalfa and dried molasses pulp.

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### Loveland Factory Notes

Our growers were lucky this year in that they had practically all their beets harvested before the bad weather set in. We began receiving beets September 30th and by November 2nd 97 per cent of the crop had been delivered. A week later, November 9th, 99 per cent of the crop had been delivered.

Indications at present are good for plenty of moisture for next year. During November, this year, we had approximately 20 inches of snow or about .90 inches of water. Last year we had .69 inches of water during November. All reports we have, say that there is a great deal of snow in the hills.

While our snows have been welcome from an irrigation point of view, they have hurt the feeding operations some. Those men who depend on beet-top pasture to carry their cattle through the greater part of December were disappointed. Of course those who live close to the factory could haul pulp, but those living out on the railroads have been in pretty bad shape, it being practically impossible for us to ship out pulp during the campaign. We need all our cars for moving the beet crop, besides our steam crane is kept busy handling coal and hasn’t the time to load pulp. A number of feeders who have
to depend on pulp being shipped out have found that their beet-top silage and dried pulp have come in very handy. It is much better to have your tops in a silo than to have them under a foot of snow.

Our dried pulp sales to date have exceeded those of all last year. The dairymen and feeders find this a very valuable and cheap food. We have shipped eight carloads in the vicinity of Johnstown alone.

In spite of the fact that our yield per acre did not come up to our expectations, the farmers seem to think they were fortunate to get as good a crop as they did, and they are making preparations to try it again next year. The cold weather and the snows which we have been having will put the fall plowing in fine shape for spring work.

Our fieldmen are now busy trying to get a line on the beet labor which will be needed for next year. They are also securing the names of families who want to come here from other states. If you have not already made arrangements for your beet labor for next year, we would suggest that you get in touch with your fieldman and give him an idea of your requirements, at as early a date as possible. No doubt we will have to ship in a certain percent of the labor necessary to take care of next year's crop, so the sooner you notify us of your needs the better chance you will have of securing a good family. If you know of any good families in other states who would like to come out here if they could get beet contracts, kindly notify your fieldman.

Now that the farmers have a few idle days they might well spend some of their time in fixing up the living quarters for their beet labor. We find in every case where a farmer has a comfortable house and surroundings for his labor he has very little trouble in getting good labor. A good, neat, warm house well located is certainly appreciated by a good family. Some few farmers have had the notion that all they need for their beet family was a little old tumbled-down shack stuck on a ditch bank on the other side of the farm. If possible provide a cistern for the family near their house. One cannot expect a man to work all day in a beet field and then carry water for domestic purposes a mile or so. It is also advisable to furnish them with a small garden spot if they desire one. If you take an interest in your beet labor they will take more interest in your beet crop.—H. Scilley, Manager.
The Farmer as an Economic Factor

(Address of N. C. Dougherty before Colorado Farmers' Congress)

(Mr. N. C. Dougherty, President of the Farmers' Congress, of Greeley, Colo., championed the farmers' cause and in order to convey the full meaning and to show the broad principles upon which the farmers of Colorado do business, the following address of President Dougherty is published verbatim.

One cannot help but feel a closer relation to and a deeper sympathy for the farmers of our country when he comes to realize the importance of the farmer in our economic life. So much was said at the Congress it simply impels mental indigestion. We listened to talks, statements of facts, quotations of statistics and even a little fiction during the four days at the Congress.

Dairying and rural life seemed to be the leading topics on the program of the Congress. However, sheep growers, cattle raisers, potato farmers, hog breeders, fruit growers and children producers came in for their share of attention. We are glad to note that our state and national government is beginning to take some notice of the human crop. This is, after all, the most important crop. A strong nation in any sense must be a nation founded upon strong homes, where strong children are born and reared; strong physically, mentally and morally. Would that everyone who reads these lines would lend his energies to the proposition that "we are going to be a cleaner, freer, stronger nation," beginning in the home and especially in the home of our American farmer, whence the great men of our nation have come and where many of our city families should return in order to best serve their nation and themselves.—J. F. Jarrell.)

