PROCEEDINGS

TRI-STATE

Grain Growers

FARGO, N. DAK.

JANUARY 23-24-25-26,
. . . 1900 . . .

BROWN &, GAGE,
PRINTERS AND BINDERS,
FARGO.

328 MILLION DOLLARS

Was the value of the wheat crop of the United States for 1899. The product of the farms of the country is worth in actual cash more than

100 KLONDIKES

1235 homesteads were taken up at one land district alone in October and November, 1899. This was at Devils Lake, North Dakota. Farmers are growing rich all along the line of the

GREAT NORTHERN RAILWAY.

For further information about free farms in North **Dakota,** Montana and Washington, write

MAX BASS,

General Immigration Agent Great Northern Railway,

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Proceedings

of the

Tri-State Grain Growers Association

Consisting of the States of

North Dakota, Minnesota and South Dakota.

Fargo, N. Dak.

January 23, 24, 25 and 26,

1900.

Brown & Gage, Printers
Fargo, N.D.

PREFACE,

THE Grain Growers' Convention of March, 1899, was sow e l l attended and the interest manifested so great and benefits resulting there from so far-reaching, that it was thought best to have another one this year. This was called early enough in the season to have the proceedings published and distributed in ample time to be of material benefit to farmers. Not only those who attended, but those who were unavoidably absent, may now have an opportunity to read the many excellent papers and addresses delivered,

The money for the publication of the proceedings was furnished by Mr. James J. Hill, Mr. E. Pennington (of the Soo railway), St. Anthony and Dakota Elevator Co., Van Dusen-Har-rington Co., Peavey Elevator systems, Minneapolis & Northern, H. F. Douglas, The John Miller Co., Ames & Brooks Co., and others, and are distributed free to all who attended and registered at the time the convention was held.

J. A. JOHNSON,
J. H. WORST,
Committee of **Arrangements.**

PROCEEDINGS

Tri-State Grain Growers' Association

HELD AT FARGO, N. D. **January :23, *24*. 25 and 26, 19OO.**

TUESDAY, JANUARY 23.

MORNING SESSION.

The convention was called to order by Mayor Johnson. Invocation by Rev. Dr. Dudley.

Our Father who art in Heaven, them hast destiny over the earth; it is the home of thine own children, rational beings, made in thine own image. Thou dost give the sunshine, thou dost give the earlier and later rains, and all the forces of nature that give us seed and harvest; for this we bless thee. We pray now that thy favor may rest upon thy servants and in furnishing their concern, their temporal interest. In agriculture and all other things pertaining to this great branch of home industry, we ask that thou direct and bless them. Bless them while they are together here in this city; bless their families. We thank 1hcc for the abundant harvest of 1899, and we ask that 10,00 may be still better, and that they may have abundance and that their harvest may be plentiful.

Let thy favor rest upon every branch of industry, upon the schools and churches, upon the press and upon all the means and instrumentalities that are in use for the wellfare of the people. We pray that thy blessing be upon the whole country. We thank thee for this republic. We glory in it. We thank thee for our civil and religious institutions, our civil and religious liberty. And we thank thee for our place among the nations of the earth and the power and influence contained in this land.

We commend to thy gracious care the president of the United States. Give him counsel to administer the affairs of this nation, and let thy favor rest on the national legislature now in session, and let the laws be beneficial to the people of the republic, intelligently and morally and to their best interests.

Hear us, we beseech thee in this, our supplication; forgive us all our sins and help us to reproduce in our lives the blessed Master, our Lord, Jesus Christ. Amen.

Mr. Johnson:—

Before proceeding, I want to make an announcement. Money has been subscribed and is now on hand to publish the proceedings of this convention, and each one who attends, by having his name registered 'by a gentleman in the foyer—name and address, a copy will he sent to him. Be sure and sec that your names are registered, otherwise, you will not get a copy.

PRESIDENT J. A. JOHNSON'S ADDRESS.

Gentlemen of the Tri-State Grain Growers' Convention :

As the presiding officer of the last convention held by you, I presume it is my duty to call you to order. In doing so, it affords me great pleasure 'to welcome you to this second annual meeting at Fargo. I trust that your meeting here a t this time will be of material benefit to all who attend. Agriculture leads all other industries or occupations in the United States, in fact, in the world and it is but just that you, as agriculturalists should meet and discuss the best methods to be obtained in the line you have chosen as your life work. It has been computed by men in a position to know what they say, that the meeting you held here last March has been of great benefit to the Northwest, and, if that is the case, there is no reason why this one, should not prove even more interesting than the one held last year. The world will soon have to look to the United States for its staple article, viz: wheat and the United States will, in turn, look to the great wheat producing states of the Northwest, for its supply. That being the case, it behooves you to see that the world shall not be disappointed and that you will, at the same time, reap a rich financial reward in catering to the wants of those who are less fortunately situated. If you can, by discussing the best methods of agriculture, raise but one bushel more per acre than you now do, on the same amount of land and by careful cultivation and selection of seed, raise the grade one point, the farmers of North Dakota, alone, will receive about five millions of dollars more per year, than they get today, without any appreciable extra ex pense to them.

Through the courtesy of the Agricultural Department at Washington, I have been able to lay before you, the production of wheat in every wheat producing country in ,the world, for the past four years. I will not take up your time by reading it all, but will file a copy with the secretary of this convention, so that, if it is deemed best, it can be incorporated in the proceedings of this meeting, By referring to that report, you will see that in 1895, the world produced 2,660,557,000 bushels of which the United States produced 400,267,000 bushels and exported 744,872,718 bushels. In 1806 the world produced 2,562,518,000 bushels, of which the United States produced 467,783,000 bushels and exported 126,443,968 bushels. 1897 ,the world produced 2,326,745,000 bushels of which the United States produced 530,749,000 bushels and exported 317,306,004 bushels. 1898 the world produced 2,870,924,000 bushels, of which the United States produced 675,140,000 bushels. (I has not been able to ascertain how much was exported in 1898.)In 1899, the world produced, according to Broomhall of Liverpool, 3,496,400,000 bushels, of which the United States produced 547,300,000 bushels. The report of the British government, from September 1st, 1898, to August 31,., 1899,

shows that in the United Kingdom, 244,000,000 bushels, of which the British farmers contributed 69,920,000, bushels, 111,411,200 bushels came from the United States, 17,408,000 from the Dominion of Canada and 45,588, 800 bushels from all wheat producing countries, of which India produced the largest share from any one country. It has been seen, that, while England consumes less than 10 per cent of the wheat grown in the world, she fixes the price on every bushel of wheat grown in the world and will continue to do so until you find other markets for your

THE WORLD'S WHEAT.

1895 TO 1898, INCLUSIVE.

	1895	1896	1897	1898
United States	467,103,000	427,684,000	530,149,000	675,149,000
Ontario	18,183,000	19,184,000	29,765,000	33,042,000
Manitoba	32,777,000	14,825,000	18,837,000	26,112,000
Rest of Canada	6,500,000	6,800,000	7,500,000	9,000,000
Total Canada	57,460,000	40,809,000	56,102,000	68,154,000
Mexico	10,035,000	12,700,000	13,500,000	15,000,000
Total North America	534,595,000	481,193,000	599,751,000	758,303,000
Chile	15,000,000	12,000,000	10,500,000	14,000,000
Argentina	60,000,000	48,000,000	32,000,000	52,000,000
Uruguay	8,915,000	4,059,000	3,600,000	6,000,000
Total South America	83,915,000	64,059,000	46,100,000	72,000,000
Great Britain	38,348,000	58,851,000	56,672,000	75,330,000
Ireland	1,109,000	1,101,000	1,355,000	1,840,000
Total United Kingdom	39,457,000	60,042,000	58,027,000	77,170,000
Norway	260,000	300,000	300,000	300,000
Sweden	3,705,000	4,701,000	4,678,000	4,542,000
Denmark	3,467,000	3,670,000	3,474,000	3,600,000
Netherlands	4,282,000	5,045 000	4,400,000	5,000,000
Belgium	18,730,000	20,554,000	17,723,000	20,865,000
France	340,432,000	339,703,000	246,596,000	371,881,000
Spain	81,218,000	7 1,892,000	94,637.000	99,000,000
Portugal	7,000,000	5,600,000	8,200,000	8,200,000
Italy	118,162,000	145,233,000	86,919,000	133,372,000
Switzerland	5,000,000	4,800,000	4,300,000	4,500,000
Germany	103,160.000	110,539,000	107,105.000	115,000,000
Austria	41,767,000	43,991,000	35,859,000	41,200,000
Hungary	158,019,000	149,954,000	89,924,000	119,638,000
Grotia - Slavonia	8,661,000	9,614,000	6,271,000	8,000,000
Bosnia. Herzegovina	2,000,000	2,050,000	2,000,000	2,100,000
Roumania	68,502,000	71,194,000	36,448,000	58,457,000
Bulgaria	37,000,000	49,275,000	30,739,000	35,000,000
Servia	9,400,000	8,300,000	7,000,000	11,000,000
Montenegro	220,000	220,000	200,000	220,000
Turkey in Europe	21,500,000	24,000.000	17,800,000	21,000,000
Greece	4,000,000	4,800,000	3,200,000	4,000,000
Russia Proper	292,272,000	300,423,000	238,557,000	339,035,000
Poland	17,387,000	19,476,000	17,808,000	24,852,000
North Caucasus	67,127,000	45,148,000	29,883,000	40,849,000
Finland	100,000	90,000	98,000	100,000
Total Europe	1,452,821,000	1,500,734,000	1,152,053,000	1,548,881,000

THE WORLD'S WHEAT (CONTINUED)

	1895	1986	1897	1898
Siberia	30,890,000	34,160,000	42,835,000	43,000,0
Central Asia	7,462,000	10,830,000	11,087,000	11,000,0
Trans-Caucasia	47,000,000	42,000,000	40,000x00	40,000,0
Turkey in Asia	46,000,000	44,000,000	48,000,000	44,000.0
Cyprus	2,200,000	2,400,000	2,400,000	2,400,0
Persia	22,000,000	20,000,000	20,000,000	20,000,0
British India	234,379,000	205,610,000	182,667,000	242,921,0
Japan	20,341,000	18,000,000	18,000,000	18,000,0
Total Asia	430,513,000	379,000,000	304,989,000	**421,321,0**
	24,400,000	17,600,000	16,000,000	22,000,0
Algeria	7,500,000	5,600,000	6,000,000	**6**,500,0
Tunis	14,000,000	12,000,000	12,000,000	14,000,0
Egypt	2,542,000	2,257,000	2.200.000	1,93 ,0
Cape Colony				
Total Africa	48,442,000	37,447,000	36,200,000	44,439,0
West Australia	176,000	194,000	252,000	421,0
South Australia	8,027,000	6,116,000	2,893,000	4,141,0
Queensland	562,000	128,000	620,000	1,041,0
New South Wales	6,708,000	5.359,000	9,132,000	10,893,0
Victoria	11,807,000	5,548,000	7,315,000	10,914,0
Tasmania	899,000	1,202,000	1,327,000	1,721,0
New Zealand	3,727,000	7,059,000	6,113,000	5,849,0
Total Australasia	32,461,000	25,900,000	27,652,000	34,980,0
RECAPITULATION BY CONTINENTS.				
North America	534,598,000	481,193,000	599.751,000	758,303,0
South America	83,915,000	64,059,000	46,100,000	72,000,0
Europe	1,452,821,000	1,500,734,000	1,152,053,000	1,548,881,0
Asia	410,281,000	379,000,000	364,989,000	421,321,0
Africa	48,442,000	37,457,000	36,200,000	44,439,o
Australasia	32,461,000	25,106,000	27,652.000	34,980,0
Grand Totals	2,562,518,000	2,488,349,000	2,226,745,000	2,879,924,0

products. That market is within, your reach, in the Orient, but it will require the action of congress to bring it to your doors. Let congress give the proper encouragement to the farmers of the United States and let it do a little less political wire pulling and you will receive what your products are worth and it will not be longer dependent on Europe to fix the price of what we have to sell. I trust you will pardon me for the time I have taken up in this matter. It is a subject of vital importance, so much so, that when once begun, it is hard to stop. Before I call for the election of your presiding officer, I should like you to hear Governor Worst, the president of the North Dakota Agricultural College and secretary of the last convention. The governor has given a great deal of time and study to this matter and I know you will be interested in hearing him. Gentlemen, I have the honor of introducing Governor Worst.

PRESIDENT WORST'S ADDRESS

The committee authorized to prepare a program and make other necessary arrangements for the comfort and success of this convention has performed its duties as well as it could, though not without some difficulties.

The good results that followed the convention of last March readily enlisted the co-operation of the progressive farmers and the several Experiment Stations which, together with the assistance, readily granted, of men of national reputation interested in cereal production, and legislation that will facilitate its transportation and promote an increased demand for it in new markets abroad, has made the task less onerous.

The extensive correspondence involved in these preparations has convinced me that aside from a present interest in cereal cultivation, the belief is general that, agricultural education and state prosperity are inseparably united. True, for a brief period, while our rich soils are giving up the accumulated fertility of countless ages, a prodigal system of grand larceny against the nitrogen, humus and oilier soil constituents may he pursued with impunity and apparently without detriment; hut as surely as the present destruction of pine in the northwest will in a few years depopulate the forests, so certainly will our prevailing methods of farming end in soil exhaustion. We have already reached a point where discussion is profitable, although but two decades have passed since 'the sod was broken. The fanners of the area embraced by this convention perhaps do not fully realize the wonderful wealth nature has placed in the soil and at their disposal. This great wealth must not be wasted. The farm should be so cultivated and the bi-products so utilized, and such returns made to the soil as will perpetuate its productiveness. A thousand years hence it should be richer in those elements necessary to produce profitable crops than it is today. Common patriotism demands therefore, that the tremendous 'burden of restoring a wasted fertility be not forced upon our children's children, not that we may do better, but that we may perform our work with less skill. These northwestern states are peculiarly situated, and the soil and climatic conditions specially adapt them to fill a place in the future of our country and of the world. The net surplus product of our bread and meat will constitute our future wealth, and the demand for it will increase as the world's population is augmented and the production of food is driven within over narrowing circles. We can afford to husband our wonderful resources. It is little less than criminal to do otherwise.

Every farmer should be a close observer, an ardent student of nature, and he should look upon unscientific agriculture and slipshod farm work as we all do upon mal-practice in surgery or dentistry.

The law does not permit of medical practice until the practitioner has earned qualification credentials, that his patients may not suffer harm on account of quackery or incompetency; but a careless farmer may 'butcher the soil and propagate weeds for a whole township without serious comment, if he is a good fellow.

Why should so much care be exercised for the health of this generation and so little for what shall produce food for the next? Or, rather,

•why should we not take reasonable cognizance of both? For the latter is as serious a problem as the former.

As we express it, "soil wears out"; crops average lighter and of inferior quality; Hessian fly, weeds and rust greatly injure large grain

areas, and smut is no respector of persons, fields, or localities. Frost,, hail and gophers do untold mischief as well.

Some of the plagues are utterly beyond human control, but most of them are either larger or absolutely controlable and others are curable.

The net annual loss to the farmers from these causes, even from evils that are curable, are appalling. The amount reaches far up into the millions. Weeds and smut alone cause a net loss to the farmers of North-Dakota of not less than $5,000,000 annually, and in the long run we give away bi-products that are worth as much more. In part of this we are the immediate losers, and in part the loss falls upon posterity.

We have met here to consider these things and to disseminate as widely as possible the ripest experience of observing men, and the remedies suggested by those who have made these matters a careful study for years. We may profit by their investigations.

But remedies for cereal enemies are not alone wanted. We desire also to learn to do better what we have not performed so badly heretofore. To learn more about the "why of thing's," that we may mingle the pleasure of knowing .with labor, and thus relieve healthful toil of every taint of drudgery. This is certainly a laudable undertaking for a territory where the production of the soil must forever prove the chief—-almost the only source of wealth, and consequently of comfort and happiness. We here deal with issues as sacred as the hearthstone; as vital as the very foundations of home comforts and state prosperity. We have therefore carefully guarded against even the suspicion of political infection and would have none of it in this convention. There should be some precincts too sacred to be drawn upon for its trading stock. T.et this convention be absolutely free, and may God's blessing overshadow and control it for the good of the people.

The program we have prepared with considerable labor is now awaiting our attention. It is made up of practical farmers eminent specialists and men distinguished in legislation and business affairs. Our only hope is that when these proceedings are published and distributed, the fanners of this great: grain belt will be benefited and encouraged. We ask no higher reward for the time and labor we have devoted to this work.

Mr. Johnson—Before introducing to you the president appointed by the executive committee, I wish to call your attention to some hemp and flax twine, one hank of each, and one bag of each, sent me from the state prison of California. It is of the common flax fibre, such as we burn up, thousands of tons every year. The hemp can be made anywhere. I am going to leave it here so that anyone may examine it during the convention.

The Executive Committee has selected Mr. E. W. Randall, Secretary of the state fair of Minnesota, as president. I have the pleasure of introducing to you, Mr. Randall.

Mr. Randall: Ladies and Gentlemen—This honor was wholly unexpected. I didn't know that I was to be called upon for this service until a very few minutes ago. Of course having no address prepared for the occasion, I can only say that I appreciate this distinguished honor, and it is a distinguished honor, to preside over the convention called for the purpose this one has assembled.

As you will hear from me during the progress of the convention, I have concluded to read the paper which I have been assigned to read this evening. In looking over the programme, I find this evening's programme

a little long, with quite a number of sneakers. It will therefore be a help to this evening's programme to get my paper out of the way. I will read my paper now, the subject of which is

GENERAL GRAIN FARMING,

BY E. W. RANDALL.

Grain growing is an important occupation and should be engaged in only by those who have a real interest and pride in the work; those who will not only master the science of it by study, but to whom it will become an art by practice and inspiration. The impression that anybody can "farm" is erroneous and unfortunate. Men should not attempt it against their inclinations or judgment. Success in any line of work is difficult enough with the whole bent of a man's mind in line with his business, and is next to impossible when the mental bias lies some other way. Many people drift through life, giving it no serious thought, unless com-pelled by stern necessity, and seem to have no special adaptability for any given pursuit. These, drifting out upon the farms, meet with indifferent success or wholly fail, and are responsible to a large extent for the "cheap" way in which the whole subject of farming is sometimes considered.

The American farmer has many avenues of work open to him. Grain growing is one of them, and is sufficient value to warrant all the attention that is being bestowed upon it. It is worth while to hold conventions, print books and make experiments.. When on the farm it was my specialty, and will be when I have finished with public work and get back to the farm again. I would urge it as a specialty for others, where soil and climate favor and where inclinations are not against it. I would urge farmers to become specialists anyway. Farmers have talent, more than is usually credited to them, but very few of them are able to successfully manage all branches of farming. The specialist understands one line of work at least and should excel. Concentration counts. It is the rule in medicine, in law, in manufactures—everywhere. The "Jack of all trades" is surely giving way to the man who can do one thing and do it well.

This line of thought must not, however, be carried out too literally. The doctor masters a general course in medicine before he selects the eye, the throat, or the nervous system as his specialty. A man will hardly succeed as a corporation lawyer, a divorce lawyer, or a criminal lawyer without a general knowledge of the principles of law and equity. For the same reason a. farmer should have a general knowledge of his occupation in order to make all resources available in his special line of work. The meat packers of this country are specialists, but their knowledge of all matters in any way effecting their business and their manner of utilizing by-products are truly wonderful. Laws in force governing the location and the management of slaughter houses were very necessary a few years ago to prevent decaying waste matter being a menace to public health. Now there is no waste matter. The tail, hair, hoofs, horns, and every scrap of bone or meat is used to commercial advantages, and even the squeal becomes a part of the bedlam of noises which testifies to the activity and energy of these institutions—yet in the face of this splendid example, farmers are not using their flax fibre; are burning their straw and have enormous capital invested where it is idle half the time. It is time for farmers to acquaint themselves with rules of work in vogue in other occupations and do some hard thinking. Farmers

have many lessons to learn from the bright men who are running the packing houses, tin; banks, the railroads, the offices, the manufactures, and other important industries. If the same quality of thought and energy as are essential to success in other occupations were expended upon the farms of this country, farm failures would be far less frequent than they now are.

Farmers ought to be good business men. Business methods are as much needed upon a farm as elsewhere, and should be displayed in every part of the work. Good seed should be selected. Not only should the best grade of the best variety be chosen, but the grain should be free from foil] seed, smut, etc. If there is cockle in the wheat, get it out; if smut, treat the grain chemically and get rid of the pest. I like, too, to see plowing well done. Lands struck out by straight furrows, which in the plowing are kept straight, usually indicate the home of a thrifty farmer. Seeding should be neatly done so that when the grain is up neither laps nor bare spaces will appear in the fields. The harrow is important in putting the seed bed in proper condition and should be thoroughly used. Harvesting should be done on time and the threshing or stacking as soon afterwards as possible. I once heard a true story of a horse who would balk, if in being- hitched up, the tugs were twisted and it seems to me that *a* self-respecting variety of grain can hardly be expected to hump itself if it is handicapped by foul seed or smut or finds itself embarrassed by a slovenly environment of crooked furrows, with ragged corners or ends, in a carelessly prepared seed bed upon shallow, cut and cover, plowing. Slovenliness in methods will also demoralize the help and everybody concerned, for no crew will stay keyed up long after it is discovered that any old way of doing 'things will suffice.

