OKLAHOMA

AGRICULTURAL EXPERIMENT STATION.

Bulletin No. 21, September, 1896.

Experiments in Corn Culture--1896

Road Making and Repairing.

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STILLWATER, OKLAHOMA.

OKLAHOMA

AGRICULTURAL AND MECHANICAL COLLEGE

AND

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EXPERIMENTS IN CORN CULTURE.--1896.

G. E. MORROW, Director and Agriculturist.
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SUMMARY.

These experiments were conducted on the upland prairie soil of the station farm, of average fertility of its class. The early part of the corn growing season was fairly favorable both as to temperature and rainfall, except that the latter was excessive during latter part of June and part of July.

Thirty-seven differently named varieties were planted. Some of these were much alike and the correctness of some of the names is doubtful. In general the best yields were from medium sized varieties which had been grown in the vicinity or in Southern Kansas for some years. No small eared or very early ripening variety gave a good yield.

Planted April 4 to 6, these varieties showed the first tassels from May 30 to June 23, and were well glazed at dates between July 4 and 28. Neither ears nor stalks were large. In few cases did an average ear weigh more than one-half or six-tenths of a pound. Most of the stalks were less than eight and few over ten feet high.

Plats were planted at weekly intervals from March 21 to May 2. The largest yield was from a plat planted March 28 the next from planting April 18; the third from planting April 25. These plats were drilled with an ordinary two-horse planter. Of the plats listed the largest yields were from those planted April 18 and 11; the smallest from planting March 28.

Of six pairs of plats only one drilled plat gave less yield than corresponding listed plat. The average yield of the six drilled plats was 14 per cent. greater than that of the listed plats.

Commencing March 28 two plats were drilled each week for four weeks; one as shallow and the other as deep as the planter could conveniently be run. Of the first week's planting the shallow gave the best stand; the deeper gave best results in each of the later plantings.

Thirty-six plats were planted at different degrees of thickness—24 with a medium and 12 with a small eared, early variety. With each kind the largest yields of both grain and

stover (stalks and leaves after the ears have been removed) were obtained from thicker planting than is commonly practiced. The rows were three feet apart. With the larger variety the largest yield of corn from any one plat was from planting three kernels each 24 inches in the row; the second from planting one kernel each 9 inches; the third from planting two kernels each 12 inches. The largest yields of stover were from planting three kernels each 24 inches, with almost equal yield where one kernel was planted each six inches. With the smaller variety the largest yield of corn was from two kernels each nine inches; the next from two each 12 inches; the third from one each three inches. These three plats gave largest yields of stover in same order. The size of both ears and stalks decreased as the thickness of planting increased.

In each one of four plats given shallow cultivation, the yield was larger than that of any one of three plats given deep cultivation. The average yield of the four was 18 per cent. greater than that of the three. The largest yield was from a plat given shallow cultivation and having the soil leveled after the cultivator. A plat receiving no cultivation after planting except to scrape the surface with a hoe to prevent the growth of weeds, gave a larger yield than either of the three with deep cultivation.

Cultivation of plats three times a week gave slightly larger yields than did weekly cultivation, but the increase was not equal to the increased cost. In each case the plats were first harrowed and then cultivated during six weeks.

When well dried, 68 pounds of ear corn could be relied on to give 56 pounds of shelled corn, of any of the better varieties. In some cases 66 pounds of ears gave 56 of shelled corn.

LARGER FIELD EXPERIMENTS WITH CORN IN 1896.

The following experiments with corn were made in 1896 at the Oklahoma Experiment Station:

Test of varieties; time and method of planting; thickness of planting; depth of planting; method of culture; rate of growth of stalks; percentage of moisture.

The station farm lies a few miles north of 36 deg. north latitude, and a little west of 97 deg. west longitude, at an elevation of from about 900 to 925 feet. It is of upland prairie soil of fair average fertility of its class. The soil particles are finely divided. The supply of decayed vegetable matter is rather small. It has been in cultivation for five or six years.

The land on which most of the experiments were tried has had little or no manure. That used in the methods of cultivation test had received stable manure in the early spring of 1896. All the land was deep plowed.