Since we last met the great war is ended and the whole environment of the farmer has been remoulded. Out of it all, there has come to us, farmers, an awakened vision; a broader sympathy with the whole world; a finer patriotism; and above all a quickened sense of responsibility. We find within ourselves a new capacity for large affairs; a deeper spirit of co-operation among ourselves; a greater willingness to bear our own burdens, and to ask no favors; a determination to stand on our own feet; to work with our own hands; and to speak our own minds; a further determination to make our own work more efficient; a determination to use the tractor with its gang plows.

We enter this new world with greater capital, guided by science, than ever possessed before. Farming has taken its place among the
great businesses of the world. It is the biggest industry in the world; notwithstanding the peace conference at Paris and the industrial conference at Washington paid no attention to it. Both of them did recognize the interest of business and trade and the interest of labor, but neither gave any attention to the interests of agriculture. It was due to the fact that we had no spokesman and we shall not have until we are thoroughly organized. All other groups of business men had perfected strong organizations, had learned to work together and knew how to exert their collective strength. But the farmer speaks today as an individual man or as the representative of a small number of people.

You know the politician. You know his instincts. You know what counts with them. When the farmers of the nation shall be organized as the farmers of North Dakota are organized, the politician will place his hands on his ears. Our representatives will speak for 35 millions of people and 60 billions of wealth. Then our voice will be heard. We shall take our seat at the council table of the nation whether it be at Paris or Washington; and we shall sit above the salt, and mighty near the head of the table if not at it, just as America did after the Spanish war in the councils of the Great Powers of the world. The farmer of today speaks his own mind, and he claims the right and demands the recognition of the principle of collective bargaining. He asks that the anti-trust laws be so amended as to permit the co-operative action of all farmers in the disposition or sale of their products. One of the most disgraceful things of the past year, was the arrest and trial of farmers in three states upon the charge of restraining trade in acting for dairymen organizations in establishing a fair price for milk. The denial of just rights by business men has done much to produce the present radical action and agitation. Business, no odds how big it may be, should stand upon the broad principle of bargaining through representatives. By so doing it would do much to lessen the spirit of bolshevism in our midst.

What we ask for ourselves, we ask for all American citizens, whether they be laborers or capitalists. Business organizations have their representatives who speak for the organization. It is most unjust for such organizations to require laborers to deal with them separately or individually. The farmer stands for the right to organize in order to promote justice and the common welfare, and we ask that the right of collective bargaining be conceded to all organizations.

To the average farmer, the principle of the closed shop seems inconsistent with our demand for freedom of action and collective bargaining. It seems undemocratic in principle, autocratic in practice,
and economically unsound. We think the object aimed at could be secured in some more democratic way.

The farmers who sat around the table in the Mayflower the night before they landed at Plymouth in 1620, and declared the right of the people to make their own laws, bound themselves then and there to obey the laws so made. And from that time to the present the American farmer has stood for the supremacy of the law. They constitute today the largest consuming class in the nation. The men who constitute this Congress are representative Colorado men. They stand for an honest day's pay, for an honest day's work, and with them ten hours constitutes an honest day. They want the just rights of the laborer and capitalist conceded and safeguarded by the laws of this commonwealth. And they demand that both laborer and capitalist obey the laws so made.

Competition was the dynamic word of the 19th century, but combination, co-operation is to be the immutable law of the 20th century. Our prosperity is bound up in the prosperity of every single market of the world. We want entrance to every market in the world, and the more prosperous that market is, the better for us. Economic ruin in central Europe will be of no advantage to the American farmer. Prosperity anywhere promotes prosperity everywhere. We farmers want a co-operative creative peace, which shall stimulate all human activity and raise human welfare to a higher plane than it has ever reached before. We want more selling power, and hence we want the markets at which we sell to have more buying power. We want to see all countries recover from the effects of war in order that we ourselves may the sooner recover.