Grain farming is in many ways a pleasant occupation. It affords lime, recreation, the opportunity for study and social enjoyments. It has its busy seasons, but .they are short, and much of the year is a time of comparative rest In fact, it is too much so. There is too much of idle time and idle equipment, and herein lies one of the problems to be solved. Business men do not invest money where it will be idle any considerable portion of the time if it can be avoided, nor do they try to plan their work in a way that will give them much leisure. They expect the time devoted to general study, etc. to be incidental. When all the needs of the home of the grain farmer are considered, as well as what is needed to maintain the fertility of his soil and make his business permanent, it may be found that this idle time, and at least part of his idle equipments, can and should be utilized. For instance, the teams needed on the grain farm, as well as any other, should be made up of brood mares, and these should be intelligently bred each year to make these animals compensate their owners for their food, shelter and care during the otherwise idle months of the year. Thus, the successful grain grower becomes a horse breeder to a limited extent, and the first step toward a subservient and yet profitable diversity is taken.

The grain farmer should raise all grains that are adapted to his locality. Do not put all the eggs in the same basket unless you are prepared to watch that basket very closely, as Puddin' Head Wilson has suggested, and in addition can control all the conditions surrounding it. The farmer is in partnership with nature and cannot control Nature's part of the work. A season may not be favorable for wheat, any yet a good crop of oats may be matured or wheat and oats may both partially fail and flax and barley do well. Then, too, it frequently occurs that the price of one cereal will be low and -the others good, or even high.

The farmer who has but the one may be hi straightened circumstances, **while** the man who Ms them all will continue to prosper. Another advantage is found in the fact that seed time and harvest vary enough with the different grains to give greater time for farm operations and make it possible to do a greater amount of work with 'the same outfit of teams and machinery.

How to maintain the fertility of grain fields and keep them free from foul seeds are serious problems, worthy of more serious and painstaking attention than has yet been given them. In considering them, the necessity for diversity becomes again apparent. The soils of the Northwest are the richest in the world from the grain grower's standpoint (so the chemists tell us) and yet so old a country as Great Britain has an annual yield of wheat per acre double the yield here. For the six years ending 1808 the average yield of wheat per acre in the United Kingdom was 30.09 bushels; in Manitoba, 17.71 bushels; in Minnesota, 14.35 bushels; in North Dakota, 13.15 bushels, and in Illinois, 12.35 bushels. These figures mean that something is wrong. Our methods are wrong somewhere—in cultivation, rotation of crops or fertilization, and possibly in all of these particulars.

We probably do not understand all of the causes of our comparatively low yields, but some of them are known and some remedial measures have been demonstrated which the progressive farmer will not overlook.

Barnyard manure and grasses and other soiling and forage crops we know to be beneficial to grain fields. Wheat does not do well the first year after manure has been spread. Nitrogen is the active and essential clement in wheat production, and it is claimed that when barnyard manure is applied either in the fall or spring nitrification does not take place until after the following mid-summer, too late to be available for a grow-ing wheat crop. Upon ground so treated the stalk and leaves are apt to be large and coarse, but the grain poorly developed. In a recent bulletin published in London by Henry F. Moore this subject is treated at some length. Official reports have come from New South Wales to the same effect. In Canada, also, some researches by Professor Robertson, of Ottawa, give us information which bears very forcibly on this subject. He has found that even where land is richly manured the time at which the nitrogen becomes available for the plant is not until after midsummer. In the case of green crops ploughed in autumn the nitrogen does not begin to become available for the plant until the following July, while in the case of farmyard manure applied to the land in the spring, the period at which the nitrification commences to supply nitrogenous food to the plant in available form, does not arrive until after midsummer day has passed. Much attention has been given the latter, life of the plant to the early ripening, but its earlier life has been neglected. To secure the best results and to give the plant a chance to exercise its full power, it is absolutely necessary that from germination to harvest its growth shall be continuous and unchecked. This cannot be the case if in the earlier stages of life-plant nitrates in available form for the plant to take them are absent or deficient in the soil.

If, after fertilization, a corn or similar crop is first grown, better results follow. Wheat will then do well. The ground is then in good condition, and the plants seem to have the desired nourishment through the whole period of growth. Wheat or other grains will also do well upon lands that have been pastured for a time, and especially well, if the pasturing has been done by sheep. Grass crops, especially the clovers,

are beneficial and in their growth store in the soil food in available form for the grain crops 4o follow, if, then, barnyard manure, corn, grass and oilier forage crops are needed in the rotation necessary for successful and continued grain growing, the value of live stock on the grain farm becomes self evident and needs neither demonstration or argument. All kinds of live stock should be kept, cattle, of beef or dairy type, accord -ing to the local market conditions and the inclination of the owner, sheep and swine, and in such quantities as will consume the forage crops grown and produce the barnyard manure needed upon the fields. Sheep will be especially valuable as grazing animals; will consume the screenings, which should be kept and utilized on the farm, and will do much to keep wild mustard, wild oats and similar pests from gaining a foot hold. A poultry yard should also be provided, the advantage of which any thrifty farmer already understands. All of these will help to swell the cash account and give an available income at all times.

That the farmer who has in addition to his grain crops a pair or more of colts to sell each year; who has some hogs and a few beeves to drive to market each season; who hits the animal clip from even fifty or a hundred sheep, and the increase of his flock to dispose of; who has some butter or cheese to sell occasionally, and whose chickens and turkeys and a basket of eggs can be exchanged for groceries for the family, will never know by his experience whether panics occur in the business world or not, and his battle with poverty is over. The fields, will never lack fertility, and his grain, instead of being sold of necessity at threshing time, when prices are usually low and transportation and elevator companies overburdened, will be stored in his own granary to be marketed when conditions and prices are to his liking.

Attention should also be given to making the home a permanent and pleasant one. The wind-swept, desolate stopping places too often seen upon the grain farms of the three states here represented should, be transformed into pleasant and tastefully arranged homes, surrounded by gardens, orchards in which small fruits should at least abound, and sheltering groves. J saw a letter recently written by a gentleman who has established a model home to a young friend just starting out to make a similar home for himself. The letter is pertinent here, and I copy it with a change of names:

Dear John:—

I understand you contemplate moving to a prairie country to make a home, and I offer some suggestions that 1 trust will be of benefit to you.

Having lived for fifteen years on the prairie, I am sure you will give me credit for having a fair idea of what adds most to the comfort and pleasure of a prairie home.

First, it should be surrounded by a wind-break. The ceaseless winds, that, at times, become monotonous and severe, need to meet the restraining influence of trees; for they not only make it more pleasant, but trees serve to check the rapid evaporation of moisture and thus insures better crops. By all means, surround your farm buildings with a shelter belt. A five-acre tract will make a very good sized piece to enclose. For example, make it 23 rods by 32 rods; although you can vary the shape to suit the location.

For the shelter belt in your northern location, you will find the ash one of the best deciduous trees to plant, and the Scotch pine, white

spruce or red cedar for evergreens. These trees have a deep root system and reach down for moisture to carry them over a dry time.

Begin by staking off the ground you are to enclose; then plow a strip on the outside 9 rods wide, leaving 7 dead furrows 20 feet apart. In the three inside furrows plant evergreens 20 feet apart in the rows. **It** will require 324. The next three rows can he planted to ash or Carolina poplar, 10 feet apart; the outside row to a willow hedge.

Cultivate the ground thoroughly; and until the trees get too large, potatoes can be raised between the rows. When the ash gets too large ;and close (together you can cut out every other tree for firewood.

This shelter belt will provide protection for your house and barns, both from the cold winds of winter and the hot, drying winds of summer. It will shelter your orchard and garden, and you will be able to grow all the vegetables and small fruits your family can eat—strawberries, raspberries, blackberries, currents, gooseberries, plums and apples.

If you do your work thoroughly and carefully, in twenty years time the ten acres you have thus improved will be worth as much to you as the rest of your farm.

Accept my best wishes for your success and prosperity.

Cordially your friend.

Make farm and home conditions right and good results will follow in many, many ways.

With farm tables supplied with wholesome meat, chickens, turkey, pork, mutton or "baby beef," either fresh or home cured, and with vegetables and fruits, the bug-bear store bill will be greatly reduced and the -comforts of life wonderfully increased; with tastefully arranged, comfortable buildings, surrounded by sheltering groves and with that diversity of effort, profitable in itself and intelligently adapted to varying conditions, prosperity will be assured and a love for home will take the place of discontent and that restlessness and love for change which are far too prevalent. Rural conditions will no longer be distasteful 'to the boys and girls, especially if they be given an agricultural education and an interest in the farm business and the disastrous tendency of the population city--ward will be checked. A more abiding interest in the home will mean a greater love for community, state and country and pessimism, where it exists, will give way to a more wholesome, patriotic spirit. The farms are the foundation, dependence and bulwark of all other industries, and the time is not far distant when the farmer's occupation will be the one most coveted in all this broad land of ours.

Mr. Randall—There is one matter to which I wish to call your attention again. The proceedings of this convention are to be published and a copy of the proceedings will be sent to each person who registers. There is a gentleman now in the foyer with whom you can register your name and address. Don't overlook this, if you care for a copy of the proceedings. We cannot send them unless we have your name and address,

President Worst—The Executive Committee has selected Major R. R. Fleming to act as secretary of this convention with the privilege of selecting as many assistants as he may need.

The convention adjourned to 2 o'clock p. m.

AFTERNOON SESSION, 2 O CLOCK.

Mr. Randall—The following are the assistant secretaries appointed by Major R. E. Fleming: John H. Worst, reading secretary;. Thomas Harrison, George F. Clark and J. A. Power.

The first name indicated upon the programme is that of Mr. J. W. Stahl, Secretary of the Farmers National Congress. Mr. Johnson has corresponded with him and will explain why he is not here.

Mr. Johnson—Mr. President: On the nth of last November, I invited Secretary Stahl to give an address to this convention. He waited his reply until the 5th day of December when he accepted and said he would be here and speak on the Extension of Foreign Trade, as he had been in Europe and had studied that subject. A few days later, he wrote a letter for me to secure transportation for him from St. Paul to Fargo and return, which I did and sent to him. Last Saturday morning I was very much surprised to receive a letter from him, stating that he would not come unless we paid him $15 for doing so. If he had stated $25 or $30, or $50 in the first letter, we might have sent it to him, but under the circumstances, I wouldn't give him 15 cents.

The last letter he marked private and personal, and I notified him that I would not consider it such, that 1 had been the cause of advertising that he was to speak, and that I should notify the convention why he refused to come.

Mr. Randall—In the absence of Mr. Stahl, we will call on Mr. W. M. House of Lidgerwood, N. D. who will speak on "Farmers' Markets". I take pleasure in introducing to you Mr. W. M. House.

THE MARKET QUESTION.

BY W. M. HOUSE.

In the farmers' interest the question of market is next in order to that of production. The farmer must inevitably create a market for his produce, or, limit his product ion to the state of the market. There was a maxim that "three women and a goose make a market". Considering this, proverb true, it becomes obvious that when the provisions are increased the market must be multiplied or enlarged. Besides, if one is to be successful in selling stock, grain or goods of any kind, he must strive, not only for many or large markets, but he wants the very best market possible.

Now, one man cannot secure all these things. However, we have only to open our eyes to see how these and all other good things can be obtained. The present age is one of monopolies and combinations and trusts and corporations. No man should be afraid of these high sounding titles. Some of them are bad and some good. If they grind us to powder it is because we are not worth saving. In commerce and business all men are equal. If it has recently been discovered that in union there-is strength, we can profit by it if we choose, but if we do not, it is folly to deprive others of its benefits and advantages. Edmund Burke said, a.

hundred years ago, that, "When bad men combine, the good must associate; else they will fall, one by one, an unpitied mass in a contemptible struggle". That "principle of Edmund Burke was true in Ids time, and it is true today. If there is strength or virtue in association let us avail ourselves of it. This will be infinitely more sensible, and profitable, and effectual than it will be to whine and whimper like a whipped cur because others are up with the times.

It may be said that this question of union and combination has nothing to do with the subject of farmers' markets. This is the vital question the only question that we have to solve. When such an assembly of men as are present here today become of one accord at one place great things may be accomplished. And this question of markets is so plain, we must agree on it today.

America has the wheat, the pork, the beef, the wool and cotton, a thousand things of produce and manufacture that other people need, and are able to pay for. The only market worthy the name we have is Liverpool. Liverpool represents Great Britain with 35,000,000 inhabitants.

In the opposite direction from Great Britain there is one nation of 400.000,000 population which would gladly take and pay for many times the amount of wheat and cotton that Great Britain buys. Not only China, but Japan and the people of other portions of Asia would heartily become American customers if we only make them fair propositions for commerce and trade. Asia contains more than half the population of the earth. Here is an opportunity for reciprocity that would be of benefit to both Asia and America. A little aid by congress for ocean vessels to oriental countries would give us immense markets in Yokahama, Nagasaki, Hongkong, Shanghai, Canton and either ports and inland cities. Subsidies for shipping our products to Europe will benefit none but Europeans. Every market opened in the orient will create new demands for, and consumption of our products and manufactures. The orientals habitually eat rice, but it has been found that they quickly become wheat bread eaters when the opportunity is offered them. They export rice, tea, silk, indigo, etc., and are able to pay for all the American products that they need.

Mr. Randall—We will not follow the programme literally this afternoon. We will now hear Mr. Bolton on "Growing Wheat as a Single Crop at a Loss". I take pleasure in introducing to you Mr. Bolton.

GROWING WHEAT AS A SINGLE CROP A LOSS TO THE FARMER.

BY THOS. BOLTON.

Ladies and Gentlemen:—I am a common farmer amongst you and I didn't come here to teach my brothers anything; I came here to learn myself, I have said that I am never too old to learn, but by the courtesy of Mr. Worst I am asked to talk to you a short lime of my experience on the farm. I have been in this slate and on the farm for eighteen years, but coming down on the train the other day I heard something that did me a great deal of good, and I hope that the same result may happen every one of us. I heard a gentleman make the statement on the train that since he had attended the Grain Growers' Convention of the year

before lie had realized $500 profit as a result. If each and all of us, by meeting here at this convention, realize one-half of that amount, **we** will be making the best week's work since we have been in North Dakota.

The subject I am going to speak on this afternoon is growing wheat on single crop at a loss to the farmer.

If we grow wheat or any other one crop, and sell it at present prices, it will be a loss to the farmer, and to the Dakotas and Minnesota, or wherever wheat is grown; because, by the closest figuring, in government statistics and reports, it has been ascertained that it coats in this state from 50 to 54 cents per bushel to grow wheat. That being the cost, and we are selling it at from 50 to 56 cents per bushel, we must then he selling it at a loss.

We must look around and do something else, and not have wheat as a crop alone. Flax is one thing that can be grown. Last year it was a very good crop and sold at good prices; but flax is a crop we may expect to be a very uncertain crop some years. It is very plain, that when it comes up very weak and tender, if it don't get the moisture and strength, the weeds will choke it down. So you cannot depend upon flax alone. Then along that line, the farmers want to grow oats and barley for feeding purposes; when they have grown such crops they should commence to have some stock, hogs, cattle and sheep—which are, without doubt, profitable—whereby they can take up this grain grown on the farms, and return the wealth again to all their lands.

While you will hear the story, no matter where you may go, or in whatever town or community, that wheat doesn't pay to grow, you will hear another man say it don't pay to raise cattle or hogs, etc., but I would like to ask you gentlemen, I believe you are fair representatives of North Dakota and Minnesota, what on earth does it pay to grow as one crop, if it doesn't pay to grow any one of these things?

There is one point we don't want to avoid, that in growing wheat, while it seems to me that !t has been the one principle crop of this valley and the land is most adapted to that one crop, yet the time has come when we are producing more (ban the people seem to be able to consume, and we have always got a surplus on hand every year—more this year than a year ago—and therefore, it behooves us to look around and find some other market, and sonic other people to consume our wheat crop. I under stand that of all the people in the world today, one-third of them live on wheat bread, and the other two-thirds live on something else.

The American people are the greatest nation under the sun, because we are a nation composed of all nationalities, and_ that is what makes America the country she is today. And while we are advancing along that line, we want to rind a market and an outlet for the consumption of this grain.

It is not so easy for the farmer that has been growing wheat—which I know from experience—to go into stock raising all at once. It takes time. It don't pay to raise poor stock. You have got to pay good prices to raise good stock, and it takes time. A man may be able to buy one or two good cows a year and so on, and it may be a few years before he can derive any profit out of them. The object of this Grain Growers' Convention is to help us at present. I have been raising stock myself for twelve years, and when I first began I was pointed at with ridicule. Many said that I would soon go to the wall. As a result, however, I stand there with my stock, and have a market, and am getting good prices, and what one man has done in Dakota another man can do as well.

It has been said here today that we fanners should not go to working and cultivating the land, if we didn't, know how, as it would be like murdering the land. If in the first place each one had understood it, we would have had better results. .In our country my experience has been that the man who bought land merely for speculation is not the man who is there today. The men who bought land and know something about it," are the men who are there today and farming it.

It is a good thing for us to have these educational institutions. It is a good thing for our legislature to pass laws or make provisions toward the agricultural, normal and all the educational institutions in this state. They are doing a good work. These educational departments are to educate our boys ,and not to educate our people beyond the age of school. There are a good many boys in the stale who need education, and this support from the stale helps them. I am glad to say it is a step in the right direction. We may be able to get some approprition to help educate the farmers who are living on their farms today. This appropriation I have reference to, is for the proper defraying the expenses of a commission to attend farmers' institutes. I believe the institute is one of the finest things in the land. Let us have an appropriation for to help them along.

We people of Park River called an institute, independent of any appropriation, and professors from the Agricultural College came up and gave us addresses. That has done more to educate the people up there— that is the two days institute—than anything we ever had. The result was that last year we had one of the grandest agricultural fairs ever held in the State of North Dakota. It was a success financially and otherwise. We started without a dollar and offered good fair prizes and premiums, and after paying everything up, we had left in our hands seven or eight hundred dollars to go on next year. We give the credit for this start to the speakers from the Agricultural College. We are now going to hold an institute either on the 13th or 14th of February; and I say they ought to have them all over the state. 1 think they help to bring up good, honest, straight forward representative men throughout the state.

If our legislature would make such appropriations it would encourage the farmers in this line, it seems to me; it would be educating those who are not able to get aid from the Agricultural College. T would say, send your boys to the Agricultural College. I happened to have the pleasure of being one of the delegates to visit the college last summer. While I have been brought up on a farm, I will say that I learned something there that I never knew before. There isn't a farmer in the State of North Dakota or Minnesota but who could learn something from that college, by visiting it.

A plan may be proposed during this convention whereby the farmers of this state, may be given help as to growing wheat, by growing more bushels to the acre, by sowing good seed and by getting the very cleanest and best; but the more we grow, the lower our prices will ho unless we can get another market to get rid of this surplus.

The growing of different kinds of grasses—and I think that along that line and in growing stock in connection with growing wheat and other crops, that we want to try and use all the instructions that we can be able to get from both the North Dakota and Minnesota and South Dakota Agricultural Colleges—as they are experimenting in the grasses that will be the best adapted to the different parts of our country.

There is another point; we are today assembled here in Fargo, and in this vicinity is our Agricultural College in the Red River Valley,

where the land is heavy and different altogether from what it is where I happen to live. But it seems to me that the time is coming when our legislature should be able to make appropriation to extend these experiment stations, and so make another in the north, and another in some other part of the state. I think there; has been an effort started, but has not been carried on, whereby we may be able to get three different stations in our state. They have five or six in Minnesota, where they are able to test the different kinds of pram in every part of the state.

In talking with a gentleman here about getting the benefit out of the manure—in our state that shows the difference in the soil—they claim that you would not be able to get anything out of your manure the first year it is put on. It is different-with us. I guess the reason is that our soil is a quicker soil than here; it acts quicker and we realize benefit from it the first year. The heaviest wheat. I think this year was on ground that was hailed out last year. I manured it and put it to wheat and it went twenty-one bushels to the acre. Along this line, another crop in connection with raising stock, is to grow millet. Grow millet when you grow your barley and oats to be fed. I have fifteen steers—I shipped a carload of hogs to Mr. Cronan in Fargo here—and I have enough grain to feed to my cattle and horses. This millet in our county grows very rank and strong and makes excellent seed. You can grow wheat after millet that will be clean. It produces more than any other crop in North Dakota, and at the same time you have feed for your cattle, and sell it in cattle, and realize cash value in that way.

There is another question that there has been a great deal said about over this state, and that is about smut. I never have grown smut yet. I believe that smut is more in the ground than in the grain. My farm has never produced any smut. The crop this year, and I sold every bushel of it, was No. 1 hard, Boulton Blue Stem.

Question: In speaking of manure, what difference do you find the second year?

Answer: A very great improvement.