The following table gives the rainfall and temperature for the corn growing season:

MONTHS--1896.	TEMPERATURE.			RAINFALL.
	Max.	Min.	Mean.	Inches.
March	85	19	46	1.21
April	91	14	66	.94
May	93	25	74	5.93
June	100	49	75	7.26
July	99	59	80	5.85
August	106	53	83	1.64

Results of experiments for one year cannot be safely taken as a guide unless they are in accord with experiments of like kind elsewhere. In comparing varieties or methods of culture, small differences in yield cannot certainly be known to have been caused by the difference in variety or method. Two stalks in the same hill may differ in size and vigor; two plats treated as nearly alike as is possible may show considerable differences in yield.

The word stover is used to describe the leaves and stalks after the ears have been removed.

As a matter of convenience most of the plats were harvested unusually early. Both ears and stalks had larger per cent. of moisture than if the harvesting had been done at a later time. Where yields are reported in bushels, these represent corn with 11 per cent. of moisture. Corn, when well dried in crib, usually has from 10 to 11 per cent. of moisture. The weight of the stover was taken after it had become well dried in the shock. Fractions of bushels are omitted.

TEST OF VARIETIES.

There are many hundreds of varieties of corn, or hundreds of names are given to supposed different varieties. Many of these are much alike; so much so that samples from different places may differ more than samples under different names. Frequently different varieties may have the same name in different localities.

Thirty-seven differently named varieties were planted on forty-nine plats. Nearly all of these were of the Dent class.

In some cases the correctness of the name under which the corn was received is to be doubted.

In no case was the yield large. In a number of cases it was surprisingly small and the differences in adjacent plats hard to be accounted for. The extreme heat of the early part of August, with hot winds, reduced the yields of some varieties. Why the effect should have been, apparently, much greater on some varieties than others of like appearance, and which give nearly equal yields in other places, is not known. Several varieties gave yields of from 30 to 37 bushels of well dried corn per acre. On land which had been manured, several plats yielded from 40 to 50 bushels per acre.

All the plats in this test were planted between April 3 and 6. Two varieties received from the Minnesota Station, at Minneapolis, showed first tassels May 26 and were well glazed July 4. Neither of these varieties produced more than three or four bushels of corn per acre. No one of the earliest maturing varieties gave a yield of twenty bushels per acre. The latest maturing variety also gave a small yield. Most of the varieties showed first tassel between June 8 and 15, and well glazed between July 14 and 24. These dates show the inappropriateness of such names as "90 Day Corn" if it is meant that any ordinary variety of field corn will become well matured in ninety days from planting, if this is done at the usual time in the spring. Late planted corn will mature, usually, in a less number of days than that earlier planted.

Three varieties of white corn and one of red color which have been grown on farms in the vicinity of the station for five or six years and each of which was brought to the Territory from Kansas, gave among the largest and best yields. A fifth variety, the Thomas, obtained from Hon. J. C. Robison, Butler County, Kansas, gave about the same yield. This variety was sent to Mr. Robison from the University of Illinois perhaps eighteen years ago and is very largely grown by him. He thinks it has much improved for his locality since he has grown it, believing it withstands drouth and hot winds better now than when first introduced. With the exception of this, no variety the seed of which was obtained directly from either Kansas or Texas gave as large yields by several bushels as did the varieties referred to as having been grown in the vicinity for some years. One of the best yielding varieties was grown on the station farm last year under the name Wisconsin White Dent, but it is believed this name is incorrect.

While there were some striking differences in the yields of plats planted with seed having the same name, and while there are contradictory results from plats planted with seed claimed to be of the same variety which had been obtained from Texas, the station crop of 1895, and from Kansas, the general results strongly indicate that it will be safer to select seed from the best varieties grown in the vicinity in which the corn is to be planted, rather than to obtain seed from any considerable distance to the north or south, however well the imported corn may have done in the region from which it is brought. Plants, like animals, seek to adapt themselves to the climate and other conditions in which they are grown and it may be predicted confidently that a variety of corn brought from a section with a climate much different from that in Oklahoma will improve in its adaptation to its new home as the years go by.

The yields of twenty varieties are given in the accompanying table. Those of plats giving less than twenty bushels of well dried corn per acre are omitted. The names Adams and Means attached to some varieties are those of good farmers near the Station from whom the seed was received. Each had brought the variety from Kansas soon after the opening of the Territory:

Test of Varieties Corn, 1896.