The farmer is no longer a dollar-a-day man. He wants the awards that his business affords. Hereafter he does not propose to give all the profits to middle men. He wants to make the division 75-25, but he wants to have the 75. The other fellow has had it for the last half century and the farmer thinks it time to change places in the division. The farmer realizes that this air was just as pure, the sun was just as warm and attractive, the soil was just as rich, when the Indian roamed over these prairies and valleys, as it is today; but the wealth of today was absent. Undeveloped resources are not wealth. We realize that the potentialities of Colorado can be realized only by the co-operation of labor, capital and brains; and the last of this trio is the most important factor of the problem. We know that we need a technical knowledge of a high order; we must have greater skill in co-operation with others; we must have a better knowledge of marketing on a large scale; we must have better business management—such a management as is shown in the California Fruit Growers’ organization; and the program of this Congress has been arranged to show our need of each of these qualities.
What are the most pressing needs to further develop and strengthen this business of farming?

First—A keener conviction than ever before, that each individual farmer study his farm as closely and manage it as carefully as is done by the best and most successful business anywhere. He must know that his success will depend upon his ability to increase the productivity of his farm; that only as he produces can he prosper; that if he fails to produce richly he will be impoverished. He must know the hidden forces of nature and be able to turn them into the service of the world and particularly the service of himself.

Second—He must develop a new and alert interest in the community ideas, as applied to rural affairs. He must realize that progress in agriculture can be advanced if all the farmers of a given locality will work together. He must know that in the new world, competition has given place to co-operation, co-operation in the improvement of their farms, in buying and selling supplies, and in selling their product. Co-operation is the best development of civic life.

Third—The farmer must not be satisfied until the rural schools of this state are the best to be had in the state. The time to mould a person's viewpoint, is when he is young, and this the rural school must do. Aside from the three R's, the rural school has a most vital function to perform, and one that is too often neglected—that of winning an appreciation of the farm and growing things in the minds of the farm children. The children of the farm need to see the propaganda for city immigration in its proper light. The city schools do not have this problem. Their children are already surrounded with an atmosphere which does not have to be changed. But in the country the responsibility of making the children see that the farm is the greatest place on earth; and that it holds benefits and advantages that no city home can have, rests directly upon the teachers of our rural schools. This calls for a broad vision, for a sympathy for growing and natural things.

That there is nothing better to do anywhere, than the growing of great crops for the race, and great herds of good cattle; nothing better than the wide, sweet fields, the warm, stirring earth, the slow-moving plow team, the sound of the robin and bluebirds and blackbirds ringing over the sunny fields—nothing better than the living earth with its shining sky, flowers, bud voices, colors and odors, rests directly upon the teacher of the rural school. This of course calls for a broad vision and a sympathy for growing and natural things for an appreciation of rural charms and a firm belief in the righteousness of farming as a life work. The farmers of this state must see to it that such teachers are to be had and that this college furnishes
them. Upon Dr. Lory and the school committee in the various districts the responsibility must rest. There must be a well-trodden path from the door of each rural school to Fort Collins Agricultural College and to the University of Boulder. We have learned in the war just closed that men cannot fight without ammunition—ammunition well made and in great abundance. One of the great factories of ammunition for all the battles of Colorado, and particularly for the farmers, is the one in which we are meeting today, manned by President Lory, and his associates. It should be, and is to this commonwealth, a pillar of cloud by day and of fire by night, to guide us not only to material prosperity, but also to all that is best and truest in life. To that end it is our duty to see that it is furnished with the best material and an ample supply. Dr. Lory must see to it that the product returned to us is a product moulded on the best patterns—tempered to the highest point of perfection—not the quantity, but the quality is of supreme importance, and that material is to be in the main our boys and girls. We want the windows of their mind and of the soul also, opened and kept open to the light and the air; we want them to take with them as they leave these halls and go into the dust and the tumult, the ambition and cares, the homely joys and sorrows, all of which will make up the texture of their days and years, an inextinguishable sense of the things which are unseen, the things which give dignity to service, inspiration to work, purpose to suffering, values that are immeasurable and eternal wherever their lives may be spent, whether on the farm or in the accounting room, or in the office; and we look to President Lory and his faculty to see that it is done.