Mr. Randall: The last speaker has brought out a great many good points. The farmers institute work, through the Agricultural College, is still sustained and still supported, but I was told your state appropriation for farmers' institutes was $500 a year. You can stand to get a much larger sum than that. In Minnesota these institutes have been in existence for thirty years. Their annual appropriation is $7,500 per year, and we think we have good results. I believe that this is a matter that you can study over in North Dakota, and you will find it a good thing to do. Enlarge your institute work and give them what they need.

Senator McCanna of Cando offered a resolution, which was read, and a committee appointed for considering a Live Stock Convention.

WHEREAS, With full recognition of the wheat growing interests of the Northwest, we also recognize the value of our live stock as an important money making factor in connection with our wheat product;

And we therefore ask this convention the time to appoint a Committee to arrange for a live stock exhibit and sales days for live stock, and therefore,

BE IT RESOLVED, That such a Committee be appointed by the Chair for

that purpose, said Committee to meet at the time and place to be designated by its own Chairman, to formulate plans, etc., for such live stock meeting, and to report the same back to this Convention tomorrow afternoon at 4 o'clock.

Presented by D. W. McCanna, Cando, N. D.

Mr. Powers: I simply take the liberty of making a suggestion that the resolution designates no number to that committee, but I find that there are a great many representing pretty nearly all parts of our state in stock as well as wheat growing, and I would suggest, Mr. Chairman, that in appointing this committee you would have pretty much all parts of the state represented. I most heartily endorse the resolution, not with the idea that it will interfere with the work of this convention in the education of wheat growing, and that it will not in any way permit of the introduction of mailers of education relating to live stock, or anything of that kind that belongs to a live stock convention.

To take advantage of the fact that we have so many men here now who are interested in stock as well as grain, we can be brought together and determine among ourselves the advantage of having, during the summer, an exhibit of live stock and sales, .similar to the one inaugurated last year. We may enlarge that or do whatever else the committee may see fit in connection with it. Therefore, we will not take the time of this .convention, but in submitting the report we may have to ask for a little time to determine what is best after that meeting.

The resolutions were adopted.

Mr. Randall: I will name (hat committee before the close of the • session.

During this meeting while considering fanning matters regarding ' the cultivation, fertilization, proper seed and other matters pertaining to the successful growing of grain, possibly, we need to consider some of the insects of the grain crops, and the next paper will relate to one of them—the Hessian Fly. I take pleasure in introducing to you Prof. C. B. Waldron of the North Dakota School of Agriculture.

THE HESSTAN FLY, (ILLUSTRATED),

Y C. H. WALDRON,

North Dakota Agricultural College.

The Hessian Fly is not a newcomer to the northwest, nor the first time that its damage has been very marked.

In 1801 I found fields ten miles west of Fargo in which the loss from Hessian may have been twenty-five per cent. In the same year the insect was found more or less common all over the Red River Valley or at least the southern portion of it. From time to time since then it has appeared in different places but rarely destroying more than a fifth of the crop in any locality. While this insect is known to breed in rye and bar--

ley yet no complaint of it has been made as injuring those grains in Minnesota or the Dakotas. I know of no published reports of the Hessian Fly in the states named before 1896 though notices may have appeared
before.

In a map recently issued by the Department of Agriculture of Washington showing the distinction of this insect, North Dakota is not included and in speaking of the probability of this pest becoming bad in the north* west the writer, Herbert Osborn, expresses the opinion that our climatic conditions preclude any real likelihood of such danger.

The facts, this last season, seem to oppose that idea. Placed at a conservative estimate the average loss from Hessian Fly in Walsh county was not less than ten per cent; and in many other parts of the state I found the damage equally great. I mention Walsh county because I drove in most portions of it and had a good opportunity for investigation. In drives aggregating over 1,500 miles different sections of the state it was rare to find a field without a sprinkling of fly, while in some fields the loss reached nearly twenty-five per cent.

I did not travel over the state sufficiently to give a close estimate of the amount of damage but I think if the pest could have been bought off for a round million that the state would have been the gainer by long odds.

On the ground that this pest is comparatively unknown, this fact is excusable, but in spring wheat regions the means for its extermination are so simple that there is no real need for such loss.

A little glance at its life history will show that its weak points are in the matter of maintaining itself in this region for an extended period. The farmer has his weak points in the struggle too and it is this: He is apt to give the insect the benefits of the doubt—hope it wont come again— and go on as before. This method works sometimes.

To begin with, the imago or adult insect at the time of its appearance depends on the weather to some extent but it must he after the leaf from the second joint of the plant has appeared for upon this leaf is the egg deposited. For this latitude I should expect the insect to appear about the middle of June. Shortly after the egg is deposited upon the leaf it hatches into a very tiny grub that, moves to the axis of the leaf where be- tween the sheath of the leaf and the stalk it takes up its permanent abode and during the five or six weeks of its larval existence passes the days and the hours in sucking the juice of the wheat plant with the result that the grub thrives better than the plant and the head of the wheat contains little or no grain. Just before harvest the infested straws bend over abruptly rig]it above the second joint and the head lies on the ground so whether it contains wheat or not makes no difference.

Meanwhile the insect itself has undergone a change. Its host plant has dried up and with its food supply gone it must learn to live without eating. It becomes shortened and thicker and covered with a brown shining membrane. This is its resting stage which it assumes during the hard times of fall and winter, or until it gets another crop. This next crop is not for itself but for its offspring, and the farmer and his business associates. But the bug has the best of it in this, what he takes is clean profit and reduces the other profits just that much. Out of this brown case the adult insect emerges the next season and provides for future generations in the way already described. It is a long time though from August to the following June and long exposure to sun and drying winds may thin out the colony materially. Just what the probable loss is from these causes in this region remains to be determined. One would think

the season just past to be an extreme one in that particular and yet in the last of November I found the greater number still alive while specimens secured then have apparently all the life and hope that they started out with. There are also a great mob of parasites strictly committed to the doctrine of anti-expansion—for the Hessian Fly—and when they all unite in feeding upon the vitals of the fly—their doctrine prevails, especially when they include the plank of 16 to 1 in their platform.

But that may happen only on an "off year". The better policy is to cut the wheat high and burn your stubble, not being too particular to keep the fire out of your neighbors' fields. Unless the treatment is general over the infested region the treatment will only give partial results. Plowing will accomplish the same end as burning, but of course the land left for summer fallowing in such cases must be plowed by the first of June.

The Hessian Fly should not become a permanent pest in spring wheat regions. With a complete crop rotation that utilizes all the land, and does not permit a part of it to lie idle in stubble till the middle of the next season, there would be no opportunity for such pests as the one described. So long as present methods of agriculture are pursued it will abundantly pay to exercise vigilence and adopt the remedies recommended.

After the reading of the paper the following questions were asked and answered:

QUESTIONS AND ANSWERS.

Question: Did you explain to us why the eggs are laid in the stem of the wheat?

Answer: The egg is laid on the leaf, where it hatches and crawls down into the stem.

Q. Where did they start from?

A. Eastern Pennsylvania, some 100 years ago, and moved west more than east. They have never heard of them in Maine, showing how much more progressive the west is than the east.

Q. How far can they travel?

A. Five or six miles in a season, and with a North Dakota zephyr fifty or sixty miles.

Q. How many eggs does one of them lay before she dies?

A. From 120 to 150.

Q. I understood you to say that plowing in the spring time would destroy them as well as plowing in the fall?

A. If done before the first of June.

Q. Does this Hessian Fly come in other crops?

A. Barley and oats a little, yes, sir.

Q. Can you change the crops and get rid of them?

A. Yes, sir; in other countries they do.

Q. Is it not killed by hail?

A. Yes, sir.

Governor Worst: If the farmers would co-operate and either plow or burn their stubble, how complete a remedy would that be?

Answer: It would be an absolute remedy, and it would last. I presume, ten or fifteen years. They would have to cross over the boundary line again. I think the loss in North Dakota last year was over a million dollars.

Question: If we could adopt this summer fallow or any rotation system, would it do any good?

Answer: Yes, sir.

Q. How would it do to disc that stubble in the fall?

A. It would not do any good. For grasshoppers it is all right, if you drag with a coarse drag, but these lie on the ground. The grasshopper eggs are just under the surface and are turned up and dried by the sun and killed.

Mr. Randall: Mr. Thomas J. Harrison will now tell us "How to Farm Intelligently." I take pleasure in introducing to you Mr. Harrison.

FARMING INTELLIGENTLY.

THOMAS HARRISON,

By this I do not mean that there are not a large majority of the farmers engaged in agricultural pursuits in the Red River Valley who are among the brighest and ablest men of the Northwest.

In the light in information on every topic connected with agriculture, I am convinced many farmers are still following in the old ruts, and as a consequence only receiving a partial return for the money and labor expended on the farm.

The farmer, as well as the merchant, mechanic, or machinist, who desires to excel and make a success in life must keep abreast of the times; in thorough preparation of the soil selection, and care of seed, See that he has not only the best of seed, but that the seed he sows is carefully and thoroughly treated for smut.

I make it a rule to select my seed before the grain is cut—by driving through the standing grain with a horse and cart I am able to select a portion of the field where the crop is nearly uniform in height. The heads long and fully developed. Careful attention is given to see that the heads are filled to the top. Care should be also exercised when threshing, to see that the machine is properly adjusted so as not to crack or injure the kernel, especially in wheat. The damage in wheat intended for seed often cannot be seen by the naked eye, but when placed under the microscope will be quite apparent.

In treating for smut it costs me for labor less than one quarter of a cent per bushel to treat wheat, oats or barley; when ready to seed I have the grain elevated into a bin ten feet above the elevator floor in the bottom of the bin, near the center a shute is placed with a slide. With formalene already mixed in a barrel, and a three-gallon can with sprinkler attached, the can filled and ready resting on a stand three or four feet above the floor. The slide is drawn by a convenient lever, allowing a small regular stream of wheat to fall to the floor. Into the falling wheat a heavy spray of formalene is kept. When necessary to re-fill the can the fall of wheat is readily shut off by use of the lever. In this manner one man can treat seventy-five or one hundred bushels in a short time.

Immediately after treatment the grain is filled into sacks ready for .the field, the grain will absorb all the moisture very rapidly. There need be no fear of the grain clogging in the drill if grain treated by formalda-hide is left exposed to the air for twenty-four hours; over 50 per cent, will be lost.

The fact that hundreds of farmers throughout the valley have their sons and daughters attending the Agricultural College is proof that they

realize the necessity of giving their children both a secular and agricultural education. There the boys are not only taught the best methods, but are caused to practice and participate in the actual work on the college farm. Also in the handling, care, breeding, and judging of stock. It would require years of training at home on the best managed farms to acquire the knowledge they can get in a single course at the Agricultural College.

The boys are drilled in the manual forms, giving them a better physical development. All this will tend to make the boys better contented on the farm, where, with the average amount of energy and pluck of the North Dakota boy will insure his success on the farm, and if called to defend his flag and country, as they were in the Philippines, they will returned crowned with glory as being the best behaved volunteer regiment in the service.

After the address the following questions were asked:

Question: Is there any way that we farmers can tell whether there is any smut in our grain?

Answer: I believe there is, but Prof. Bolley will tell you about that. If you never had smut before, that is no reason why you won't have smut in the future. Using the threshing machine of your neighbor may give it to you.

Q. I would like to know the effect of the formaline treatment. I tried formaline, but I had plenty of smut in my wheat. I used formaline about one pound to fifty gallons of water.

Mr. Harrison: I have yet to see wheat treated with one pound of formaline to forty-five gallons of water, and the kernels thoroughly wet where any smut has been found.

Mr. Randall: I will now ask Gov. Worst to read the names of the members of the committee for the Live Stock Convention. This committee is to report tomorrow on the advisability of holding a Live Stock Convention next year. This committee has been made up very largely of North Dakota people. It is simply to arrange for another movement which will be brought out next meeting.

The following is the committee as named:

Hon. D. W. McCanna, Cando, N. D.
H. F, Miller, Fargo, N. D.
J. H. Reed, Owego, N. D.
E. C. Sargent, Amenia, N. D.
W. A. Scott, Fargo, N. D.
W. J. Howe, Casselton, N. D.
A. A. Booth, Roger, N. D.
Ferd Piper, Addison, N. D.
G. S. Barnes, Fargo, N. D.
Prof. . H. Shepperd, Fargo, N. D.
J. A. Johnson, Fargo, N. D.
H. F. Arnold, Larimore, N. D.
Mr. Spangler, Inkster, N. D.
P. B. Wickham, Glen Ullin, N. D.
H. U. Thomas, Bismarck, N. D.
E. D. Childs, Crookston, Minn.
Knut Nomland, Hillsboro, N. D.
Thomas Boulton, Park River, N. D.

Louis Pond, Church's Ferry, N. D.
J. B. Power, Power, N. D.
Judge F. L. Thompson, Cando, N. D.
Dr. T. D. Heinbauch, Tower City, N. D.

Mr. Power: I would like to have added to that list of the committee the name of Dr. T. D. Hinebauch, of **Tower City.**

Mr. Randall: It is almost impossible to follow out the program as furnished, as some are not here who will be here and others cannot be here, but have sent in their papers. We will now have one of the papers read.

Gov. Worst will now read Mr. Shellenberger-'s paper, "When Shall we **Begin** to Diversify?"

WHEN SHALL WE BEGIN TO DIVERSIFY?

BY H. R. SHELLENBERGER,

Minnewaukan, N. D.

I believe there are few farmers who will deny that some time the present practice of raising grain and selling the same will have to be abandoned, for the reason that it will no longer pay. The soil will cease to produce crops even under the most favorable weather conditions. This has been the experience of all the older western states. When I went to school the geography told us that Illinois was the greatest wheat producing state. Now, I believe she stands fifth. The leading wheat states are the newer ones farther west.

But in spite of this knowledge about the older states we continue to confine our farming to raising grain and selling it.

In Eastern Pennsylvania about twenty years ago, when farmers began to feel the effects of western competition, many farmers ceased to keep stock and sold their hay. This was aptly called selling the farm by the ton. We might just as aptly say our present practice is selling the farm by the bushel. The value of the farm is reduced by every crop we take from it without in some way putting back the elements we look from the soil. If we intend to make the farm our home and farming our business for life we must change our tactics for the plant will soon be come worthless. We are killing the goose that lays the golden egg.

Now, I am aware that this is nothing new. That most people admit it; that agricultural papers continually preach it, but the trouble is we do not act; on the knowledge, and the object of this paper is to direct attention to this matter as it concerns us as a community of farmers. The limit of profitable production of grain is perhaps not yet reached, but is it wise to raise wheat until the soil will not produce it any longer? Must not the last crop entail loss? Are not some of our older fields already decreasing their yield? The last three years have been seemingly favorable for wheat, but the crops were disappointing. Summer fallow especially seemed to run into straw. But whether our oldest ground has reached the limit of profitable production or not, it soon will reach it. Then what? We must fertilize. We must devote a part of our land to raising food, both long and short, and feed it to good stock and return the

manure to the land. The row or two which have hitherto been kept to supply the family with milk must be added to until, with the horses and colts we have enough to eat up all the feed that can be raised on half the farm, while the other half in rotation can raise crops for the market. I believe a. herd of eight or ten cows with their increase until three years old can be kept and fed on a quarter section of land without diminishing the yield of wheat on that farm. That is, half the ground under manuring and rotation will produce as much grain as the whole would under continuous grain raising, with occasional summer fallowing. That the profits on the grain must be much larger cannot be disputed, while the cattle will likely more than pay for the extra work. This extra work is not a small item at the outset. Without fences and buildings a few cattle can easily make themselves so troublesome that the average man will soon decide that wheat and cattle cannot go together. But, as the Germans say: "All beginning is burdensome," and we must not be discouraged if for a few years the returns from the herds do not seem adequate pay for the outlay of capital and labor. Persevere on these lines and in due time the returns will come directly from the herd and indirectly from the fields. The troubles of beginning with stock will be greatly decreased if we keep our buildings and fences a little ahead of the herd rather than vice versa, until the entire farm is fenced and ample shelter provided for all of the stock the farm will support. It may not be out of place in closing to contrast the condition, ten years hence, of the farmer who now begins with stock, with the farmer at that time who has con-tinued his present practice of raising grain only and selling it.

Mr. Randall: It has been suggested that a question box might be of advantage, as there are many of you no doubt who have come down here with problems that you would like to have answered; so if you will write out the questions on a slip of paper and send them to the desk, we will endeavor to find someone to answer them, which may prove beneficial and instructive.

We would very much like to have the ladies present this evening. Bring your wives, daughters and sweethearts. The woman who is interested in her home, is interested in her husband.

We will now listen to Dr. Hinebauch, of Tower City, on "Corn Culture Outside of the Red River Valley."

CORN CULTURE OUTSIDE OF THE RED RIVER VALLEY.

BY DR. T. D. HINEBAUCH.

We are farming on the principle that mixed farming pays better and keeps the soil in better condition than a single crop. I have been farming about two years, and I have diversified the crops so far as I could under the conditions. Now the figures that I wish to give you are those that are taken from a, quarter section of land. I have been using that quarter section of land and paid cash rent. That is the simplest method. I have no interest or taxes to pay, but merely a rental per acre. When I first came to this state, it was supposed that corn could not be grown

profitably. But as the years go by. many farmers see that there is a profit in it—if not in the corn itself, in the crop that follows.

My wheat crop during the last two years has averaged twenty bushels per acre, so that I think I am up to the average of the state at least so far as wheat is concerned, but my corn crop has produced me more money than the twenty bushels of wheat.

Corn, like wheat, has to be adapted to the climate and the soil in order to *get* the best results. Now there are two great classes of corn raised in this state; Flint, or what is more generally known as dent. We don't expect to raise dent corn that will produce as heavy or as long a kernel as in the South, where the seasons are longer. Now, as far as the selection of the seed is concerned, it is necessary to decide what particular variety you want to raise. Be sure and purchase your seed from some firm that is perfectly reliable. I have tried both varieties of corn, and they ripened thoroughly last year. I have prepared my ground in two ways, first by fall plowing and the other by spring plowing.

Corn that is planted with a corn planter will ripen from five to ten days earlier on the fall plowing than it will on the spring plowing. _A11 corn planted on the fall plowing ripens better than on the spring plowing. I usually disc fall plowing lightly and harrow it down. I don't check it. My planter drops one to two kernels every fifteen inches. If the corn is of the flint variety, a little care must be taken in seeding with the planter, as the seeds are smaller. I began to plant the 12th day of May. My corn was thoroughly ripe the 1st day of September. This year I began the 8th day of May and finished five and a half days later. The corn came up nicely, made a good growth, and a portion was cut and in the shock by the first of September, while all of it was in the shock by the 8th. I have brought here a few samples which I have raised this year, selecting only the average ear. (Mr. Hinebauch here explains the corn on exhibition.)

After planting the corn, just as soon after as I can, the same day if possible, I harrow it the same way that I plant it. A few days later I harrow it crosswise. Then I harrow it once a week until the corn is six inches high. I don't use a cultivator until it is at least six inches high, and this year that was not until the 1st of July. Up to that time the corn is thoroughly clean. I use a six horse harrow thirty-six feet wide, taking but one day a week for that amount of corn. I use a cultivator and cultivate as close as I can. The cultivation is finished about the 20th to the 25th of July.

This year a portion of my corn got quite foul. It was not due to a lack of cultivation, but was due to the hard rains which came on at that time when I had about finished it. I cultivated forty acres after the rain which is perfectly clean, while the other is somewhat foul. But on the whole the fields are as clean as it is where it is checked in.

There are several objections to drilling corn as against the checking method, but it cuts nicer where there are one or two stalks than where there are five or six stalks which are also more liable to break the knives. They may be broken or the machine may pass over entirely. Labor is too expensive in this day; we must use some sort of harvester to cut and bind it. After binding it, I set it as soon as I can into shocks— of the tall corn twenty-five or thirty bundles in a shock. The smaller corn growing only about six feet high, instead of putting them into large shocks, I put them into smaller shocks. As long as we carry the bundles the easier it is to put up, and the more we can put up

in a day. I am in favor of using a harvester that carries a bundle carrier, just as the old fashioned harvester does. In the shocking of your corn you get it done better and it is more desirable in every way. After putting the corn into the shocks I allow it to stand there until it freezes. If you take it before, you are apt to have moulded corn. I think there are some people here who can say that their corn moulded in the shock. It is much more desirable to leave it in the shock until the middle of winter than to stack it.

In regard to the expense of producing a crop of corn, I will state that on this quarter section I had ninety acres of corn. I wintered seventy-two head of cattle, and I called them worth $6 per head more in the spring than in the fall—that was making $432 income. I sold hogs that were raised and fatted from this field for $367. Had enough corn left to give to my hogs through the summer. Total, $799. Besides, thirteen horses were fed from this corn, together with two quarts of barley and oats per day. In the spring they were in first-class condition, and became so from this corn. The items of cost producing this $799 are as follows:

Eight bushels of seed	$10.00
Harrowing	$18.00
Cultivating	60.00
Cutting	36.00
Shocking	18.00
Twine, 55 pounds, costing	6.05
Hauling and stacking for man and team	24.00
Rent	262.00

The total cost, $5.37, deducted from the income, leaves $5.96 per acre as the net profit on the ninety acres. The same year I grew wheat on fifty-seven acres of this quarter section, which yielded 572 bushels and sold it for 53 cents a bushel or $303.16.