NAME.	Color.	Source of Seed.	Glazed	Bu. per acre
Adams' White	White	Stillwater	July 18	37
Thomas	Yellow	So. Kansas	July 18	36
White Dent	White	Stillwater	July 18	35
Means' Red	Red	Stillwater	July 22	35
Means' White	White	Stillwater	July 18	34
Wisconsin White Dent	White	Station, '95	July 25	34
Jumbo	Yellow	Station, '95	July 25	31
Leaming	Yellow	Texas Station	July 14	30
Riley's Favorite	Yellow	Station, '95	July 18	28
Golden Beauty	Yellow	Station, '95	July 18	28
"90 Day Corn"	Yellow	Station, '95	July 14	28
Leaming	Yellow	Station, '95	July 17	26
Ea. Giant White Dent	White	Station, '95	July 18	26
White Kansas King	White	Kansas	July 18	24
Mammoth White Dent	White	Station, '95	July 18	23
North Texas White	White	Texas	July 22	23
Early Mastodon	Mixed	Kansas	July 15	23
"90 Day Corn"	Yellow	Station, '95	July 14	22
Mexican or Red Foliage	White	Texas	July 27	21
Champion White Pearl	White	Kansas	July 17	20
Riley's Favorite	Yellow	Kansas	July 15	20
Early Mastodon	Mixed	Station, '95	July 14	20

TIME AND METHOD OF PLANTING.

To compare the results from drilling corn with a lister and with the ordinary two-horse corn planter, adjacent plats were drilled, one by each method at weekly intervals from March 21

to April 25. But one listed plat gave a larger yield than did the adjacent plat. In two other cases the yield was nearly the same, but the average yield of the plats drilled with the corn planter was 14 per cent. larger than that of the listed plats. A plat planted May 2 gave slightly smaller yield than any other where planter was used, except the first planted.

To compare effects of deep and shallow planting, adjacent plats were drilled at weekly intervals from March 28 to April 18. In each case the planter was set to run as shallow for one plat and as deep for the other as was conveniently practicable. The deep planted plats gave an average yield of five bushels more per acre than did the shallow planted ones. A larger percentage of the shallow planted kernels grew from the first planting, while in each case thereafter the deeper planted kernels germinated better. Probable explanations are that the soil was too cool for best results from deep planting at the early date, while, later, the soil near the surface had not sufficient moisture. The yields in this experiment were larger than in other tests, the explanation being that the land was in somewhat better condition and had received stable manure.

Time and Method of Planting.

DATE.	METHOD.	YIELD PER ACRE.	
		Corn bu.	Stover lb.
March 21	Lister	23	1811
March 21	Planter	27	3600
March 28	Lister	21	1756
March 28	Planter	38	3256
April 4	Lister	30	2885
April 4	Planter	31	2737
April 11	Lister	32	2708
April 11	Planter	26	2440
April 18	Lister	35	2343
April 18	Planter	36	2995
April 25	Lister	27	2743
April 25	Planter	34	3235
March 28	Deep	46	3211
March 28	Shallow	47	3073
April 4	Deep	42	2908
*April 4	Shallow	—	—
April 11	Deep	44	2945
April 11	Shallow	29	2848
April 18	Deep	49	3307
April 18	Shallow	43	3633

*Crop accidentally injured.

THICKNESS OF PLANTING.

To test the effects of planting at different thicknesses thirty-six plats were used. The rows were three feet apart in each case. The corn was thinned so as to leave as nearly as

possible at the rate of one stalk for each three to twenty-two inches in the row. Some plats had one kernel at each space; others two and still others three kernels at different distances. In these trials the corn and fodder were weighed while still containing much water, so that the yields are not to be compared with those in the other experiments. The results were contradictory in a number of cases, but in general they indicate that larger yields of both grain and stover is secured by planting considerably thicker than is commonly practiced. This is in accord with the results of many experiments at other stations. With increased thickness of planting the size of both ears and stalks diminishes. For convenience in husking and for appearance of the corn when offered for sale as well as for lessening the cost of cutting the stalks, it is better to secure large ears with fewer and larger stalks. If the corn is to be fed unhusked or unshelled the smaller ears may be an advantage in cattle feeding, while the smaller stalks are more palatable than the larger ones.

In these trials the largest yield of corn was from a plat planted with three stalks each twenty-four inches; the second from planting two kernels each thirty inches; the third from planting one kernel each nine inches. But taking the average of all the plats planted at like rate, the largest yield of corn was from planting at rate of one kernel each nine inches, while largest yield of stover was from planting at rate of one stalk each six inches. The average yields are given in table.

In case of a small, early maturing variety, five plats planted at rate of one kernel to each six to nine inches, gave considerably larger yields of corn and very slightly larger yields of stover than three plats planted at rate of one kernel to each ten or twelve inches.