The great problem before not only the farmer, but the whole American people today, is that of setting our house in order; the problem of subordinating every personal ambition, every race attachment, so that the hyphen may disappear from our people, to the dominant idea of an America, free, just, powerful, forward-facing that shall stand out in history of nations as the name of a people whose mission and true greatness lies in service to mankind. What poets and philosophers have dreamed that we are trying to do. Our stumbling are many; but if we keep our hearts clean and our heads clear, he who in a thousand years from now writes the history of liberty and justice will be able to tell the far-off generation, a proud story of the American nation of the 20th century. Let us build this nation fit to serve. Let us make a nation that does not find its end in its own aggrandizement, however great that may be. Let us be a nation that carries a lesson to mankind of what America found possible to do for humanity on this continent.
The Buildings on the Farm

E. H. Huelskemper

CONVENIENCE and economy in the buildings on a farm can be obtained only by proper planning, and to plan properly the first necessity is an outline of the entire farm, showing the present location of buildings, fields, roads, ditches, reservoirs, etc.

Generally it is the house which determines the location of the farmstead. However, special types of farming sometimes make the location of the house dependent upon the best location of barns, water supply, natural shelter, etc. Healthfulness and sanitation must not be overlooked in locating the house. The size of the farm house depends upon the size of the family, the size of the farm and the pocketbook. In this country it should be, and usually is, the outstanding building on the farm. A plain and substantially built house in which convenience, comfort and beauty have not been overlooked in the building makes the most desirable farm house and is the cheapest in the end. Inside conveniences, especially those which make the work of the farmer's wife easier, need not be lacking any more in a farm house than they are in a city home. Running water, electric lights and furnace heat can at the present time be had at but little higher cost than things cost in the city.

One feature often overlooked in the building of the house on a farm is the arrangement which makes it unnecessary for the hired help to pass through the kitchen or the living rooms used by the
family when coming into the house. Where a separate house is provided for the hired help this, of course, need not be taken into consideration. Suitable and convenient living quarters for the hired help go a long way in solving the help question on the farm. Another feature often missing in farm houses is a convenient place in which to put heavy and dirty work clothes, overshoes, boots, raincoats and the like without bringing them into the kitchen. A farm office in the house adds prestige to the farm and makes it easier to carry on the farm business.

The kind and size of the barn which very often is used as a gauge by which the fertility of the farm and the prosperity of the farmer is judged, depends a great deal upon the size of the farm and the kind of farming that is carried on. Sanitation is the greatest factor in determining its location with reference to the house. It should be in plain view of the house and in a direction opposite from that of the prevailing winds in summer. For convenience and appearance the barn should be farther from the road than the house; never on the opposite side of the road and always easily accessible from the fields and permanent pasture. The horse barn should be grouped with the machine shed and workshop nearest to the house, while the cattle shed, hog house, corn crib and silo may be grouped together a little farther away in the most convenient manner possible.

Neat fences, well-kept driveways and lawn, permanent walks, trees and shrubs add to the pleasure and enjoyment of life on the farm. To the farmer these things may not seem to be of much value, but his wife and family generally appreciate them. If the farm is ever to be put up for sale these outside attractive features will help greatly in getting a better price than it would be possible to get for the same farm if the surroundings of the house were not so attractive. If in building or locating new buildings the ideas that permanence and attractiveness to possible future buyers are always kept in mind relative small sums invested in apparent non-essentials serving only for ornament and appearance will bring good returns.

On rented farms good, substantial, well-arranged buildings attract the most desirable tenants. On farms operated by the owner himself good buildings and conveniences make the hired help problem an easier one than it is at present on most farms.