The cost of handling that wheat was as follows:

Drilling	$11.40
Seeding	47.31
Harrowing	5.00
Cutting	19.95
Shocking	8.25
Twine	8.40
Threshing	45.00
Hauling	14.30
Rent of the 57 acres	57.00
Plowing	57.00
Total	$274.77

Now you will notice that in this estimate I have not charged corn up with plowing, for the simple reason that I charged the plowing to the following wheat crop. I think it is a fair proposition to charge it up to the wheat crop because I never plow corn land for wheat. I gained from five to seven bushels more per acre on the corn land, if I did not plow it. I have gained just $28.29, or 49 cents per acre, as the net profit on fifty-seven acres of wheat as against a net profit on the corn of $5.96 per acre on ninety acres. You see you have to farm a large tract of land to make any money out of it and live on it.

As to the crop of 1899, these ninety acres produced 2,490 bushels, or

twenty-seven bushels per acre, bringing in $1,416.69 the total income from that crop.

Expenditures, charging the plowing against the wheat:

Discing	$ 15.00
I disc it a little before I seed. I don't harrow it.	
Drilling	18.00
Cutting	31.00
Shocking	12.00
Twine	19.00
Threshing	243.00
Hauling	40.00
Rent	90.00
(Another item)	54.00
Total	$613.67

Leaving a net income of $803.02, or $8.92 per acre as being the net income on the ninety acres of wheat which the year before had produced$5.96 as the net income from corn. Now I still had about seventeen acres which had been put to corn. Seventeen acres, at twelve bushels to the acre, 204 bushels, sold for $118.93. The total expense was $85.28, including the rent. I won't enumerate this, as it takes too much time, leaving a net gain of $23.65, or $1.39 an acre, or $1.74 profit for the two years, while the corn ground produced nearly $16 for the two years. If I had not sown the corn on that land, or if I had not received any benefit from it, my crop the second year would have been eight times more than I received from farming it to wheat.

The machine that threshed this wheat began in the morning and threshed 2,100 bushels on the corn land, but they had to stop on account of water. Water had to be hauled five miles. They would probably have threshed 2,500 bushels that day. The best day's threshing that they had done was 1,600 bushels. But the wheat on this corn ground did not hinder it at all. It was a shorter wheat and had a head with three well developed rows on each side. Blue stem wheat.

It seems to me that these figures are pretty good evidence that it pays to raise corn and cattle. I will take corn and cattle as against wheat, and I can make it pay every time as far as I am concerned.

The Northwestern dent corn is a good cropper for the dent variety. I have grown this Northwestern dent corn for six years and it has not failed to ripen a single year. There was corn here that was planted as late as the 26th day of May and still ripened. We made this corn ripen at the same time as any other of the red flint variety. We have other corn which will produce more to the acre perhaps, the White Flint for instance, which was developed from other corn. This is one of the best harvest croppers and is the corn I would grow entirely, if I didn't remove it from-the stock. I intend to turn the steers into mine and let them husk it. I have been crossing corn for two years trying to produce some better quality, and at the same time keep them up to where they could be cut by the harvester, say to six and a half feet high.

The improved Northwestern dent has not been successful with me this year. It did not ripen with me, but I presume if the frost had held off to about this time, it would have ripened.

Here is a sample of what is known as the Jehu corn but it doesn't grow high enough to be cut with the harvester—about five-or six feet—and

the cars grow about from 14 to 16 inches **from** the ground. To be a good harvester the ears should not be less than 20 inches from the ground.

Question: What is the best dent corn?

A. The best dent corn is the Northwestern dent. I don't want to sell corn, I am not here advertising my grain.

Q. Do you husk the corn?

A. No sir.

Q. How do you feed it to the hogs?

A. The hogs husk it themselves.

Q. What-does corn average per acre?

A. Last year I husked an acre of corn of the flint variety and got 103 baskets, which I think was very fair.

Q. What kind of baskets, grape or bushel baskets?

A. Bushel baskets.

Q. What corn, the Northwestern dent or the Minnesota King,- do you prefer?

A. The Northwestern dent.

Q What kind of harrow do you use?

A. I use the Boss harrow; the ordinary harrow.

Q. You sow your rows how far apart?

A. Three feet and ten inches apart.

Q. What kind of a harvester do you use?

A. Peering corn harvester.

Q. What weeder do you use?

A. I don't use any. I use the Boss harrow and that keeps it cleaned out.

Q. Do you have any trouble of having the snow blow into your shocks?

A. It hasn't snowed yet.

Q. In former years?

A. I wasn't raising corn at that time.

Q. You say that you let your cattle and horses husk their own corn?

A. Yes sir.

Q. How do you know how much you ought to feed them?

A. I feed them what they want.

Q. At what stage do you cut the corn, when ripe or in the milky stage?

A. When ripe.

Q. In your comparison of the wheat and the corn how did you estimate?

A. I husked one acre, the result of which I gave you. I husk the corn and put it into the stacks and use it when I want it—haul it out and feed it.

Q. How deep do you put the seed in the ground?

A. Just to be sure that it is planted and covered.

Q. How deep?

A. That will vary acccording to the soil. In some soil it will go down about two and a half inches; in fall plowing about an inch or an inch and a half. The best results come from the corn that comes up the most rapidly.

Q. Won't the drag pull the corn out?

A. It has not with me, I have dragged it. until it is six inches high.

Q. Which is the best, fall or spring plowing?

A. Fall plowing is a great deal the best. You get larger ears and it matures earlier.
Q. Don't you get better results from husking it and then feeding it?
A. No sir. I feed just enough and watch that they don't waste any of it.
Q. How much does it cost to husk the corn?
A. .It costs more than it is worth; that is my experience.
Q. In cultivating you corn what time do you do your last cultivating?
A. As near up to harvest as possible.
Q, How does the drill compare with the corn planter?
A. It is not very satisfactory.

Mr. Randall: We will adjourn now until 7:30 p.m.

EVENING SESSION.

Mr. Randall: We will now listen to Prof. R. W. Waugh on the Continuous Cropping of Wheat. I take pleasure in introducing to you Prof. Waugh.

PROGRESSIVE WHEAT GROWING IN THE RED RIVER VALLEY.

BY R. W. WAUGH.

For centuries to come wheat will be the staple crop of this country. But if that is to be so we must so plan our farming processes that the natural fertility of the soil is not to be wasted, but maintained, as it cannot possibly be on our present methods.

Everywhere we hear of soil exhaustion. It was rich enough when we came in, but we have done our best to impoverish it, sometimes byways that did not even put money in our pocket. Every prairie fire that ran over that land destroyed vegetable mould enough to make three or four wheat crops. We have scourged it by bad management, and everywhere we hear the cry, what shall we do next.

Some things in our natural environment we cannot control. We cannot change the texture of the soil itself. We can only try what treatment and crops will best suit our farm and act accordingly. We cannot control the seasons or hail storms, or cure rust.

But we can prevent smuts, and treat our land so as to save moisture for good crops, part of which now goes off in the air and part to grow weeds. We can rotate our crops, and we can use simple but effectual means to attract nitrogen from the air and restore vegetable matter to the soil. Soil exhaustion can only be restored as we restore the vigor of a tired-out horse. We must do it by proper feed properly administered. Let me show you here the program of a talk at a farmers' institute in Manitoba. We go out under the patronage and at the expense of the local government, collect 50 to 100 intelligent farmers, talk to them half an hour on it, answer their questions, and hear their opinions on the question at large. With your permission, I shall talk along much the same line here and invite your questions and criticism on what I have to say.

Program on a sheet six feet square shown on the platform.

Soil exhaustion.

Causes and remedies.

Nature of the Soil—
1. Silt produced from primary rocks.
2. Debris of more recent rocks.
3. Alluvial deposits.
4. Humus—decaying vegetation.

Fertility Exhausted—
1. By continuous grain growing.
2. Summer fallowing, good and bad.
3. Prairie fires.
4. Bad management.
5. Weeds.

Remedies—
Restoring the humus.
1. Crop rotation.
2. Barnyard manure.

Rotation Crops—
1. Brome grass.
2. Fodder corn.
3. Roots, clover.
4. Oats, cut green.
5. Barley and millet.

Stack Feeding—
1. Buy and breed grade beef cattle,
2. Never use a grade bull.
3. Never buy a show bull.
4. Bulk food for growing animals.
5. Concentrates to finish.

DROUTH.

Limited rainfall is one of the familiar difficulties with which the Red River Valley farmer has to contend and the further west we go the greater does that difficulty become. In the early days this shortage of rainfall was much aggravated by the bad effects of unskillful fall plowing. Fall plowing is one of the very best ways I know for drying out the next years seed bed, and perpetuating crop weeds. It not only embalms the seed as I have already tried to show, but it wastes much of the limited amount of sap left in the ground and instead of our seed going into a nice moist, well compacted seed-bed, the very finest of all seed beds for wheat, the land is often left so loose and dry that it will blow away even in mid-winter, and rarely does any spring pass without many tons of loose mould being blown off every acre of our wind-swept prairies.

How to avert the mischievous effect of these over-dry seed beds is now better understood than in those early days. To harrow and even roll heavily close behind that fall plowing is one way that I have found very successful. The press drill—not the sham apology, but a drill that will-squeeze down the mould along the track in which it has deposited the seed is another help of great value to prompt germination. To sow east and west as a safeguard against blowing is another point worthy of attention. These devices for saving moisture and making it available for our wheat crops are, I trust, familiar to every practical farmer, and I have mentioned them now mainly because I want to lead up to a point that some very practical men have never yet reached. If I get the ear of one of these men and lead him to recount his experiences he will tell me that his land is much easier dried out now than when he first knew it.

Such is the fact, and to my mind there are two causes for this tendency to dry out. One cause is the bad management, of fall plowing especially, which produces a loose, dry seed-bed as I have just tried to show. This is a defect which can to some extent he remedied by the more skilful use of mechanical means. Put every true student of plant life knows that one of the very best ways to hold moisture-is to have a sufficiency of vegetable mould in our land. Every succeeding crop of grain sucks out of the land another installment of its humus, and thereby makes it more susceptible to drouth. Perhaps it is no exaggeration to say that for every crop of wheat we take off, it will take half an inch more rainfall in the growing time to put the land in equally good moist condition for the production of the next crop on a soil of moderately open texture.

WEEDS

Besides the dryness due to the absence of sufficient humus in the soil, there is the demand made by the crops of pigweed and buckwheat that are found everywhere in greater or less profusion.

These weeds, unless checked by the prompt use of the harrow as soon as they show their first green leaves among, our crops in the spring, will send their roots straight down and secure for their own benefit the moisture so badly needed by our more valuable crops. To my mind weeds are just nature's silent protest against perpetual wheat growing. Wholesale wheat growing means fall plowing, and no matter how well we manage the mechanical part of our work, we are still burying and embalming a more or less abundant stock of foul seeds that never fail to germinate at the first favorable opportunity.

SUMMER FALLOWING.

When weeds get so abundant and crops so unsatisfactory that we can no longer reckon on getting paying crops by easier methods, we make a virtue of necessity and try summer fallowing. If continuous wheat growing is our sole object, I know of no better plan than summer fallowing if properly set about. I was once, in August, walking along the land of a level-headed old Scotch pioneer on which he had done a bit of what I thought was beautiful fallow work The mould was fine, yet compact, an ideal seed-bed for wheat; the result of repeated rounds of the harrow. "But," said my friend, "there is one thing I cannot understand. I fallowed that land to get rid of. pigweed, and though you and I believe that harrowing is the best way to make that seed grow, yet I have seen very little of it." The summer had been a rather dry one, furnishing no moisture to speak of, and I was for a time at a loss to read the riddle. At last I asked when he began to harrow it. "As soon as it was all plowed." In short, the land had been dried by weeks of warm sun, and had hardly moisture in it to germinate a single seed. The careful cultivation furnished a splendid seed-bed for the weeds as well as the wheat, and on the spot I promised George the biggest crop of pigweed next year that he had ever reaped. George never needed another lesson in summer fallowing, for I know no better farmers of the old school than he is. That was many years ago, yet I am sure there are too many men doing much the same work now that he did in his prentice days.

In this country fallowing can hardly be started too early, and should be made a good job of; fairly deep plowing, followed closely by say a double round of the harrow. If a shower or whole wet day comes along, harrow once more as soon as the surface can be gone on without puddling. Some men tell me it pays to harrow a dozen times, and if in the

fall there are pigweeds some inches high cattle will hold picnics there, and if no cattle, snow will lie, and prepare that land to start your wheat with a rush on a surface free of foul seeds, and a seed-bed that no common drouth can affect. A firm seed-bed means early start, free growth and early ripening of a high grade crop of wheat with enough straw to stand it up good and strong, enough and no more. Two or three grain crops may follow a good fallow, and the plowing may be much shallower for the second than the first. If the first crop of wheat is strong the disc harrow may be quite enough for a second wheat crop. We sometimes burn the stubble in the spring and seed on that without more ado.

But no matter how skilfully we cultivate, so long as we do nothing but grow grain continuously we are simply working out as fast as we are able the stock of humus and readily available nitrogen that nature in her own quiet, deliberate way has been storing up for our benefit. And it is more than likely that in fallowing we work off a good deal more fertility than goes into our wheat crops. Sooner or later, and very soon for most of us, will come the necessity for doing something to restore the humus that we have been doing our level best to work out of our land.

Mr. Randall: I take more than usual pleasure in introducing to you the next speaker whom I have had the honor of listening to in connection with the Farmers' National Congress. He always has something to say and says it well-Col. B. F. Clayton.

Col. Clayton: Mr. chairman and fellow citizens, and by this I mean the ladies—as they ought to be. They generally, succeed in what they undertake, even to conquering an unruly husband.

My good friend says that I have been doing some work in the Farmers' National Congress—and I have. I have been meeting some of your best representatives from the state of North Dakota. One thing they have told me, you have a splendid city up here, and that is true. I have studied agricultural statistics, statistics of production—very closely, and I have come to the conclusion that North Dakota is one of the best states in the union—of course excepting Iowa.

I am going to do something now that I very rarely do and that is to speak from paper. I am glad that I didn't disappoint you—that is to say, I didn't disappoint you in coming.

THE FARM AND THE FARMER.

COL. B. F. CLAYTON, INDIANOLA, IOWA.

Ladies and Gentlemen: Agricultural pursuits are as old as the race of man. It was the first factor in reclaiming man from a barbaric and a savage life. It was the first and has been the foremost of all occupations Ancient history has been so confounded with the mythical, and so interwoven with tradition, romance, and poetry, that it becomes difficult to separate facts from fiction, or to divide the legendary and dreamy mists of men from what has been practically realized.

I have not the time, nor have I the disposition to stop to consider whether mythology is history changed into fable, or whether fable has been changed into history. It is not essentially important to us to know how much of truth may be contained in the graphic description of the farm in the poetic language of antiquity; for it is a fact that since man was placed in the garden and commanded 'to dress it and to keep it, the

farm and the farmer have ever stood between the world and want, and the art of cultivating the soil and securing from it what is necessary to maintain animal life has been the problem of all the ages.

The entire assets of the Patriarchs consisted of the flocks and the herds that roamed over the hill country cast of the Mediterranean, while the rich valleys of Egypt became known as the land of corn.

You that read your bible will remember something of the episode between Jacob and his father-in-law Laban. Jacob seems to have became the first practical and scientific stock man, and by his shrewdness, imparted by his mother, he succeeded in securing the most of his father-in-law's property. You will also call to mind the fact, that while Joseph, the favorite son of Jacob, was sold into Egyptian slavery, yet he retained enough of Hebrew shrewdness to become the chief butler of a royal household and the prime minister at the courts of Pharoah while Joseph might have been actuated by higher principles than the modern board of trade speculator, yet he demonstrated his ability to run a corner on corn in such a way as to get, not only all the money his friends had in Palistine and in Egypt, but all the land and live stock of both countries.

The first agricultural pursuit was in the valley of the Nile, a strip of country from seven to eight miles wide and from five hundred to seven hundred miles long. The sediment deposited by the annual overflow of the river formed a splendid top dressing upon which seed was sown as the water receded—the stock turned on and the grain trampled in, and all they had to do was to await the harvest. They wanted no fertilizer, the overflow has kept the land rich and its production as certain today as it was four thousand years ago, That valley has been to the City of Cairo, what the great Northwest has been to the City of Chicago, and while it is small in extent it produces in greater variety than any country on the globe.

Upon the tombs of the pre-historic ages is found the representation of the plow and the farmer and stockman resting under the shadows of the pyramids long before the Christian era and the interest inspired in agricultural pursuits spread with the advance of civilization over the continents of Asia, Africa and Europe. The republics of Athens, of Carthage and of Rome, became deeply absorbed in agriculture. It became the prominent theme of the poet and the first consideration of the statesmen. The Roman senate ordered the writings of Mago, the bright Carthagen-ian, translated into Latin for the use of the Roman farmer. We find the first traces of agricultural literature in the writings of Pericles, Plato and Socrates; and the writers of the Orient and of the Occident discussed every phase of farm life. They studied the cereals, the grasses, horticulture, the live stock, and the chemicals of the soil was well understood. Pliny declared that it was not uncommon in northern Africa and in Italy to find from two hundred to four hundred stalks of wheat growing from one single kernel. Cato was an elaborate writer on the various branches of farm pursuits. Virgil, the sweetest of the Latin poets became enthusiastic regarding small farms and thorough cultivation. It was Virgil who declared that seven Roman acres, about equal to three of ours, was enough for any Roman gentleman to farm. Varro became the advocate of the compost heap and the fertilizer. At the downfall of the Roman republic agricultural literature had reached the highest point in the history of any age, except that of England, France and Germany of today. It was the revenues of the farm that paid the expense of the togied courts of Caesar, furnished the armies of Brutus

and of Cassius, supported the regal granduer of Mark Antony and supplied the wines offered to Basshus at the drunken and disgraceful courts of Nero.

While the Roman farmer was somewhat restricted in his civil rights; yet, Roman and Egyptian mythology has been liberal in supplying; him with innumerable Deities. One informed him when to break his ground in the spring, when to cross plow, when to use the harrow, when to harvest and another when to sell his crop, if 'the grain grower of this day was doing business under the same conditions and could get a stand-in with these mythical Deities he could outstrip what Joseph did in Egypt, but the farmer of today is not the object of such profound solicitude from any source.

The dark days of agricultural pursuits dates from the downfall of Roman democracy to the dawn of English history. It was the pen of Sir Walt Blyth, Hugh Platt, of Jethro Tull, and of Arthur Young, in the riper years of Anglo-Saxon civilization that awakened agricultural progress from the sleep of more than two thousand years.

One of the forcible theories of Mr. Young was that to suppose that agriculture should ever rest upon a scientific base, regulated by just and accurate principles without the chemicals of the soil being well understood is a childish and ignorant superstition.

There is no better place for me to discuss what I believe to be the practical and paramount question of success to the farmer 'than at this point of my address. Some one has truly said "the farm is the foundation of the riches of state," and who dare deny it? When a man fails, in other business that he will make a success on the farm is a falacious idea. It requires as much solid thought and brain to reach success on the farm as it does in the professions. Mr. Libig and Sir Hugh Davey, more than fifty years ago agitated the question that a higher education, and a better understanding of the science of agriculture be taught in our common schools. Not that they could get the full scope of science, but the elementary principles that would enable the farmer boy to, in part, analyze the soil and to determine what crop would be the most successfully raised. It is as essential for the farmer to know how to handle his farm successfully as it is for the attorney or the physician to understand his case, or for the chemist to know how to compound his drugs, and the best place to gain this knowledge is in the common schools. If suggestions of eminent writers of fifty years ago had been adopted there would have been less complaint of abandoned farms from New England and the south today. It is true we have experimental stations that can make your analysis, but it would be more practical to teach the elementary principles in the common schools and thus place the farmer in possession of the means to determine what crops would be the most profitable on his farm.

In the development of Iowa, the Dakotas and this great and grand Northwest there has been no question as to the best crop for the farmer. Twelve years ago, the train upon which I was a passenger between Duluth and St. Paul on the Great Northern Railway, was sidetracked at a little way station at midnight while eight massive trains of wheat passed us. To me, this solved the problem, that wheat and its kindred crops was applicable in the Northwest. But, did you ever stop to consider that it is an inevitable law of nature, fixed and inflexible, that you cannot indefinitely continue this crop without giving something in return for it? You continue to raise wheat for a long series of years and the best farm in the great wheat region will be sold for tax. We

could hear no complaints from New England, the south and middle states" if in their cultivation the farmer had given back some recompense for the magnificent crops they have harvested and such a thing as abandoned farms would never have been considered by the statistican. You of what, what we call the Red River regions of the North, the great watershed and wheat emporium of the world, are to be congratulated upon the untold wealth that is now filling you coffers, Your product is marvelous and astonishes the world, but continue your wheat crop for half a century and you would have to import your breadstuff. It is now, in this high-day of your success that you should begin your rotation of crops and the preservation of the farm. If not this inflexible law of nature will come to you in abandoned farms as it has come in the past to New England, the south and to the middle states. We have long since been forced to temporarily abandon wheat as a staple crop in Iowa and southeast Minnesota until we restore the wheat producing qualities of the soil. As I have said. Pliny declared two thousand years ago that it was no uncommon thing to find from two hundred to four hundred stalks of wheat growing from a single grain, today she largely imports her breadstuff, unless she imports costly fertilizers. The only country on the earth where you can continually grow the same crop is in the valley of the Nile, where the overflow has formed a top dressing for four thousand years, and may continue for a million years with the same regularity as that of the seasons and the ages.