Thickness of Planting—Rows Three Feet Apart.

One Stalk Each.	Yield per Acre.	
	Corn bu.	Stover lb.
3 in	3865	13068
6 in	5076	13205
9 in	5239	11410
12 in	4775	7880
15 in	4954	6880
18 in	4491	8248
22 in	3344	7084

METHODS OF CULTIVATION.

To test the effects of different depths and frequency of

cultivation nine plats were used. The corn was planted April 8. All the plats were harrowed April 21. Plat No. 1 received no after cultivation except to scrape the surface with a hoe to prevent the growth of grass and weeds. Plats Nos. 2 to 5 were cultivated with a spring tooth cultivator, it being run as shallow as practicable for plats 2 and 3 and deep for plats 4 and 5. Plat 6 was cultivated with a disc cultivator not cutting deep; plat 7 with two shovel cultivator run deep; plat 8 with a cultivator with five small shovels, followed by a block of wood smoothing the surface; plat 9 with the spring tooth cultivator, run deep for first two workings and shallow for four later ones. All the plats were cultivated six times, in addition to the harrowing, at weekly intervals, except plats 3 and 5, which were cultivated sixteen times, or three times a week, the last cultivations being on June 4 and 6. These last cultivations are believed to have done harm rather than good. In all cases more cultivation was done than is advisable in general practice. The different depths cannot be positively stated. Plat No. 7 had deeper than any other.

In each case the shallow cultivated plats gave larger yields than those cultivated deep, and even the plat which only had the surface scraped with a hoe gave a larger yield than either of the deep cultivated plats. The largest yield was from moderately shallow cultivation with the surface smoothed with a drag following the cultivator. Deep cultivation twice followed by shallow working did not, apparently, reduce the yield. The yield of stover was also larger where the cultivation was shallow.

These results agree with those obtained at a number of other Experiment Stations, and it is believed may safely be accepted as showing that deep cultivation of corn, especially after it has made a fair growth, is almost always undesirable. Root pruning of corn is, at the best, a necessary evil. In our fairly dry climate the roots are usually not as near the surface as in regions where the soil has more moisture.

It is believed that few things would do more to increase the average yield of corn in Oklahoma than the substitution of good shallow working cultivators for the large shovel cultivators so commonly used.

The very frequent cultivation gave almost same yields as the less frequent. Much corn does not receive enough cultivation, but many experiments seem to prove that, if the culti-

vation is frequent enough to prevent the growth of weeds or grass and keep the surface loose, additional work will little increase the yield; very rarely enough to pay the cost of the extra labor.

Method and Frequency of Cultivation.

Implement.	No. Cultivations.	Depth.	Yield per acre.	
			Corn bu.	Stover lb.
Hoe		Scraped	42	2904
Spring tooth	6	Shallow	41	3440
Spring tooth	16	Shallow	42	3539
Spring tooth	6	Deep	37	2835
Spring tooth	16	Deep	37	2853
Disc cultivator	6	Shallow	44	3147
Double shovel	6	Deep	37	2816
Five shovel	6	Shallow	50	3390
Double shovel / Spring tooth	2 / 4	Deep / Shallow	44	3225

YIELDS OF STOVER.

In the tests where the corn was planted in rows of ordinary width, 3 feet, 8 inches, and at ordinary rate as to thickness, the average yield of well filled dried stover was something over 3000 pounds, or one and one-half tons per acre. In cases where the corn was planted in rows three feet apart and thickly in the row, the largest yield of corn and stover was a little over nine tons per acre, the stover in this case weighing nearly seven tons. These weights were taken August 7th, at which time the corn was well glazed, probably as mature as is most of the corn when put in silos. In one trial of such thick planted corn it was found there was 45 per cent. of the total weight of ear corn and 55 per cent. of the stover after the crop had fairly well dried in the shock.

RATE OF GROWTH OF STALKS.

A large number of observations were made as to rate of growth of the stalks on plats planted with the "Adams' White" variety, the plats having been planted from April 6 to April 8. The most rapid growth was made between May 20 to June 8. Single stalks made a growth of a little over four inches in one day, but in no case did the average growth of ten stalks examined quite reach four inches. The greatest growth in any one week was something over fifteen inches. For three weeks, from May 20 to June 10, the average growth of a large number of stalks was about two inches per day. The greatest average height of the stalks varied from about seven and one-half to eight and one-half feet. This was found at the measurement on July 20.

PERCENTAGE OF MOISTURE IN SHELLED CORN.