Where married farm help is kept either for part of the year or all year, a good, plain, neat and comfortable house for their own use will pay big dividends in satisfied, desirable and permanent help. On beet growing farms the question of housing help has very often received too little or no attention, and the result is generally shown by poor work, dissatisfied beet help, much moving and changing of such help. Such moving often comes at times when something much more profitable could be done by both the farmer and laborers. If
the farmer himself does not realize the value of good housing facilities for beet help his fieldman does, and if the fieldman were allowed to tell his story it would always be that the farmer with a good beet "shack" is much more certain of good help than the other fellow whose house for beet help is in worse condition than the farm cow shed for living quarters.

General Care of the Farm

M. B. Wilson

DIFFERENT people have different ways of looking at this subject, as it can be viewed and discussed from a great many points.

In dealing with the above subject, I will divide it into the following parts and discuss each part individually. They are—first, soil; second, irrigation; third, livestock; fourth, housing accommodations; fifth, tools and implements; sixth, accounting. Regardless of the order in which they are numbered, all have a like importance and one depends upon the other in the operation and maintenance of a farm.

We have come to the time when our soil must have careful attention in order to obtain the best results. A number of years ago no interest was taken in the soil except when putting in the crop and harvesting it, but after continuing in this manner it was found that although the seed was planted there was nothing returned, so something had to be done. Fertilizers were introduced and a series of crop rotations took the place of the old custom of planting regardless of the returns.

Irrigation has to be reckoned with in all semi-arid regions where the rainfall is not sufficient to produce the crop. There are no two farmers who irrigate alike—each individual has a certain way of his own.

Then the soil itself has a great deal to do with the way irrigating is done—some soils will wash easily, others not so much. It is a good idea to have ditches running on grade whenever possible; if not, straw or other material should be used to keep from cutting away valuable soil. At all junctions in ditches boxes can be used to a great advantage, these being installed very cheaply when made out of refuse lumber picked up around the farm. No steady stream of water can be maintained in two ditches unless there is some kind of a dividing box.

All laterals should be cleaned out before water is turned in, then no trouble will be experienced during the growing season. When this
is not done a great deal of valuable time is taken and the crop must consequently suffer.

Flat land must be considered carefully in irrigation or a sour soil will be the result, and on this nothing will grow.

Livestock constitutes an important part of the farm, and they require excellent care. The horse is steadily being replaced by the tractor, but some time will elapse before he leaves the farm entirely. In preparing the ground, planting and harvesting the crop, the horse does the major part of the work, and he must be fed, watered and cleansed regularly in order to obtain his maximum efficiency. Barms should be built, windproof and waterproof, this being done to insure good health.

Like results can be obtained by the same care of cows, hogs, chickens and all other livestock on the farm.

Housing accommodations are a big item—one which needs a great deal of care. The farmer himself usually has a very good house and employees should be given good quarters also. Take the beet industry for example—in this particular crop houses are necessary for the beet help, and they should be built to withstand all weather conditions, as they will be occupied early in the spring and late in the fall.

All new buildings should be painted, and even if only one coat is applied the weathering agents will not destroy as rapidly as they would had no paint been put on. Painting can be done a great deal cheaper than a new building can be built.

Tools and implements should have the best of care also, and when not in use should be properly housed. The depreciation of farm machinery through carelessness in not housing is much greater than through the actual wear of the farm work. Before housing a little time can be profitably given to the tightening of loose screws and nuts, and broken parts replaced by new ones. At least every two years the woodwork should be repainted—this to prevent warping, and all other parts should be well oiled and greased.

The care of implements has become a fixed habit, especially in the more thickly farmed districts, and the small farmer pays more attention to it than the larger one. A house or shed for small tools, etc., is a big asset, and the time lost in locating such around the farm is well repaid by such an investment.

Accounting is a matter which every farmer must deal with, and the farm is not properly taken care of until this is a known factor with him. The old way of paying out and taking in and making a guess at the amounts has been done away with and a new system of bookkeeping has taken its place; and the farmer, besides being a producer, becomes a business man.

In conclusion will say “The General Care of the Farm” includes many more points than those mentioned, but the above, I believe, are the important ones.