There may be some question as to the application of the principle of evolution in the development of governments and individuals, but there can be no well founded criticism to the proposition that the farmer has plodded his way for more than four thousand years along lines in complete harmony, not only with the ancient theologian, but with that of Darwin, Spencer, Huxley and the entire brood of modern scientists. For more than forty centuries the farm and its labor has been the great wealth producer. The city, the town, the mechanic and the professions are not producers, they are consumers. Every wealth must come from the farm—from the soil. Under the stimulant given to agricultural pursuits by eminent scientists, and the artificial aid given to a soil already rich and deep the English farmer reached the highest tide of prosperity and their lands advanced to fabulous prices, The progress made by the farmer in the last half century has been beyond our comprehension. It is within the memory of man and during the last half century that much of mechanicism and of science has been applied to the farm stripping it of its menial drudgery. The emigrant from the old world where lands are largely held by installment and where the poor man has little hope of securing a farm, have come within our gates to cultivate the rich valley and plain of this great new continent of ours. While the early settlers of this country better understood the art of farming than those of the darker *ages*, yet their modes seem primitive when compared with the improvement of today. Our forefathers, in the beginning were farmers and mechanics. First he was a farmer, and used the other vocations as incidental to the first employment. He lived almost entirely within his own resources. He created his own cabin, constructed his own fire-place and chimney and fashioned his own implements. It has been less than fifty years since you could hear the spinning wheel and the hand loom in the American home. A portion of the farm was set apart as the "flax patch" and when the crop was pulled, bleached and broken it was woven into cloth for the use of the family. The cotton and the woolen submitted to the same preliminary

process and were manufactured into "homespun" without leaving the farm. The skins and the furs of animals were tanned on shares and converted into shoes, often by the farmer himself both on the same last and regardless of a fit. Like the old Greek philosopher the American farmer made his wants few and learned to supply them himself.

The evolution on the farm for the last fifty year has been wonderful. Art and science and the mechancal genius has been a great factor in the onward march of the age. These great forces have taken the primitive implement from the hand of the farmer and have made him the master of a machine and have bade him perform the labor of a score of men. The flail and winnowing process of which Milton wrote, and which Dryden so graphically and poetically described has passed away and made room for the steam thresher and separator. The old mode of plowing, "with one to hold and one to drive" in plow- ing a half acre per day, has been abandoned and one man can now do the work of ten. The cotton gin and compress has reduced the cost of production more than half. The spinning wheel and the hand loom is a relic of the past and the factory girl may now touch a button and put in motion ponderous machinery performing the labor of hundreds.

Everywhere we see the joint result of these great forces. They are in the powerful engines that sweep the valley and plain. We see them as they drive the mighty ships of war and of commerce that disturb the tranquil waters of every ocean carrying the product of the farm and the factory to every civilized port.

In securing the magnificent results the American people now enjoy I would not have you understand that the farmer was the only factor. In the onward march of the age we cannot ignore the artist and the professions. In felling the forest and in the development of our splendid resources the process would have been slow without the scientist, the mechanical genius, and the profession. There is an interpendence existing between the various occupations that interlock and interlace each other like the wool and warp of a closely woven fabric and as inseparable as the intricate machinery of the human body.

It would seem that the American people had reached the climax in liberal government and the highest type of civilization, and in this onward march we should not forget that every industry and every institution is a contiguous part of a magnificent political organization.

Together these great forces have developed a soil rich and deep, They have gone beneath the earth's surface and revealed its hidden wealth. They have penetrated the mountain and searched the valley and the precious metals hidden away by miserable nature has become the life-blood of trade and of commerce. It has required all these forces to harness the silent agencies of nature and to make them subservient to man's will. These great factories in the world's civilization have made it possible, by silent and unseen force to guide the still small voice from distant friend to distant friend, and permit them to speak as if face to face though separated as widely as the bounds of a continent. Together they have furnished light, heat and health. They have clothed the world with better and cheaper clothing, but back and behind this great force is the chief factor—the farm.

From the vast and varied product of the farm springs the inspiration for every useful invention and every art that adorns. It promotes ever scientific discovery that enlarges our field of knowledge. To handle our surplus product 180,000 miles of railway has been called into exist-

ence; our merchant marine, warehouses and banking institutions organized. Factories have been erected, whose smoke darkens the sky above every village, giving employment to capital and labor, and activity to our commercial centers. Standing in the breach between these great con-fending forces, the friend of law and order, the farmer becomes the logical arbitrater between the discordant elements; and the most sensitive of all interests it is the first to feel the shock of vicious legislation and the distress of financial disaster.

From the farm comes the revenues that discharges every financial obligation. The street car fare, the interest on bonds, the dividends on stocks; the payment of grocery bills; the fees of the professions; the pensions of the soldiers and the cost of running the intricate machinery of all governments must be paid from the product of the soil. Even the gold and silver mines are rendered more valuable because of the wealth created on the farm; and a single year of total failure on the farm and wreck and ruin, starvation and death would be the inevitable result. There can be no controversy but what the farm must remain the true foundation upon which rests the beautiful temple of American success. With that protection that of right belongs to- it thrown around the agricultural interests, the government we love so well and the liberty that we praise so highly will be perpetuated.

It is doubtful if the farm is properly appreciated. It requires a quiet life and a love for home to make a successful farmer. In a great measure, the farm is void of excitement. Agriculture, with its institutions of learning has but recently taken its place beside other occupations with its leaders demanding profound research.

In our colonial days our forefathers looked upon the occupation with pleasure and with pride. At the time of the formation of our government, a large per cent of our political and military leaders came from the farm, and it is safe to say that seventy-five per cent of our population lived on the farm.

In the past the most potent argument against the farm has been its hard labor, but that has been largely overcome by improved methods and machinery. While the farm may be harder at times yet its labor is not so constant and unrelenting as that of the counting house, nor is its results so precarious and uncertain. No panic can invade its fields to scatter the savings of a life time and paralyze the arm of labor. No factory presents such splendid and certain results as the farm, with its fields white and yellow with their golden grain and orchards bending beneath the richest fruitage.

While it is an occupation in which fabulous fortunes are not so quickly made, yet it is an honest, healthy livelihood, and when wealth *is* once accumulated it cannot be so easily swept away. Whether or not the different classes have moved forward intellectually, physically and financially in the same ratio is a question; but the farmer is confronted with problems more complicated than those of other occupations. Being isolated in the past he has read too little, and often he is doubtful if he has been benefited by the little he has read. What little he does read often intensifies his prejudices and does not fortify him to cope with the great problems of life. He brushes so little against the world of which he is so important a factor that the world ignores his existence. He looks the matter up and finds he is enumerated in the tables computing the population but he is virtually expunged from the list of those who hold office. He is enrolled on the tax list but cancelled from the catalogue of those who levy tax. He is registered in the poll books but too often curtailed

in the right of citizenship by 'the manipulations of party machinery, and his environments drives, him to one of two characters; he must become a political healer and whoop it up for the other fellow, or be for- ever branded as a sour, stoical hay-seed.

But the remedy is in the farmers' hands. Whether he will assert his right remains to be seen No class of men will willingly remain slaves when the remedy is within their grasp; but let us remember, that great and lasting victories are established in mental combat, and such victories are more permanent.

But what of the future? Let me say the outlook is promising if we crystalize and unite our forces in common action. Until we organized the Farmers' National Congress, and kindred farm organizations, the American farmer was as isolated as Robinson Crusoe on his lonely island amid the great ocean. The benefits of these organizations cannot be estimated in dollars and cents.

We must study the greatest good to the greatest number of people. Mental combat with our fellow man enlarges our estimate of human life; and broadens our ideas in moral and mental culture and gives to us a better estimate of our true social and political position. That is the object of the "Harvest Home" and kindred meetings, and not to parade imaginary and fancied grievances.

I have often been asked—should the farmer go into politics? I answer most emphatically, yes, with his coat off and both sleeves rolled up. The citizen that takes no part in politics is not a good neighbor, a good citizen nor a good farmer. Every man, it matters not what his occupation or his political affiliations may be should take that interest in questions at issue as will enable him to vote intelligently and to the best interest of himself and his neighbor. When the political party to which you belong, through its organization has called the local caucus it is your place to be there and to aid in the selection of your best man, regardless of his occupation, to represent you in the higher councils of his party. You should remember that when the caucus has adjourned the door is closed and your authority has been delegated to another person to act for you. Nothing can be accomplished without organization. In the preliminary campaign it is the right of every man to help formulate the platform, and to advocate the nomination of any candidate he may see fit; but when the party in its proper organization defines the policy and nominates a candidate the only honorable thing you can do is to support the ticket. Should you fail to do this the only thing you can do is to remain at home sulking in your tent or check your baggage through to some other party manipulated by the same kind of political machinery.

I hold it to be true that it is the patriotic duty of every man to do the best he can to remedy existing evils by the use of the ballot. No man should remain behind the counter in the shop nor in the field on election day and intrust the welfare of his country to the political rustler. The .ward healer is not the best man for the safety of his country.

The way to maintain the highest type of republican government is for every man entitled to the right of suffrage to take an active part in politics from the first meeting of the local caucus to the close of the polls on election day. In my judgment it is infinitely better for you to miss 'the opportunity of voting than to neglect your township or ward caucus. When you have secured good men to be voted for good men can only be elected.

There is no danger of the farmer when he asserts his political rights

and his manhood. He is as competent to give and receive hard knocks as any class of men on the globe. At a recent meeting of the Farmers' National Congress in Fenuil Hall in Boston—that old cradle of liberty, whose walls have resounded with the eloquence of Sam Adams, Daniel Webster, Garret Smith, Charles Sumner and Edward Evert, was filled with American farmers. After the preliminary welcome and responses I was appoached by one of Boston's elderly and classical gentlemen who declared he had heard the men I have named, and in all those years he had never heard anything that surpassed that day. While I regarded a part of it as flattery, yet I want to say I was well pleased with the deportment and dignity of the farmer under a most trying ordeal.

A biographical sketch, furnished by its members discloses the fact that out of a membership of four hundred and forty-five composing the congress of the United States, the farmer had but one in the senate, and he was from North Dakota, and thirty-five in the house. The chairman of the agricultural committee of the senate recorded himself as a lawyer and he was from the poorest agricultural state in the union. The only farmer in the senate was down on the tail end of the committee. Ten of the eighteen members of the house committee, including the chairman was lawyers. The only chairmanship in that congress held by a farmer was that of "Acoustics and Public Health," the committee for which he was the least fitted. The great states of Pennsylvania, Ohio, Michigan and Missouri have one farmer each, while the best agricultural regions in the world—Indiana, Illinois and Iowa have no farmer in either branch of congress.

I do not know that either of the two great political parties are to blame for this condition of things; it lays at the door of the farmer; and if a fault, it is a sad comment on the party fealty and the patriotism of the farmer.

The farmer is a suspicious animal. As a class he looks with envy upon the rest of mankind. There is too many of them that concludes that all there is of life worth living is found within the brown stone castle of city life, behind the bank counter or riding upon the storm-tossed political ocean. He is too often enchanted by the glare and glitter of outward appearance. He does not consider the fact that beneath the surface of apparent wealth and supposed luxury there is often the most bitter disappointment and sleepless nights are often spent trying to solve the question of bankruptcy and ruin. We are not always able to look behind the screen and to come in contact with the true condition of things that often drive men to desperate deeds.

Do not misunderstand me. I would not have you believe that I have lost faith in American statesmanship, or that all congressmen are dishonest. I think that a large majority of our public servants are honest, but I want to emphasize the declaration when I say, if the mechanic, the laboring man and the farmer could always be actuated by the greatest good to the greatest number of people, and could_ always be relied upon to discharge his political duties in the fear of God and the best interests of his country we would soon have a better political atmosphere.

This country that we possess is a magnificent heritage. Its future possibilities cannot be estimated. In our mad struggle for success let us not forget our obligations to society and to our government. He is not a good citizen who will lay aside his duties to his government and to his fellow man, Farmer or whatever may be our occupation it is our duty to see to it that the vicious class that care nothing for law and

order are held in check. The political trimmer and the common street loafer is not the best man to control the destinies of our splendid republic ancl ttie political party lo which, we belong. He is not the safest man to administer the affairs of state. The farmer should have no patience with that spirit that would engender strife between capital and labor. It is granted that capital may become oppressive and that labor, through the machinations of the common agitator may become unreasonable, but the true position of these great elements is to go hand in hand in the onward mareh of this progressive age; they are dependent one upon the other, the one being helpless without the other; and they should be united against the common enemy that would make our politi-' cal and social arena attractive to the restless spirits at home and abroad whose business it is to ferment discord and distrust that would produce revolution.

I congratulate your fair young state of North Dakota upon the energetic class of emigrants that have come within your state. As farmers and as American citizens we should extend a welcome hand to all who come to our shores to better their social, political and financial condition, but we should let the foreign emigrant who expects protection under our flag know that he must leave his social and political vices behind him and he must become an American citizen and in favor of American institutions. To such as will make good citizens we should extend to them ten thousand welcomes, but we have no room for the vicious that would parade our streets with banners upon which are inscribed sentiments that would become disastrous to good government.

Great as our resources are, grand as our progress lias been in the past and bright as our possibilities may seem for the future, we will never reap the full benefit of this wonderful country until the rights of all men are respected; when the relations between capital and labor, corporations and people shall be fairly and impartially considered; when we shall agree upon - the enactment of just and equitable laws in the interest of the greatest good to the greatest number of people, then, and not till then will we enjoy the full prosperity that of right belongs to us.

Meeting adjourned until 0:30 a. m. Wednesday.

WEDNESDAY, JANUARY 24-

MORNING SESSION.

The Convention assembled at 9:30 a. m, pursuant to adjournment, President Randall in the chair,

Mr. Randall: I will now announce the committee on resolutions and as matters come up upon which this committee should act, they can be referred cither to the chairman or any member of the committee: Col. J. B. Power, chairman, Oscar L. Taylor, W. F. T. Bushnell, J. H. Worst, Thomas L. Bolton, G. N. Lamphere, Conde Hamlin.

Our next paper this morning is on Wheat in Minnesota and the Two Dakotas, **by** Prof. J. H. Shepard of the South Dakota School o£ Agriculture.

WHAT IN MINNESOTA AND THE TWO DAKOTAS—CAN THE YIELD PER ACRE BE INCREASED?

BY PROF. H. SHEPARD, DIRECTOR SOUTH DAKOTA EXPERIMENT STATION.

It is not the purpose of this paper to propound startling theories. Nor is it hoped that a final and complete answer to the question can be given at this time. But, it is hoped that a conservative discussion of the primary factors involved in spring wheat raising may be of value to the farmers of these three prairie states.

No apology is needed for limiting this discussion to the three states named in the captain. The conditions obtaining in these states are not only nearly identical, but they are typical of a large area of the prairie Northwest not embraced by their boundary lines. Their soils bear internal evidence of a common origin, while certain of their climatic features differ only in degree. . They are pre-eminently spring wheat states. Their importance as wheat producers may be gleaned by an inspection of the following statistics taken from the Year Books of the Department of Agriculture, 1897 and 1898:

STATE	1897		18 38	
	Acres	Bushels	Acres	Bushels
Minnesota.....	4,607,003	59,891,104	4,963,159	78,417,912
South Dakota ...	2,680,156	21,441,248	63,390,397	42,040,923
North Dakota	2,752,772	28,353,552	3,864,892	55,654,445
Total	10,039,9,16	110,085,804	12,218,448	176,113,280
The Whole United States	39,465,066	530,149,168	44,055,278	675,148,705
	¼	1-5ˣ	¼ˣ	¼ˣ

It will thus appear that in 1897 these three states had nearly one-fourth the acreage of the wheat grown in the United States and produced over one-fifth of the entire crop, while in 1808 the acreage was over one-fourth and the crop exceeded one-fourth of the entire wheat produced. Surely the needs of these three states are worthy of consideration at any time and in any place.

In these days of expanding commerce when the remote parts of the earth are brought close together by inland roads of steel and swift ocean grey hounds; when widely sundered nations have become near neighbors, the attention of economists is seriously directed towards the production of the world's staple supplies. The great prairie Northwest, the granary of the new world, is already attracting such attention. Hut, as I take it, it is not for this great assemblage of representative wheat growers to deal with the wheat question from the standpoint of the mere economist. It is for us to dwell upon the narrower, and to us, the more interesting and vital questions of increasing or at least maintaining the yield per acre. Even this narrow question is now receiving much consideration at the hands of experts both at home and abroad. We must remember that England, our chief customer for our surplus grain, also owns a goodly portion of the prairie Northwest.

The following statistics will reveal some interesting facts concerning the wheat yield per acre for Minnesota, South Dakota and North Dakota, covering a period of the last six years. These statistics are also gleaned from the Year Book previously mentioned:

	1893	1894	1895	1896	1897	1898	Av.
Minnesota	9.6	13.5	23.0	14.2	13	15.8	14.35
South Dakota	8.5	6.6	12.0	11.2	8	12.4	9.78
North Dakota.....	9.6	11.8	21.0	11.8	10.3	14.4	13.15
Averages	9.23	10.63	18.66	12.4	10.43	14.2	12.59

It thus appears that the average for Minnesota for the six years in question is 14.35 bushels per acre; for South Dakota 9.78, and for North Dakota 13.15, while the average for the three states taken together is only 12.59 bushels per acre. This yield is certainly low.

In fact the causes underlying this low yield are already a subject of much interest and some controversy. Various hypotheses have been offered in explanation. Some writers have attributed it to waning fertility, some to a deficiency in one of the more important plant foods, some to poor farming, etc., etc., and still others to climatic conditions. Thus each theorist has attempted to place his finger upon some one particular cause which is to be held solely responsible for Ibis state of affairs.

In the opinion of the writer it is now high time that we stop and ask ourselves, whether this low yield is due to one or to many causes. It certainly would not be the part of wisdom for us to spend all our time and energies slopping up one rat-hole in our wheat bins while a dozen or so mouse-holes are entirely neglected.

Before commencing a discussion of wheat yield, it would be well to state that there is often used an element of unfairness by some writers who compare spring wheat yields with those of winter wheat yields, or

who draw comparison between older lands under intensive cultivation with altogether different climatic conditions.

It is the belief of the writer that our conditions are unique and that any ameliorations de-sired must be sought for among the peculiar factors immediately involved. Acting upon this belief the following considerations are submitted:

Climate-—Much depends upon climatic conditions. Among the most essential of these are our rainfall and winds. The region under consideration is not one of excessive rainfall. This fact alone is not, as some would have us suppose, an unmitigated evil. On the contrary it oilers almost ideal conditions for the conservation of soluble plant food that is invariably washed out of the soils and lost in drainage and surface waters where an excess of rain occurs over and above that required for maturing the crop. It is now the expressed opinion of those who are competent to judge that our average rainfall is sufficient for maturing our wheat when intelligent steps are taken to conserve the moisture at our disposal. And, now, since it is absurd to attempt to increase the annual rain fall, it follows, naturally enough, that our utmost endeavors should be given towards retaining what moisture we have. This will be referred to later on.

WINDS—That the winds profoundly affect crop production cannot be denied. High winds in the spring not only uncover the grain sown but when occurring at a later period often act like a sand blast cutting off_ the growing blades and causing much damage. Again, hot winds striking the grain when it is forming heads or when it is going into the milk state may prevent the heads from filling properly, thus lessening the yield by shrinkage. The remedy in both cases, so far as they may be ameliorated, is an abundant supply of rather coarse humus which prevents the soil from blowing and retains the ground moisture.

Moreover, we now have hardy shrubs and trees which stand perfectly in this climate and which are suitable for hedge rows and wind breaks-along our roads and lanes and around our fields. These trees are both ornamental and useful. I refer to the Elaegnus or Russian Olive, and to the Caragana Arborescens or Australian Pea Tree. Both these produce seed from which they are readily propagated. The latter can also be grown from root cuttings. The Elaegnus grows to a great height while the Caragana is more suitable for low and ornamental work.

In regard to hailstorms which sometimes occur over limited areas in these three states, it may be said that there is no remedy known. They never affect the whole region at once, hut they have a marked effect when tabulating results for the whole region.

SOILS—Our soils are mainly derived from the weathering of a yellow drift or boulder clay which usually extends as a subsoil to the depth of from twenty to forty feet. This fact alone precludes the possibilities of soil exhaustion so far as mineral food is concerned. Moveover, from published analyses from the other two states and from an extended chemical research upon soils now in progress at the South Dakota station, the same conclusion must inevitably be drawn. We have thus eliminated from the problem before us the question of a sufficient supply of mineral plant food, such as lime, potash and phosphoric acid. It now remains for the farmer simply to provide these foods in a soluble condition suitable for plant consumption. This will be discussed further on.