The percentage of moisture in corn when harvested varies greatly, depending on the time and the condition of the weather, and also on the variety. The percentage in the corn after it has become well dried in shock or crib should not vary greatly. In most cases from 10 to 12 per cent. of moisture will be found in the shelled corn.

In the variety test, the planting was done April 3 to 6. The corn was not cut but was husked from the standing stalks September 1, and the percentage of moisture in samples of the shelled corn was at once determined. The smallest percentage found was a little less than 19, in an early ripening variety, giving very small yield; the largest nearly 32, in a late variety from Texas. The average percentage in corn from forty-six plats was nearly 23. In most cases the variation was not great; the moisture in samples from twenty-six plats ranged from 20 to 23 per cent.

Samples from the ten plats used in tests of methods of cultivation, where the stalks had been cut August 1, and the corn was shelled September 12, showed an average percentage of moisture of about 12½ per cent. the extremes being 9 and 14 per cent.

Samples from twenty-three plats used in other experiments, where the stalks were cut at different dates from August 4 to August 13, and the corn husked from September 19 to 26, showed an average of 13½ per cent. of moisture, there being less than 4 per cent. variation between any two plats.

Samples of corn which had been cribbed more than a year showed nearly 12 per cent. of moisture.

From sixty-six to sixty-eight pounds of ear corn fairly dry gave fifty-six pounds, or one bushel of shelled corn.

ROAD MAKING AND REPAIRING.

G. E. MORROW, Director

The construction and maintenance of the public roads of any community require the expenditure of much time and money. To secure the best results at least cost requires sound judgment and skill on the part of those in authority. The difficulties are much increased in the case of a territory of large extent rapidly settled, as has been the case of Oklahoma. It would be unreasonable to expect in such a region as good roads as can be found in many older settled and more wealthy regions. In old settled countries the condition of the roads is often a fair test of the civilization and prosperity of the people.

All classes of residents are benefitted by good roads, but no class needs them more and is more helped by them than are the farmers. They use the roads more than any other class. The main cost of construction and repair is borne by them. Each farmer should be interested in having the best attainable roads in his community. The better the roads, the greater is his comfort and convenience in using them; the larger the loads he can draw; the less the injury to vehicles and the fatigue of his teams and animals, and the more valuable his property. In so far as there is any truth in the charge that no where else is there so much of carelessness and idleness to be found as in road working, it is an evidence of a lack of shrewd selfishness on the part of those who are called on to do the work.

The laws of Oklahoma provide that "all section lines in this Territory shall be and are declared to be public highways. The said roads or highways shall be 66 feet wide * * * " Another section gives those who lay out roads authority to fix the width within the limits of sixty or eighty feet, with further provision that "outlet roads" for individual farmers are not to be more than twenty-five feet wide. Forest or shade trees may be planted at the road sides but not nearer to the center than twenty-five feet. The proper officers may vacate or alter roads for sufficient cause.

If roads were laid out all over the Territory as permitted by law, the quantity of land required would be over 1,000 square miles, or one-fortieth of the whole area. The owner of a square mile of land with a road around it, four rods wide gives to the

public practically sixteen acres. While lands are low priced this is not felt to be much of a burden, but when farm lands become worth $50 to $100 per acre, as they are in many of our states, the loss of so much land from cultivation becomes a serious matter—the more serious because there is no need that so much land should be given up to roads. For very many country roads sixty-feet is needlessly wide. The writer firmly believes that roads of forty feet or of three rods at most are abundantly wide for ordinary use. Abundant evidence of the correctness of this position is to be found in European countries. A comparatively narrow road bed can be kept in good repair more cheaply than a needlessly wide one. Where the roads are wide, the sides often become a harbor for weeds, a nuisance to the farmers and to the passer by. A road bed of sixteen to twenty feet in width, if kept in good condition, is sufficiently wide for most country roads. Where the road bed must be raised because of a wet foundation or where it is necessary to fill in at the bottom or grade down the top of a hill, the lack of necessity for a wide road bed is recognized in practice.

The wide streets of eighty or 100 feet which have been laid out in many cities and villages in the Territory, may be made an attractive feature, but the plan of keeping the whole street in condition for the use of vehicles is unnecessary, involves needless labor and causes a great increase in the annoyance from dust and mud. It is every way better to assign a reasonable space in the center for the street traffic and to "park" the street sides. Green grass with trees set a little distance from the sidewalks are more attractive than is a dusty or muddy wide street. When the time comes for paving the streets there will be a large saving of cost if only a reasonable width is paved. In many of the smaller cities of more eastern states a good deal of work formerly done on the streets has been undone in the way of filling the ditches and preparing the street sides for grass or shrubbery.