But our soils in addition to mineral plant foods must also contain an abundant supply of humus or decaying organic material. Moreover, this humus must be rich in nitrogenous matter, since nitrogen and the

mineral plant foods previously mentioned are indispensible for plant growth.

It is not so certain that all our wheat soils have an abundant supply of humus rich in nitrogen. This statement is made with full knowledge of the fact that most of-our soils have a much larger per cent of nitrogen than the best English wheat soils. There are other offices than that of simply furnishing nitrogen to our crops which humus is called upon to perform. An, abundant supply of humus places our prairie soils in a condition to work up into good tilth. It keeps them from blowing. It tends to conserve soil moisture and it unites with and renders soluble potash and phosphoric acid. Bearing in mind these varied and important functions of humus it is quite certain that our peculiar soils under our peculiar climatic conditions require a much larger per cent of humus than the soils of England or of any other wheat growing country where excessive rainfall is the rule and not the exception.

Too little care has been exercised by our wheat growers in maintaining the supply of humus. Thus another place for improvement is indicated.

Too much reliance has been placed upon the roots left in the ground and upon 'the stubble left after harvesting to supply the necessary humus. It is true that the grain roots and stubble nearly equal the straw removed. Rut the humus formed is poor in nitrogen and slow to decay.

Again, many have lulled themselves into a fancied security from crop deterioration by a wrong application of the valuable lessons derived from the experiments of Rothemstead, where wheat has been grown after wheat for fifty years without manure of any kind. The last crop so grown was twelve bushels per acre, showing a decrease of from thirty bushels, the average of Great Britain to twelve bushels, the average of the United

•Stales. Such a proportionate decrease would ruin grain growing in the Northwest. The spring wheat grower must remember that he has a different soil, a different climate, and a different variety of wheat to contend with when compared to those concerned at Rothamstead.

But few of our best authorities, however, are inclined to attribute our waning yield to soil exhaustion. A recent English writer, Henry F. Moore, has lately sent to this country a pamphlet dedicated to the Ministers of Agriculture of the United States and Canada, and to the Directors of the Experiment Stations of those countries. In this brochure he has brought forward the theory that our low yield is due to a lack of soluble nitrogen for the young wheat plant during the early spring months. This lie contends stunts the plant and delays its maturity, thus materially affecting the yield. He proposes as a remedy the application of a small amount of soluble nitrogen as nitrate of soda. lie says:

"From the facts taught us from Rothamstead as to the losses of nitrates in drainage waters, and about the big wheat crop of 1898, we also know that the big wheat crop of a year ago could be, as Sir J. B. Lawes wrote me, clearly traced to the accumulation of nitrates, due to the dry winter of 1897-98, and their liberation and dissolve by the large rainfall of May.' It is in this early stage of the life of the wheat plant that nitrogen in available force is more urgently needed by the plant; it is in spring also that even the richest soils are usually deficient in such food in available (i. e., nitrified) form and immediately assimilable by the plant. The winter is just over, and in it the soil has been washed and denuded of its available fertility. The spring is still cold, and soil nitrification is cither inactive altogether or very sluggish, and the result is that the

young plant is starved and checked, unless, indeed, man comes to its assistance and gives it the necessary food in such quick-acting and immediately available form as nitrate of soda.

This knowledge throws a vast amount of light on what is probably needed to make the prairie soils more fertile. On all these soils the life of the wheat plant is short, and the varieties grown have therefore lo he those which grow quickly and mature early, in the past the greatest amount of attention has been devoted to the later life of the plant—to the early ripening. The earlier life of the plant has been neglected, or at any rate, it has not had the attention paid to it that it deserves. To secure the best results, and to give the plant a chance to exercise its full powers, it is absolutely necessary that from germination to harvest its growth shall be continuous and unchecked. This cannot be the case if in the earlier stages of plant-life nitrates in available form for the plant to take them are absent or deficient in the soil. The period of growth must then be longer, and the ripening is pushed on to the dangerous early autumn frosts. Curiously enough a report has just been officially issued dealing with wheat-growing in some of the western parts of New South Wales, in which this point is brought out. "As nitrification is more active during the summer months, we find that in the early spring the amounts of nitrates available is deficient," the result being that (with early maturing wheats) the crops are poor and the grain shrivelled. This, it is worthy of note, is written of a country "where loss of plant food is rarely caused by excessive drainage." in Canada, also, some researches by Professor Robertson, of Ottawa, give us information which bears very forcibly on this subject. He has found that even where land is richly manured the time at which the nitrogen becomes available for the plant (i. e., nitrified) is not until after mid-summer. In the case of green crops ploughed in the autumn (a form of cheap manuring of which we have heard much in recent years) the nitrogen does not begin to become available for the plant until the following July, while in the case of farm yard manure applied to the land in the spring the period at which nitrification commences to supply nitrogenous food to the plant in available form does not arrive until after midsummer day has passed. The result is (so far as cereals are concerned) a stalky and leafy growth at a period when the formation and ripening of the grain ought to be taking place.

During my visits to the prairies, and more especially in that paid during the past summer, this question of the supposed soil exhaustion has interested me very much, and in connection with it I have noted the conditions of the western country, and more especially Manitoba, very closely. That the early stages of the wheat crop both here and in the two Dakotas and Minnesota, are accompanied by a deficiency in the soil of nitrogen in available (i. e. nitrified) form for plant food cannot be doubted. During the winter the temperature is frequently down to 35 degrees F. to 40 degrees F. below zero, the most severe cold being in January and February. The land is frozen up, and in the spring, as soon as a few inches of the surface is thawed out, the ploughing and seeding takes place. Germination takes place on what is really a subsoil of ice, and it is only when the summer is well on that any nitrification can take place. The continual thawing of the soil keeps the plant well supplied with moisture, while from the same cause the dew on the prairies in the spring is quite equal to a very reasonable rainfall. In spite of this very beneficial condition, I was told on all hands that in its young stage the position of the wheat crop is always critical. This, as I have already

shown, is not to be wondered at. Rich as the soils are, there is a period which, we may safely say, extends over the first six months of each year, when the temperature is not suitable—is, in real fact, dead against—that nitrification of the nitrogen in the soil humus which is a first essential to effective fertility.

This being the case—and all our modern research points most clearly to it—we ought to be in no doubt as to the remedy. Nature's shortcomings must be supplied by man if these rich wheat lands are to produce to the full abundance of their powers.

This theory certainly has the merit of simplicity in detail and in ease of execution. But like other single cause theories, it fails to recognize other essential factors.

I am riot in a position to deny that there is or is not a lack of soluble nitrogen in our soils during the early spring months, nor that this may be a contributory factor toward our low yields. We shall make tests along this line during the coming season at the South Dakota station. But I should hesitate to guarantee to the fanner an increased yield if he applied nitrate of soda. I am certain this application would be useless where the crops are destroyed by blowing, hail, and hot winds, and excessive droughts. In these the expenses of its application would be simply an additional burden. I am also inclined to believe that Mr. Moore has underrated the rate of nitrification in the earlier part of the wheat growing season. The nitrifying bacteria are capable of working at comparatively low temperature.

Warington has found that a considerable amount of nitrification goes on at temperatures between 37 degrees find 39 degrees F. It becomes really active, however, at 54 degrees F., and reaches its greatest activity at 0.9 degrees F., when it is ten times as active as at 57 degrees F. 'It ceases entirely at 32 degrees F.

Fortunately we have a record of soil temperatures at the South Dakota station, covering the growing months for the past three years, and extending to a depth of from 4 inches to 5 feet, About the middle **of** April when our wheat is germinating, at a depth of one foot, the temperature is nearly 32 degrees, while the surface is usually much higher, but sometimes freezing at night. By May ist, at one foot, it has usually risen to 42 degrees F., at which 'temperature a considerable nitrification surely takes place.

The following table gives the average soil temperatures at 4 inches and 12 inches for the past three years, for the growing period extending from May to November:

	Four Inches	Twelve Inches
May	65 25	52
June	69 22	56 55
July	81 26	87 98
August	75 91	66 88
September	68 30	62 89
October	53 34	54 89
November	39 84	39 13

This table shows that nitrification is really active during May and June, or at least two months earlier than Mr. Moore supposes.

It also shows that nitrification continues, actively, during the latter part of August after the wheat crop is harvested, and also during September and October. This throws a flood of light upon the causes of the almost magical growth of weeds that follows immediately after the removal of the wheat crop. Now, since this weedy growth removes available nitrogen and locks it up in an insoluble form, we must certainly place it among the factors causing low yields. In "this case the remedy is simple and requires the application, not of nitrate of soda, but of early plowing just as soon as the crop is removed from the field. This plowing will also increase the activity of the nitrifying organisms, thus favoring largely the accumulation of soluble nitrogen in the soil. It is true that the weeds which follow the wheat crop do not remove the nitrogen from the soil, but they do render it insoluble and unavailable, in which state it is most sure to remain for a year or more, especially if these weeds are plowed under late in the fall. In case early plowing is impracticable, pasturing off with sheep is still a better method of treatment.

I am also inclined to think that Mr. Moore has overestimated the danger of losing soil nitrogen by leaching, especially in the two Dakotas. The mean precipitation for many years for the autumn, winter and spring months of North Dakota is only 5.35 inches, and for South Dakota is 6.93 inches. When we remember that the precipitation during this period seldom occurs in heavy showers, it will become apparent that there is little danger of our soils leaching. Our heaviest rainfall occurs in the summer or growing months. At the South Dakota station we have determined by excavation that our wheat roots penetrate the soil and subsoil to a depth of nearly six feet. It is therefore doubtful if any appreciable amount of soluble nitrogen escapes beyond the reach of the wheat roots. Moreover, a failure in most instances, to detect nitrates in our shallow well waters, strongly confirm me in 'the same conclusion.

SEED WHEAT.—.There can be but little doubt that our farmers, as a general practice, have given too little attention to the quality of the seed sown. Spring wheat is a quick growing wheat and is at the best, not overly generous in its yield when compared with the slower growing winter varieties. It is a well understood law that early maturity and large yield are never found combined in the same plant. Spring wheat is no exception to the rule. Most farmers sow their seed without grading out the imperfect kernels, which are prompt to give birth to a sickly and inferior offspring, and, indeed, too many of them sow it without cleaning at all, thus adding insult to injury by increasing the foul stuff which follows the crop and robs the soil of available plant food.

Again, by careless practices different varieties of wheat are mixed together until it is now the exception to find a sample of pure seed of any variety. These different varieties seldom ripen together, consequently a portion at least of every crop is green when cut and shrunken when cured. This lessens the yield and reduces the grade.

Without attempting to enter into any discussion of varieties, it must suffice to state that the Fyfe vaariety, especially in the northern portion of Minnesota and North Dakota, gives a better quality, viz "No. I Hard," while the "Blue Stem" or "Velvet Chaff" variety gives a larger yield per acre, grading "No. I Northern." For Southern Minnesota and South Dakota the Blue Stem is preferable. But both varieties are susceptible of improvement. The Blue Stem is too prone to shell and the Fyfe gives too low a yield.

Probably one of the most praiseworthy results ever accomplished -, for the wheat growers of the Northwest was that at the Minnesota; station by Professor Hayes in breeding up new varieties of spring; wheat. It may safely be said that the new Fyfe and Blue Stem wheats, which he has originated are largely free from the objections just recited. When these wheats can be grown in sufficient quantity we may confidently expect a distinct amelioration from their intelligent cultivation. Meanwhile, there are to be had pure wheats of both varieties which are so superior to the low grade seed usually sown that farmers should make great efforts to obtain them.

SOIL TREATMENT—From a close observation of methods now obtaining in handling our wheat soils, the writer believes that much improvement is possible. Good reasons have already been given why a vigorous campaign against weeds should be inaugurated.

Again, the soil should be stirred much deeper that at present. Plowing to a depth of from three to five inches is now the rule over moat **of** the territory under consideration. I firmly believe that by gradually lowering the plow from year to year the depth may be safely increased **to** ten or twelve inches. It is true that this work must be done judiciously, taking care not to bring up too much new soil at one time, and adding constantly increasing amounts of humas as the soil is deepened, and by always making sure that the seed bed is firmly packed beneath and left loose on the surface. This deeper seed bed will afford better conditions for holding soil moisture and for furthering nitrification and liberating plant food in a soluble condition.

Our common mould-board plows are far from being perfect machines. They leave the ground too often in coarse lumps which dry out and waste soil moisture, prevent nitrification and the decay of humus. Moreover, they usually leave channels under each furrow which tend to augment the same objections. Again, they place stubble and coarse manure in a continuous layer between the furrow slice and the subsoil , beneath, thus impeding capillary communication between the two, thus tending still further to aggravate the objections previously raised. In • turning up new soil this is brought to the surface instead of being thoroughly incorporated with the soil as it should be, and the cut of the plow share is trowelling tending to form a hard-pan impenetrable to moisture.

From limited observations I am now hoping much better things of the new disc plows. They pulverize the soil, leave no channels, mix stubble and trash more evenly through the soil, and in cases where the plowing is to be deepened the new earth is mixed with the old, while the cut of the plow is a scraping cut, leaving the bottom of the furrow unpacked and readily permeable to moisture. These conditions are more favorable for decay of humus and for the promotion of nitrification, and for the conservation of soil moisture. Their greater ease of draft and rapidity of execution should encourage a wider use.

In the matter of firming the seed bed much greater care should be taken. Earlier and better plowing, a more liberal use of the harrow, and a wider patronage of the press drill for seeding are the most plainly indicated remedies.

In order to increase the soil humus the straw and stubble must not be burned according to the lamentable practice now prevailing. These must be returned to the soil. The straw should first be converted into manure by stock, and in this connection a strong plea for the conservation and use of more barnyard manure should be made.

There is only one case where the burning of straw and stubble can

be justified, and that but once, and that is as a preparatory step in destroying weeds. More stock should be kept on our wheat farms, such as cattle and sheep, for the aid they give in furnishing manure and destroying weeds.

Some rational system of crop rotation should he maintained, and where clover can be grown it should be employed to enrich the soil in nitrogenous humus. Where clover is not to be had the summer fallow with green manuring, such as plowing under a crop of green millet, should be practiced. When sheep are available, rape and Swede turnips should be grown occasionally and fed off in the fields. In any event, the supply of nitrogen in this climate needs to be large and must be kept continuously up to a high standard.

After this imperfect review of the main factors involved in growing the wheat crop in the Prairie Northwest, a summation of the main lines along which amelioration may be expected must suffice:

1. Conserve the soil moisture by thorough tillage, better plowing, and by a plentiful supply of coarse humus. Humus from stubble and straw will answer.
2. Guard against blowing by a plentiful supply of coarse humus, and by the use of the press drill.
3. Modify if possible the effect of hot winds by conservation of soil moisture and as rapidly as possible by planting hedge rows and wind breaks.
4. Provide a plentiful supply of soluble plant food by having an abundant quantity of decaying humus rich in nitrogen. That from barnyard manure, green crops plowed under or fed off on field is preferred. Practice crop rotation and keep more stock. Do not raise weeds. If any start, plow them under green or feed them off with sheep. Plow the wheat field as soon as crop is removed.
5. Sow pure, graded seed wheat. Remember that like begets like. Do not sow weed seeds.
6. Deepen the plowing gradually, increasing continually the supply of humus, thus affording more soil for the use of the nitrifying bacteria. When you can find a plow better adapted to our soils, buy it.
7. Prepare a firm seed bed, mellow on top. Use the harrow more liberally. Sow with the press drill across the directions of the prevailing winds.
8. Give due heed to all the foregoing details. Do not expect maximum results by improving in one or jwo particulars only where so many factors are concerned.

After reading this paper the following questions were asked:

QUESTIONS AND ANSWERS.

Ques. by Mr. Hayes: Which would be the most conducive to the action of bacteria, in the soil, simply discing and thoroughly killing the weeds or turning the stubble under and making it drier?

A. That would depend largely on what condition it was in. It would make a deeper bed for the bacteria, if you plowed it.

Q. Would you advise burning stubble wherever it is possible?

A. No, sir, I would not burn it—I am certain this would be useless.

Mr. Sheperd: A great many farmers think that they can get a different variety of wheat, a cross wheat, by sowing several different kinds

at once. I think there is hardly one case in a thousand where wheat will cross at all under these circumstances—not one case in ten thousand.

Q, What is good seed, big shells, and heavy wheat?

A. I think that is pretty good seed wheat.

Q. How is it if you screen it?

A. That would be very good wheat. I think that we ought not to sow small, imperfect kernels; it ought to have sufficient strength to get the young plant above the ground, and until it is ready to lay hold of the soil.

Q. Would you harrow as soon as you plow it?

A. I should unless I used a disc plow. I think it is a good plan to leave the land rough in the winter, so that if there is snow we can keep the moisture.

Q. Are there any successful disc plows on the market?

A. Yes, sir.

Q. How about the disc drill?

A. I don't like it. But I am going to get one and give it a trial next year. I wouldn't use any drill that did not pack the seed after it was sown.

Q. Would a disc drill be all right on summer fallow?

A, Yes, where the ground is perhaps a bit hard.

Q. On very light plowing?

A. No, I don't think I would use it on light land.

Q. Would you use a roller after using a shoe drill without a pressure wheel?

A. No, I would not do that. A roller is more apt to pack the ground too hard.

Q. The roller I mention is a Welland Pulverizer; it don't leave the ground smooth?

A. That is a different proposition.

Q. Wouldn't a disc spread the wheat out a little better?

A. I think it would.

Q. Do you understand the construction of the Monitor drill?

A. I believe it is a disc drill.

Q. Don't the wheels of the shoe drill do all right?

A. No, the wheels do not carry the weight of the drills.

Q. If you put on too much pressure, don't you sow the grain too deep?

A. You have got to have a drill that is somewhat adjustable.

Q. Can you get the seed too deep?

A. I don't think there is much danger.

Mr. Randall: I am very pleased to meet a newspaperman. The newspapers are certainly our friends and benefactors. They are not working for their own personal interests, but go to work for every good cause. I now have the pleasure of introducing to you Col. Conde Hamlin, business manager of the Pioneer Press.

THE PRESS AND THE FARMER.

BY CONDE HAMLIN.

Mr. Chairman and Gentlemen of the Convention: As you can see, I am not a farmer, and so I am going to explain how I happened to be here. I can do that best by telling you a story. There was a young man who had a very bad habit of getting full, and his father said to him, "My son.

you should learn to say no," and the boy replied; "Father, that is what I do say; the boys ask me if I have any objection." So, when Mayor Johnson asked me (I presume at the time in a joking way) if I would come up here and address this convention, I said yes. And the result is, I am here. But as I look over this programme and look at the members of the convention—as to what I am to say, I am like that famous billy goat that was on a steamboat on the Ohio River. The captain had asked every one nearly if they knew where the billy goat was going, and they didn't know, and finally he asked Sambo. He said: "Sambo, where is that goat going?" Sambo replied: "I don know, sah, 'deed I doan know, sah; the goat dun gone eat his tag."

I appreciate being here on an occasion where newspaper men are usually seen, and where it is their business and their pleasure to take up the important debates here given to this immense audience, and still more important perhaps because it gives its thousands of readers an opportunity to take advantage of the great good to be derived from such a gathering with such an object.

You have heard it said that the railroads were the making of this country; that they were the cause of its settling and its growth and prosperity, but I say that the newspapers have had as much to do with it all, as the railroads. When the St. Paul and Pacific Railway was built to Breckenridge, a newspaper was already singing the praises of the glorious Red River Valley, and that song has been taken up by the Fargo newspapers and the Grand Forks newspapers, and the country newspapers all over the valley, until all over the world the Red River Valley has a reputation like that of the Valley of the Nile in ancient times.

It was the newspapers in St. Paul that were significant in getting the people to subscribe to a thousand dollar bonus, and that bonus amounted to the building of the St. Paul and Duluth Railway, that completed the great link of the lines of the Northwest, and which got rid of the Chicago route, and gave us a direct line for our products straight through to Europe.

It was principally the St. Paul newspapers that got the people to vote five million dollars for draining the lands and Minnesota advanced over twenty-five years in less time than it took to put it through. So I think the newspapers and the farmers have some connection and have some mutual interests. If you are trying an important undertaking in the Red River Valley, or if you are interested in an organization for some good work, to whom do you look but to the newspapers for assistance.

Let us take a look at the present time. The newspapers are interested in you—not altogether a selfish interest. The farmers own the Northwest, or almost own it. If the report should get out that gold mines had been discovered in these three states that would produce $75,000,000 dollars a year, there wouldn't be trains or transportation enough to take care of the incoming multitude. You have got a greater Klondyke here than there is in Alaska. It is safe to say that for every million dollars that comes out, there are ten millions sunk there forever, and think of the hardships in getting that one million. And what they of the gold country get is gotten out for good, and the resources of that land are gone forever. It is not so with the Northwest—its gold is not for one year, but for year after year as far as I can look into the future.

Your prosperity means the prosperity of the states of the Northwest. Wipe out the farmers of these three states, and you wipe out St. Paul and Minneapolis, and Fargo and Grand Forks. The newspapers are interested

in these states and in you, and more than that, there is a direct interest because we have to rely on you for support, and in turn give you support for the objects in which you are interested.

If you will excuse me, I want to touch upon just one point and that is this. Sometimes the public press is given credit for having a view not in harmony with the masses of the people. That perhaps is true, but it will always be true as long as people have different opinions. But your interests are our interests; they are united, and while we may misunderstand each other at times, yet, it is inevitable that we must work together. I think there is too much of the gospel of the pessimist, and there has been throughout the Northwest. Perhaps you remember some of the celebrated stories that were written by Hamlin Garland that have created great sensations all over the country, in which is told the great hardships of farm life. I have been asked again and again if they were true. I said, undoubtedly they are true in a sense, but they were wrong on the same principle that a physician diagnoses a diseased man and lets alone a healthy man.

We don't need writers to depict the hardships of the farm. What we need are writers to take up the life of the business men who are in the cities. What we need is to show to the country men and boys that all the pleasure is not in the cities. We need to show them as statistics show, that ninety-five per cent of the men who go into business in the cities are failures, according to commercial records. Show them that in the city is the bitterest competition of modern life; then you will see that the farmers' life is important. You have your health. You don't arrive at 60 years worn and fagged out, perhaps a failure. No matter how your circumstances, you have the best thing that anybody can have and that is your health. The trouble with the farm is, it has not been made the important profession that the professions of the city have. It ought to have the same preparation that other professions have.

When the hard times of 1893 came, the population of St. Paul and Minneapolis had a notable decrease. The people were unable to get a living; a great many had to go back to their native countries, where their own people were living. And the prosperity in the country was more in demand, because of the depression at that time.

These things show the necessity of making farming a profession— the greatest profession of the Northwest. The Northwest depends upon it. You can better bring up your sons and daughters to make them farmers, than to turn them loose in the city with all its competition and temptations.

I really have not a right to appear upon this program, but I want to thank you as a tribute to the profession and to myself personally.

AFTERNOON SESSION.

Convention met at 2 o'clock.

Prof. Hays: Ladies and gentlemen, Mr. Randall had some business to attend to this afternoon and has asked me to preside, and to do this thing in a sort of farmers institute way, and to devote tomorrow to short papers. The first thing on the program this afternoon is an address by Dr. Webber, of Washington. Mr. Webber is connected with the division of Vegetable Physiology and Pathology of the U. S. Department of Agri-

culture at Washington, D. C. He is unable to be here, but has sent a communication which will be read by Gov. Worst.

The following letter was read by Gov. Worst:

LETTER FROM MR. WEBBER.

WASHINGTON, D.C., Jan. 20, 1900.

Hon. J. H. Worst, President Agricultural College, Agricultural College. North Dakota:

Dear Sir: You have probably received Mr. Galloway's letter explaining that I am unable to attend the Grain Growers' Convention in your city, as arranged. I greatly regret that I am prevented from doing so, as I should have greatly enjoyed meeting the grain growers and scientific men of your section of the country.

I have sent the manuscript of the lecture which I had intended to deliver to Hon. J. A. Johnson, of Fargo, so that portions of it may be read before the convention and published in the proceedings if desired. Kindly express to the members of the convention my regret that I am unable to be present.

Assuring you of our interest in the convention and our desire to aid the farmers of the Northwest whenever possible, I remain,

Very respectfully yours,

H. J. WEBBER,
In charge of Plant-Breeding Laboratory.

THE IMPROVEMENT OF CEREALS

BY HERBERT J. WEBBER.

In Charge of Plant-Breeding Laboratory, U. S. Department of Agriculture.

GENERAL CONSIDERATIONS.

Wheat, oats, barley, and all of the cereals commonly cultivated in America, except corn, are of foreign origin, and the races of these plants first cultivated were accordingly imported. American conditions, however, are very different from those in Europe, and it is probable that such imported races soon become very markedly changed in different ways, due to the many distinct local conditions of soil and climate. In early days, furthermore, there was very great difficulty in obtaining seeds from a distance, so that is seems likely that a neighborhood usually grew the same strain for a considerable period if it produced results at all satisfactory. Very scanty mention is found in literature of the condition of agriculture in this country in early times, and it was not until the beginning of the present century that agricultural records began to be kept. Since that time agricultural conditions have been gradually improving, and the plants themselves undergoing a constant change, keeping pace with the development of the country and the demands of cultivators. The methods first used of improving the strains commonly grown were very simple, being evidently simply the obtaining and growing of seeds procured from local cultivators who, by careful tillage and manipulation for a series of years, had gradually brought their plants

up to a high state of vigor, sufficient to attract local attention. The selection of good seed and large grains for planting, a practice early followed by careful growers, also probably had a decided influence in improving the general productivity of the cereals.

Corn, a native of America, was first cultivated by the Indians and greatly improved by them. It had reached a comparatively high state of amelioration before the discovery of America, and our early varieties, some of which are yet grown to a limited extent, although probably considerably modified, were obtained direct from the Indians. Such are the Golden Sioux, King Philip, and Tuscarora races of field corn. An early sweet corn is also recorded as having been obtained from the Indians of the Six Nations about 1779.

Wheat growing has been rapidly extended in recent years to all available lands suited to its culture, both in this and all other countries of the world, and economists are beginning to ask what the world can do to produce the amount of wheat required to meet the necessary demands. While wheat can be grown over a very wide range of teritory and is a .general crop, it is the "staff of life" of all civilized nations, and at the present rate of increase in the world's population with no possible commensurate increase in the wheat lands over those areas now cultivated, it is thought probable that in a very few years there wil be a scarcity of this staple product. Mr. C. Wood Davis, writing in The Forum, says that the world's "output of wheat in 1897 was several million bushels less than requirements, acre yields having been but little below an average; that an average yield from the acres now employed would be 275,000,000 bushels less than preent needs; that the greatest crop ever grown could not equal present requirements; that requirements for wheat and rye progressively increase year after year by more than 40,000,000 bushels, that not an acre has been added to the aggregate of the world's bread-bearing area since 1884; that while yearly increasing needs in the seventies implied average yearly additions of less than 2,800,000 acres, they now imply additions of more than 4,000,000 acres of wheat and rye per annum." These figures, while largely theoretical, are nevertheless very instructive. We should not, however, view them from the standpoint of the alarmist. We have not yet exhausted our own resources. The careful experiments of plant-breeders have opened a field of possible improvement and extension which, it carried out, will doubtless greatly increase the productivity of our present wheat lands, and also probably greatly extend the area over which wheat can be grown. Sugar beet growing was resuscitated and placed on a basis of profitable production by the careful experiments carried on first by Louis Vilmorin, and then by others, through which the sugar content of the sugar beet, was raised from about 6 per cent to, in some cases, as high as 20 and 22 per cent. The gluten contents of wheat, which is its important constituent, has been found to be quite variable in different sorts, but as yet no extended systematic attempt has been made to increase the per cent of this most important element in the grain. The starch of wheat flour which constitutes something over 78 per cent of its dry bulk, can apparently be substituted just as well by starch from potatoes or rice.

Some bakers are even now said to dilate wheat flour with starch from other sources in making bread, and this can be done without detriment to the quality of the bread if the wheat flour has a higher gluten content than is required to give good results.

If, then, the gluten content of wheat could be perceptibly increased, the bread producing capacity would be proportionately much more increased, as starch from other sources could be used to give the correct proportion of gluten and starch to yield the best bread.

Again, certain very large areas are now unsuited to wheat culture because they are too dry throughout the year, or from drouth coming on too early in the summer, or some other easily recognizable climatic or soil feature more or less detrimental to profitable wheat growing, but not by any means prohibitive of its culture, it is highly probable that sorts could be gradually bred which would resist these inimical features and allow a great extension of the area of profitable culture. It is certain that good drought resistant sorts would greatly increase the average annual yield of some of our now standard wheat areas, where droughts frequently cause a considerable loss. Rust-resistant sorts, which it seems judging from results already obtained, can almost certainly be produced, would also greatly increase the yield in all of the wheat growing region of the world. With a recognition of these possibilities it is not surprising that within recent years there has been great activity in experimenting to improve wheats.

As the interest of this convention is mainly centered in wheat growing, the following treatment will be confined largely to this cereal.

IMPROVEMENT BY SELECTION.

In the improvement of cereals the same methods are used as in the improvement of other plants, there being simply minor differences in the details of application. Selection and hybridization, the two principal factors in plant-breeding, have both played an important role, almost all of our best races having been originated by the intelligent application of these principles. Some of our important races, however, were originated as chance variations or sports which were selected and propagated because of their good qualities. Improvement by selection depends upon the selection of seed for planting from individuals which exhibit in the highest degree the quality which it is desired to improve and at the same time are up to the standard of excellence in all other necessary qualities. By continuing to select seed for a series of years with the same object in view a quality can be augmented and fixed, as we say, so that it becomes a staple character of a new race or strain. Selection is usually employed within a race simply to secure improved or pedigreed strains. If, however, it is continued long enough there is no doubt that differences sufficient to characterize new races, at least as we at present understand them, can be produced. In wheat, as yet, selection has been used almost solely to increase the yield, although other factors such as quality, gluten content, etc., could doubtless be increased in the same way. Hallett and Hunter, in England, have beeen the chief exponents of improving wheat by this method, and little systematic work of this sort has been carried out in America. Hallett says: "The plan of selection I pursue is as follows: A grain produces a plant consisting of many ears. I plant the grain from these ears in such a manner that each ear occupies a row by itself, each of the grains occupying a hole in this row, the holes being twelve inches apart every way. At harvest, after the most careful study and comparison of the plants from all these grains, I select the finest one which I accept as a proof that its parent grain was the best of all under the peculiar circumstances of that season. This process is re-

peated annually." Hallett's Pedigree Wheat, famous the world over, though no longer cultivated to any extent in this country, illustrates what may be accomplished by selection. In the production of this sort from the Original Red, by constantly selecting the best grain from the best head of the best plant during five years, the length of the largest selected head was increased from 4 3/8 inches to 8 3/4 inches, and the number of grains from 47 in the original head to 123. On three acres of land Hal-lett averaged 72 bushels of wheat per acre, from a seeding of one-third of a bushel per acre. The increase in size of ears of several races which Hallett improved by selection are shown in the following table:

Name of Variety	Grain in original ear.	Grain in improved ear.
Original Red	47	123
Hunter White	60	124
Victoria	60	114
Golden Drop	32	96

In a similar manner Hunter improved a variety of wheat and by "continuing selection and cultivation for a period of six years, increased the yield per ear from 90 to 124 grains."

It is only within recent years that selection experiments of this nature with wheat have been carried out in America. The most extensive and successful of these known to the writer have been conducted at the Minnesota Experiment Station under the direction of Prof. Willet M. Hays, and are still in progress. From 1888 tip to the present year 552 different races have been tested and eight of these finally selected as worthy of preservation. Selection experiments were started in 1892. 400 plants of each race were grown and at harvest time the best ten of each selected, attention being given not only to the yield but to hardiness, rust resistance, etc. These eighty plants when subjected to more critical selection were reduced to thirty-one and from one hundred to four hundred kernels of each were planted the next year. From the resulting plants the best ten seedlings from each of the original thirty-one were again chosen, and from each ten one best plant was finally selected and its seed planted in 1894, making again thirty-one plants. This process was continued annually and is still in progress. As a result even at the end of the first year four of the best eight new plants surpassed in yield and in some other qualities the best four of the old varieties, and some of the sorts which have been under improvement for several years have given very striking results. One of the best, Minnesota No. 169, from a selected mother plant of Haynes' Blue Stem, cultivated for four years (1895-'98) at the Minnesota University farm, and in 1898 at Grand Rapids, Minnesota, and at the Agricultural Experiment Stations in Iowa, South Dakota, and North Dakota, gave an average yield of 24.7 bushels per acre as compared with an average yield of *21.9* bushels per acre by the parent sort, Haynes' Blue Stem, cultivated the same years at the same stations. This is an average increased yield of 2.8 bushels per acre under a very wide diversity of conditions. The average increase, it should further be noted, is much greater if the yields obtained at the University farm only are considered. Here in 1895, 1896, 1897, and 1898, Minnesota No. 169 gave an average yield of 28.3 bushels per acre, while the parent sort the same years averaged only 22.5 bushels per acre, an average increase during four years of 5.8 bushels per acre. The greater yield obtained at the University farm is easily understood

when it is remembered that the new strains were selected here and thus were bred to suit the local conditions. This emphasizes the necessity of conducting selection experiments with the standard races in different lo-calities to obtain strains best adapted to the local conditions. In this regard wheat is no exception to the general rule. It has been found repeatedly with various plants that varieties originated in one locality and adapted to one set of conditions, when removed to a different locality where different conditions obtain, may give indifferent results or fail completely;

The work of selection to simply increase the yield and better adapt plants to local conditions is simple so that it can readily be carried on by any intelligent grower, and the writer would urge this as a very practical and feasible line of improvement for local growers to undertake. The improvement of quality, increasing of gluten content, etc., and hybridization experiments require considerable skill and greater facilities for testing, etc., and probably can be successfully carried out only by those who make a specialty of such work.

In corn, selection has played a particularly important role, some of our most valuable and generally cultivated races having been produced in this way. The now famous Leaming corn, a yellow dent variety, was produced by Mr. J. S. Learning, who began in the early fifties, by going through his fields of an ordinary not very prolific yellow corn and selecting the best formed and most prolific plants, the seed from which was saved for planting. This selection was continued for over thirty years. The Boone County White, one of the best races of white dent, which for several years has given the highest yields in the variety tests at the Illinois Experiment Station, was produced in a similar manner by Mr. James Riley, of Indiana. In addition to selecting seed only from the most prolific stalks, Mr. Riley followed the practice of going over the patch of corn in which selections were to be made, just before the silks began to appear and cutting the tassels from all small and poorly formed stalks. This insured that the ears on plants finally selected for seed were fertilized by pollen from vigorous well-formed plants.

Recently the Illinois and Kansas Agricultural Experiment Stations have opened up a most important field of experiment by demonstrating that the protein, starch, and fat content of corn vary greatly in different individuals of the same race and are capable of considerable increase by selection. Corn is continually becoming more important as a human food and these researches may mark the beginning of an era of improvement which will make corn a successful rival of wheat as a world food.

In many plants the effect of cross-fertilization must be carefully considered in all selection experiments, and this is a factor influencing the final results, which is frequently overlooked. In corn where pollination is effected by the wind, this is a very important consideration. Corn planted for selection should be located at some distance from other Acids and all non-typical or weak stalks should be carefully cut out before the silks begin to appear, so that all ears in the patch will be fecundated by pollen from typical and vigorous plants. In other cereals such as wheat, oats, and barley, the influence of cross-fertilization in selection experiments may be safely disregarded, as the flowers are almost invariably self-fertilized. It has indeed been doubted whether natural crossing ever occur: in these plants, but the results of Rimpau's experiments in Germany have demonstrated that it probably does occur, though very infrequently. It

seems quite probable in the light of these experiments that many of the spontaneous variations or sports which are occasionally found in fields of standard varieties of wheat are due to this cause. In a period of fourteen years, during which Rimpau grew an average of about sixty-two races of wheat annually, in a small space, and each year carefully hunted for variations, he found only seventeen cases that could be considered as naturally produced hybrids. During this period he also found five similar variations in barley and five in oats, which were thought to be natural hybrids. By cultivating these variations they exhibited reversions greatly resembling varieties which had been grown in close proximity in his plots, thus leading to the conclusion that they were of hybrid origin.

IMPROVEMENT BY HYBRIDIZATION.

While selection is an important factor in the improvement of cereals, the majority of our new and promising races have been produced by hybridization, so far as the original variation is concerned. However, when a promising variation is secured by hybridization, the work is only half completed; it must then be put through a careful course of selection to improve and fix the race, and this is a very important part of the process.

The production of a new race of any cereal by hybridization includes the following necessary and important steps. First, the careful selection of the parents most likely to give the desired variation; second, the process of emasculation and cross-pollination; third, growing the crossed seedlings through one or two generations and selecting the desired variations ; and fourth, augmenting and fixing the chosen variations by selection.

SELECTION OF PARENTS.

The selection of parents in every case depends upon the improvement desired and demands the utmost care. When the races which it is desired to cross have been selected, it is then of importance to choose vigorous and typical individuals as parents.

Farrer says that he had expected that wheat hybrids would mainly resemble the mother in season of ripening but found that the father parent exerted fully as great an influence as the mother. In the second or variable generation, he says, about an equal number revert loward each parent.

In striving to obtain races very different from those now grown widely distinct parents should be selected for crossing. It is apparently very desirable in some cases to combine different species to obtain special features. The Garton Bros., of England, who have achieved such important results in breeding wheats and cereals in general, introduced a slight strain of spelt into some of their best hybrid wheats and claim that it has been highly beneficial by improving the milling quality of the grain and fixing the grain more firmly in the husk and thus preventing loss by shelling out. In crossing the common oat with the naked oat (Avena nuda) the Garton Bros, claim to have obtaind hybrids yielding heavier in grain and straw but with naked grains like the Avena nuda parent. In barleys, however, when naked and husked races are hybridized it is apparently the rule for types with husked grains to result. McAlpine in reviewing the work of the Garton Brothers says "naked barleys can be

freely compounded with husked forms, because the tendency of the compound is to produce husked grains; in oats the tendency is in an opposite direction, the introduction of a naked parent leading to the production of naked grains by the compound cross."

The influence of the parents on the offspring has been found so variable that no general rules can be followed, .though in the majority of cases the first progeny is intermediate between the parents. The following table showing the variation in the influence of the male and female parent on the progeny, in wheat hybrids made by Rimpau is interesting in this connection:

	VARIETIES	Character of First Generation	Character of Second Generation
1	Saxony red *x Kessingland *	All alike, unvariable	Very variable
2	Red Geman Bearded *x Kessingland*	All as similar as a constant sort	Very variable
3	Rivetts Bearded *x Szxony Red *	All similar	Very variable
4	Rivetts Bearded *x Red German Bearded *	All similar	Very variable
5	White Bald Spelt *x Red German Bearded *	All similar	Very variable
6	Rivetts Bearded x Squarehead x	Considerable variation	Very variable
7	Early Red American *x Squarehead *	All similar	Very variable
8	Mainstay *n Squarehead *	All similar	Very variable
9	Early Red American *x Mainstay*	All similar	Very variable
10	Saxony Red *x Squarehead *	All similar	Very variable

1. Saxony Red * x Kessingland * Intermediate between parents.
2. Red German Bearded * x Kessingland * Intermediate between parents.
3. Rivetts Bearded * x Saxony Red * Almost wholly like father paarent.
4. Rivetts Bearded * x Red German Bearded * Almost wholly like father parent.
5. White Bald Spelt * x Red German Bearded * Almost wholly like mother parent.
6. Rivetts Bearded * x Squarehead * Intermediate
7. Early Red American * x Squarhead * Mainly like mother. .
8. Mainstay * x Squarehead * Intermediate.
9. Early Red American * x Mainstay * Intermediate.
10. Saxony Red * x Squarehead * Mainly lik father.

Most of the hybrids which have been produced in this country have been simply between different races of the same species (racial hybrids) but it seems probable that in many cases the combination of distinct species might give desirable results. For instance the writer is informed by Mr. W. T. Swingle that in experimental tests in the Palouse what region in Washington, Jones' Winter Fife wheat was found to give the remarkable yield of from 60 to 65 bushels per acre, but was discarded as worthless for general culture because the grain shells out badly. It is probable that by introducing a slight strain of the Spelt into the Jones Winter Fife by composite crossing, races could be obtained with even increased vigor and holding their grain well.

COMPOSITE CROSSING.

Composite crossing, s it is called, refers to the crossing of hybrids with other races or hybrids which results in the production of forms containing the blood of three or more races or species. Composite crossing has been used very extensively with wheats and some other cereals, and has apparently given very important results. This is a primary principle in the valuable work of the Garton Brothers in England and of A. N. Jones in this country. Without doubt many of our races with appar-ently simple pedigrees are in reality very complex hybrids, as while two races only are used in their immediate production, these races may themselves have been produced by the hybridization of other and different races. Some of the Garton hybrids contain six or more sorts combined in the direct production of a particular sort, arid some of these races may themselves be of hybrid origin, further complicating the pedigree. The following is a sample pedigree of one of their composite wheat crosses:

A. Black Spelt with Hardcastle White.
B. White Chidham with Hungarian Red.
C. Pedigree Red with progeny of A.
D. Mainstay with Hungarian White.
E. Progeny of A. with progeny of D.
F. Progeny of C. with progeny of B.
G. Progeny of E. with progeny of F.

Such complex crossing as the above requires years of time and the outcome can not be predicted. It seems probable that the same results in most cases could be obtained in shorter time by a careful selection of parents from fixed races of known origin; however, it is a well known practice of plant breeders to mix things up as much as possible and then strive to create order out of the mixture by selection.

VARIATION OF HYBRIDS IN DIFFERENT GENERATIONS.

It is important to understand that as a rule hybrids do not exhibit their most interesting variations until the second generation, which has been very aptly termed the "variable generations." In some cases of hybrids of very closely related varieties, however, the first generation is the most variable. In wheats and other cereals almost without exception the hybrids, whether racial or specific, are but slightly variable in the first generation and very variable in the second generation. The following is a tabulation of Rimpau's experience with wheats:

It will be noticed from the above table that of the ten sets of hybrids experimented with only one set showed any appreciable variation in the first generation, and this but slightly, while in the second generation all broke up into many different forms. In the second generation reversion toward each parent usually occur in fifteen degrees and sometimes totally new types are produced. It is from this varying lot of second generation hybrids that the selection of improved types for fixation must be made.