Because they lead to cities or towns, to railroad stations or other market points, or because they have fewer "bad places," some roads are much more used than are others. While care should be taken that injustice is not done to any individual, the greatest good to the greatest number should always be considered. If it is impossible to have all the roads in a community put in good condition, it is everyway better that those most used should receive chief attention. In a good many cases the

use of "outlet roads" or cross roads will make it unnecessary to have a road on each section line. It is better to have the roads on which the great mass of the long distance travel is done kept in good condition than to distribute an insufficient amount of work over all the roads of a district.

In like manner it is generally better to do thoroughly the making or repairing of the worst part of a road, so this part can be left for years with little attention, than to yearly do just enough work to make it passable.

Roads have been compared with a chain. As the strength of a chain is measured by its weakest link, so the load that can be drawn over a long road may be determined by the steepness of one short hill, or the difficulty in crossing a swamp or mudhole.

The rolling prairie lands characteristic of much of Oklahoma have some advantages for road making, and this is true, in less degree of the rolling timbered lands. Often very little work was necessary at the first, over the greater part of the distance. The roads are seldom muddy for any considerable time. On the other hand, the occasional steep hills or hollows; the deep and steep banks of streams and the nearly perpendicular sides of many "draws" are serious disadvantages, as is the difficulty in securing ready drainage from some low place or on some bottom lands with a very compact subsoil.

Our finely divided soil is readily blown away as dust and our hard rains cause the washing out of ruts to a serious extent on sloping land. On some hill sides the case is made the worse by the exposure of ledges of rock. Many roads which were in good condition when opened have already become badly "gullied" not in one track alone but over the full width of the road.

These conditions make the old saying that "a stitch in time saves nine," especially applicable to the repair of Oklahoma roads. It is convenient to have all the road work done at one time each year. There are practical difficulties in having work always done when it is first needed. But there are many cases in which an hour's work by a man with a spade in opening the side ditches or in checking the tendency to wash in the road ruts, would save the expenditure of much labor of men and teams months later in filling the ditches washed out in the middle of the road. There are hundreds of miles of roads in the Territory already so badly washed that only large expenditures of work can put them in good condition. The writer has recently

seen several cases in which lack of care at the end of a plow furrow ditch at the road side has turned the water, carried by that ditch, into the road on a steep hill side.

The best roads have a comparatively narrow road-bed, made and kept "crowning" or slightly higher in the center than at the sides, with the side ditches kept open, but not allowed to become too large, and with slight elevations diagonally across the road at intervals on steep hill sides or long stretches of moderate slope, to turn the storm water which falls on the road to the side ditches.

The better types of road-making machinery are somewhat expensive but they do work better and more cheaply than is ordinarily done with plow and scraper, unless the road is stony or has many stumps. If the plow and scraper are made use of, harrowing and rolling the road adds greatly to the comfort of those who are to use it.

Where there are depressions in which the water stands or long stretches of level land with hardpan sub-soil, the only effective means of securing a reasonably dry road-bed in wet weather is to thoroughly drain off the water. Raising the road grade in such places will do some good, but the water at the sides will be more or less drawn to the surface by capillary attraction. If the road-bed is to be raised through a pond, the earth should not be taken from the low land as this only makes a larger place in which the water may stand or makes it necessary to make the ditches deeper.

Many of our streams are so narrow that the extra cost of putting the bridges at a good height is not great. Where a culvert is used it is not always remembered that if the earth used in filling over the culvert is taken from the top of the hill, each foot of filling may reduce the height of the bank two feet.

The private roads on the experiment station grounds are kept in good condition by the occasional use of a good road making machine. The enterprise of a farm owner near the station last year caused a half a mile of public road to be properly graded. While this road is on sloping ground and has received little attention since this work was done, it is still in relatively good condition. A mud hole near by, and deep gullies also near at hand make the same road anything but agreeable to drive over and reduce the loads it is possible to draw over it.

The writer fully recognizes that, in present conditions, we must often do as we can rather than as we would, and that we must be content with roads not at all perfect, but he also strongly insists that using sound judgment in deciding where and how road work is to be done, thoroughly completing what is attempted and giving as prompt attention as is practicable to needed repairs, would often give us better roads at less cost.