THE PROCESS OF FIXATION.

In the third generation hybrids of cereals are quite variable, but usually not so much as in the second generation. In this generation all the progeny are examined and those selected for seed which have reproduced true to the type selected in the second generation. This selection is continued annually, and succeeding generations give a larger and larger proportion of individuals like the type first selected, until all come true, when the race is said to be fixed. Rimpau, who has carefully selected and fixed many types of hybrids, found considerable variation in the ease with which different hybrids could be bred into stable races, the time required being from 2 to 9 generations after the selection of the type, made in the second generation. M. Henri Vilmorin says: "Four or five years of selection were necessary on an average to make each sort tolerably even and fixed." In Rimpau's experiments also, five years seems to be about the average time required to fix a selected variation.

SOME RACES PRODUCED BY HYBRIDIZATION.

Within recent years there has been great activity in wheat improvement and many valuable hybrids have found places in our lists of important races. Attention has been mainly directed to increasing the yield by crossing different strains and securing earlier and hardier sorts. Among the earlier experimenters in this field Arnold and Pringle were probably the most successful. Arnold's Hybrid No. 9, a cross of Michigan Amber with the White Soules, has in some places given good results. Pringle's Defiance, said to be "a hybrid of a White Wheat common in California upon an eastern club variety," has proved very valuable in California, Colorado, etc. Prof. A. E. Blount, while at the Colorado Experiment Station, made many wheat hybrids and obtained several improved varieties. Blount's Hybrid No. 15, a cross of Sonora with Lost Nation, has become a well known variety, giving excellent results in some states. Probably the most: valuable work in wheat hybridization in this country has been done by A. N. Jones ,of Newark, N. Y. Mr, Jones writes: "Most of my cross-breeds are from Russian and American varieties with some blood from Mediterranean Longberry or offsprings from these combinations. The old Mediterranean crossed on American wheat has produced some of my very popular sorts which are leaders wherever known, but my most successful cross-breeding has been from what I call 'combination crossing.' This consists in crossing Mediterranean Longberry upon American Wheat, the progeny of which is then crossed with Russian Velvet or some smooth chaff. The progeny of this is then again crossed with an American wheat. This combination gives a very strong, healthy grower with strong deep root, and thick walled, stocky straw, and grain of fine milling qualities in a compact built head." Of the sixteen or more hybrid wheat races introduced by Jones, several have become

standard sorts. Winter Fife, which is extensively grown in Indiana, Ohio, etc., is probably his best known nice. In his own words: "This desirable sort originated from a combined cross, the first being from Mediterranean and Seedling No. 87, this being a cross between Mediterranean and Fultz, which was crossed with Velvet Chaff." His Early Red Clawson (Clawson X Golden Cross), Early Genesee Giant (seedling from a combination of crosses) etc., are among our widely grown varieties. Some of his hybrids are of very complex parentage, being the results of four or five combinations of distinct parents. This is shown in the pedigree of the Early White Leader.

Early White Leader

Whit Rice No. 2 x Seedling.
White Michigan Seedling.
Martin's Amber x Seedling No. 701.
White Chaff Golden Cross x Fultz.

Beginning in 1888 and continuing to the present time Prof. William Saunders, Director of the Experimental Farm, Ottawa, Canada, has been hybridizing wheats particularly to secure early ripening races. To accomplish this he has sought to secure earliness and hardiness in the best American races by hybridizing them with various Russian sorts. Preston and Stanley from Ladoga, a Russian sort, crossed with Red Fife; and Alpha, Percy, and Advance from Ladoga crossed with White Fife are proving valuable additions. In the Minnesota Experiment Station tests. Preston and Advance have given good results. Prof. W. M. Hays, of that station, says, "Preston is the most interesting and promising variety of wheat procured outside of the state, and it bids fair to be a strong rival of our best Fife and Blue Stem wheats." The cross-bred Diehl Mediterranean, a wheat originated in Munroe County, New York, is a cross between the Red Mediterranean as female parent and the old White Diehl as male. It is said to have "always shown the broad leaves, vigorous growth, and extreme hardiness of the Mediterranean, with the strong upright straw of the Diehl." The Rudy wheat, produced by E. Rudy, of New Carlisle, Ohio, some seventeen years ago, is apparently an illustration of a naturally produced hybrid. Mr. Rudy informs me by letter that it was obtained by mixing the seeds "of the old White Chaff Mediterranean and so-called 'Nigger' wheat, and sowing them together until a few heads with a brownish chaff were developed." These were then selected and sown by themselves and gave rise to the Rudy wheat."

Wheat and rye have been successfully hybridized by Horsford, Carman, Rimpau, and several other experimenters, but apparently nothing of very great value has thus far resulted. Several named sorts, however have been introduced to the trade and something of value may yet result from such experiments.

Probably the most interesting oat hybrid produced in this country is Pringle's Excelsior, a so-called hull-less oat produced by crossing the common Chinese Naked or Hull-less oat (Avena nuda) with the Excelsior, a race of the common oat. This hybrid is said to possess the strength and robust character of the common oat and to retain the peculiarity of the naked seed derived from the Chinese Hull-less. This remarkable hybrid was introduced in about 1881, but does not appear to have proven satisfactory for general culture. Recently Garton Brothers, of England,

have introduced a similar "naked oat" as mentioned above, which gives promise of producing a valuable sort particularly for the preparation of oatmeal and similar foods.

Corn has been greatly modified and improved by hybridization, but no important improvement stands out as marking a distinct epoch. The earliest account, known to the writer, of a new race being originated by hybridization is that of the "Smith's Early White," described in a letter writtten by Dr. Gideon B. Smith, in the Albany Cultivator for 1838, the experiments being said to have started some ten or twelve years earlier. It was the result of a cross between the Tuscarora and the Sioux.

The ease with which corn hybridizes naturally in the field has led to great mixing, and doubtless many forms now cultivated are selected types of these. Very many of the best races, however, originated as carefully produced hybrids.

IMPROVEMENT BY THE SELECTION OF CHANCE VARIATIONS.

Marked variations or sports possessing improved characters occasionally occur in fields of cereals and these are sometimes found by observing growers and developed by selection into valuable races.

Many of our well known races of wheat have originated in this way The Tappahannock wheat which, in 1872, was considered to be a valuable race, was found in 1854 by a Mr. Boughton, of Essex County, Virginia. The account of its discovery as given in the Report of the Department of Agriculture for 1872 is as follows: "He noticed in his field a bunch of wheat of such growth as to attract his attention * * * At harvest he found it to be a white wheat, at least two weeks earlier than the surrounding red wheat." The Fultz wheat, which is a very popular and excellent race, grown extensively in the eastern states, was found in 1862 in a field of Lancaster Red by a Mr. Abraham Fultz, of Pennsylvania. Some beautiful heads of smooth wheat attracted his attention and they were saved and the seeds planted by themselves. These produced the wheat later named the Fultz. The American races, Wheatland Red, Pride of Butte, and Gold Coin, and the well known English races, Hopetown and Chevalier, were other accidental seedling variations. The Pride of Butte wheat, quite well known in California, was found in a field of rye and because of its extreme vigor was saved for trial. The Gold Coin wheat, a seedling sport differing from the Hybrid Mediterranean in being bald and white, was found by Mr. Ira W. Green, of New York, in a field of that race and improved by selection. Mr. Green informs me that by five years of selection he succeeded in fixing the type and meanwhile increased its yield about ten per cent.

CONCLUSION.

In the preceding pages the writer has endeavored to point out the general way in which races of cereals are originated and to give a few illustrations of the results which have been obtained. If he has succeeded in awakening an interest in the matter his object is accomplished. Much attention has always been given to the subject of improving wheat by the introduction of improved methods of cultivation and manuring, and doubtless much can be accomplished in this way. Of equal importance, the writer believes, is the quality and inherent vigor of the race grown, and this factor of success in wheat growing has not received its proportionate degree of attention.

Mr. Hays: I believe the secretary has a resolution to present to the convention. This will be read by Gov. Worst. Following is the resolution:

THE RESOLUTION.

WHEREAS, The Farmers' National Congress, composed of one delegate from each Congressional District in the United States, two from each Agricultural College, and one from each Agricultural Society, appointed and commissioned by the Governors of the various states and es-tablished the custom of holding its annual meetings in different sections of the United States, and,

WHEREAS, It has held for the last two years its meetings in the extreme South and East, and expects to hold its meeting this year in Colorado, and,

WHEREAS, It is desirable that it shall hold its next meeting in 1901 in the grain growing states of the Northwest;

THEREFORE, BE IT RESOLVED, By the farmers of the States of Minnesota and North and South Dakota, in convention assembled at Fargo, N. D., that the Farmers' National Congress be and is hereby invited to hold its meeting in 1901 in the City of Fargo, N. D.

Introduced by J. A. Johnson, Fargo.

Prof. Hays: The resolution will go to the executive committee, and in this connection I would like to say, that anyone having suggestions to make in regard to this, the committee will be glad to receive them. These resolutions are referred to a committee in order to take the burden off the convention and facilitate matters.

There has been a remarkable harmony prevailing in this association. This is a good audience for speakers to come before, and you are a credit to your speakers. We all feel a great gratification that this association has so nicely brought together the workers of these colleges and stations and thus brought out a better field of experiments, and necessarily much good is accomplished by this working together. The colleges and stations belong to the farmers. We, in a large measure, are your servants, and you must use us, but we hope you will use us kindly. You must understand that we have an immense and an intricate field to learn from. We learn from your sons in the schools and from the newspapers, besides from our experiments.

Twelve or fifteen years ago I knew a young man down in Iowa in college. He look a notion to change colleges, which he did. He afterwards graduated at several colleges and post-graduated at many; then he went to Chicago, and worked with a venerable agricultural editor, and then lie came up here and began work in your Agricultural College.

I have watched his development, knowing the difficulties and opportunities your college gave, and I have been surprised in some ways at his development. I take pleasure in introducing to you Prof. J. H. Shepperd of the North Dakota Agricultural College. During the last year he was chosen by the National government to select grain for the Paris Exposition from the Plains states. He has taken for his subject this morning, "Grain for the Great Plains States."

VARIETIES OF GRAIN FOR THE PLAIN STATES AND HOW TO IMPROVE THEM.

J. H. SHEPPERD, NORTH DAKOTA AGRICULTURAL COLLEGE.

Last summer while making a study of the export grain crops of the plains states from Texas to Manitoba, I was impressed with the small number of varieties grown in a commercial way in each region.

A particular type or variety has succeeded, and so has come into common use. The oat crop south of the center of Kansas is practically all of the Texas red rust-proof variety, while north of that line while Russian oats constitute the crop very largely.

In the red rust-proof oat region I inquired whether they had tried the white Russian oat, saying that we find that strain very successful at the north. They replied that they had tried it, and the black oat as well, but they had found that both were inferior to the red rust-proof strain with their conditions. Red rust-proof oats have a very chaffy berry, with a long-, heavy awn, which makes it inferior to .the white Russian strain when compared bushel to bushel.

The market has much to do in the matter of establishing varieties, and while the buyer often cannot tell the less distinct varieties apart, he helps one kind to become fashionable by calling for it, by learning the color of it or by recognizing some other minor point.

I found that generally two varieties of a particular kind of grain have succeeded best in a given district, and are being grown there. Sometimes they were reported as making up about equal acreages, but more frequently one would constitute three-fourths and the other one-fourth of the grain grown.

A prominent grain man in Nebraska told me that blue stem or velvet chaff wheat is the only variety which succeeds north of the Platte river in that state. He said they had tried the turkey red frequently, but that it is not a success north of the river.

The varieties of grain which produce .the three chief crops in each of the plains states from Texas to North Dakota number a half dozen or less.

Could better proof be had that certain varieties or types suit the conditions in a particular state or district? Many kinds have been tried in almost every one of these states by settlers who come northeast, east and southeast of each state, bringing their seed grain with them. In Oklahoma-the residents in boasting of the variety of their products, said: "You see, at the crack of the pistol which opened Oklahoma to settlement the people rushed in from north, south, east and west as they never have done in any other state, and each brought along bags of seed from the district where he had last resided. They all did well, and so **we** grow everything which is commonly grown both north and south." Be that as it may, I found that they, too, had reduced to practically two recognizable varieties or types of wheat, oats and corn.

Dakota and Minnesota people have always been enterprising in their search for seed, and at this point I wish to say that while I searched diligently for farmers who had improved the varieties of seed grain by breeding and selection, until they had sold seed in quantity, and I found none upon the trip until I reached South Dakota. Do you tell me that it is an accident that these three states are holding a Grain Growers' Convention to-day, and in so doing they have scored a point in advance of the remaining portion of the country? I tell you, Mr. President, it is because we are in the vanguard and have found that we can learn

from each other's experience and by reasoning together and thinking out our problems.

The Experimental Stations have looked upon the matter of improving the seed grain of their respective states as one of their chief sources of usefulness. The United States Department of Agriculture has also done a work of searching foreign countries for varieties which they have given to the State Experimental Stations for trial. What is .the verdict? A certain and very limited number of types or varieties succeed better than the rest, and are used. The North Dakota and Minnesota Stations by co-operation and through the aid of the United States Department of Agriculture have secured spring wheat under about two hundred twenty-five different names from all of the sources to which one would natur- ally look for improved things. Those varieties came from South Dakota, Iowa, Michigan, Colorado, Oregon, Ontario, Quebec, Manitoba, Russia and other European countries, besides strains of fife and blue stem which were secured from local farmers in the two states. They were grown side by side with all conditions similar, and except in clear cases of being unfit and useless they have been grown for five years in these trials. What do the results show? Fife and blue stem strains from the hands of the farmers of North Dakota and Minnesota have outranked all others, when both yield and grade are considered.

These best kinds have been taken for foundation stock and improved by selection and breeding from the best individual plants, and we find that they respond to the universal law of heredity which has been believed in for so long a time, viz.: That offsprings tend to resemble their parents. Testimony of faith in it comes to us in such terse expressions as "like begets like, "a chip out of ,the old block," etc. All of which is to say, we believe in the law of heredity.

Some of these new strains have outranked their parent kinds in yield more than two bushels per acre after having been bred from the best plants for six or seven generations.

There is another recognized law which is found working in plants which has a tendency to produce wide variation or difference. It is known as the law of variation, and proclaims exactly the opposite from the law of heredity, viz.: That like tends to produce unlike. Neither law is absolutely true and neither is false. That there is a resemblance among families of people no one will question I think. That is subscribing to the doctrine of heredity. Of the many thousand people whom you have known during your life only an occasional pair of twins among all of the brothers and sisters have given you trouble to distinguish the one from the other— if they had looked alike you could not do it. Therefore, like tends to produce unlike, as is shown from your own observation.

That is very fortunate, for if all of the seed from a single plant of wheat produced plants of identical size, form, yield and grade, and all of the plants from this seed did the same, and so on indefinitely, there would be only one kind of wheat in the world and no chance to improve it by selection, for no selection would be possible. Breeding grain and breeding animals successfully or in a way to improve them, depends upon your ability to select the best, and the-more expert you are in selection the more successful you will be. If you will keep these two simple laws — which you already know—in your mind they will help you.

In breeding wheat you get good plants which produce splendid yields and you will get inferior kinds, viz., light yielders, poor in color, and small in berry.

The more successful animal breeders have been very expert in select-

ing good individuals, and they have been very ready to destroy the poorer ones.

Colonel McIlvain, of the State Soldier's Home, told me recently that. one of the veterans of the civil war has charge of their poultry. They have a number of Plymouth Rock chickens of good breeding and so quite uniform in color and size. That man knows each fowl among a few to several dozen personally, and declares that there is as much difference in their faces as there is in the faces of men. A famous breeder of grey hounds was asked the secret of his success. He replied: "I breed many and I hang many." In other words he produced a large number and kept but a few of the best of them. In Germany, I am told, that at some of the agricultural fairs they give a prize to the sheperd who shows the greatest proficiency in learning to recognize sheep. The record is that the best of those sheperds have come to know one hundred strange, "unmarked sheep personally in less than a week, a teat which seems almost incredible. It would be hard for most of us to become similarly acquainted with that many people in a week.

I have recited these facts to show you what study and expert judgment have accomplished, and that the results obtained by the most expert breeders of animals have depended upon them.

The flower breeders, the breeders of beans, peas and other garden seeds, and the fruit men have shown similar results from study and expert judgment.

A poultry breeder, who visited the college grounds recently, asked about certain purchases which I had spoken of. He said: "You obtained no perfect birds from Mr. A——. He is too good a breeder to part with his best stock at any price so long as he continues breeding."

I have cited these cases to show you that breeders who have earned success by their operations have prized the individuals which have varied widest from their parent kinds, and toward the types which they desire to produce. I have hoped to convince you that they have taken advantage of the fact that living things vary in their appearance so that those of the same ancestry are unlike and some are better than their parent kinds. I have tried to show you that they expect to keep only a small percentage of the number which they produce and that the ones kept shall be the best of the entire number. That they believe the money value of the individuals which are the best and descended from the best is great. I do not wish to advocate impratical things. You are grain growers and your object as grain growers is to produce a large yield of wheat, which will make as many barrels of flour of high grade per acre as possible for the money expended. I realize that your account must show a balance upon the right side of the ledger and that to be able to do that it will not be possible for you to spend much time or money upon making personal acquaintances among individual plants of wheat, corn and flax as have the breeders whom I have mentioned. You are, however, subject to the same laws and will be repaid for practically taking advantage of them. What is the practical way of selecting wheat? I believe it is by the use of the fanning mill. At the Experimental Station we often screen away one-half of the wheat which we use for seed and send the poor half to market. The first of this month we sent some screenings from the fanning mill to market and received a grade of I Northern upon them, and no dockage. More than half of the original bulk of wheat was thus taken away. We sometimes reduce three bushels to one by screening out the small seed. I don't want to breed from those small berries. It may be that I have left some large berries

which have come from the small berried plants, but I will venture that I have much fewer of them than I would have had if I had not screened out the small ones.

I received a letter from a Barnes' County farmer recently which pleased me. He said that he had screened his wheat through a 7x7 sieve in his fanning mill and found that a woman's thimble level lull of the wheat before screening held eighty-three berries of it, and after screening it held seventy-two berries. That is a very ingenious and practical test, and demonstrates very conclusively that he is breeding from the best. In that operation he has culled out a lot of scrubs.

Set apart a piece of clean, good land to sow a few acres of grain for seed. Good, clean land will have a tendency to make large, strong, heavy yielding plants which will give you good seed for the following year.

By that means you will again take advantage of a law well known to animal breeders. You may take a herd of the best bred, thoroughly acclimated, beef cattle in this or any other country and in a few generations you can make scrubs of them. How? By poor care and feed. Beginning with the calf make what is known as a "buttermilk" calf of it by starving it. It's head will grow, it's horns will grow, and it's belly will grow until it is out of proportion to the remainder of the calf. A head, belly and running gear is about all you will have. Let it pass the winter upon poor hay or upon straw and with poor shelter. Let the heifers drop calves at two years old, let them pass the winter in the manner described, and if you are not reducing them rapidly enough get them full of lice.

Growing seed grain upon poor soil and allowing weeds to divide the plant food and water supply with it will accomplish the same purpose with grain, while smut will do just what lice do upon live stock.

QUESTIONS.

Question: What is the proper age for a heifer to become a mother?

Answer: It depends upon what you want her for. For a beef cow, I wouldn't have her come in before three years; for milk and butter, two years.

Q. If fife and blue stem wheat are mixed together and sown, what is the result; will they cross and make a good wheat?

A. Now, the answer has been made very plain that wheat varieties change type comparatively slow. There is no crossing. They are slow to fertilize, and there is not a tendency towards a mixture of the different individuals.

Q. What would be the best for seed, planted early or late seeding?

A. Seed planted at the time in the season when it will get the best growth, whether early or late.

Q. It has been assumed that blue stem wheat has deteriorated in Minnesota and Dakota, therefore, would it be wise to get new blue stem wheat?

A. I think not.

Q. I. would like to ask if better results would not be obtained for seed wheat by throwing the wheat, and thus getting the heaviest wheat rather than the largest wheat?

A. I haven't worked that out. I haven't been able to make a comparison as to the two wheats.

Mr. Boss: I don't know the results as to wheat, but as to oats, there

was a difference in yield something like ten bushels to the acre in favor of using the heavy kernels.

Q. I would like to know, whether we shall keep on growing the same wheat for twenty-five years, if we have taken good care of it?

A. Yes, sir, for the same reason that you wouldn't charge in breeding good cattle.

Q. Is it wise to change wheat from a sandy to a clay soil and vice versa?

A. Prof. Bolley: We have tried experiments on that, and there is no advantage gained from changing.

Q. Would you advocate early or late plowing?

A. Plow early, first-class and all the time.

Q. The professor has brought forward two varieties of wheat, but he hasn't told us which is the best seed for these states; the Scotch Fife or the blue stem?

A. My judgment is that blue stem will outyield fife somewhere from one to two bushels per acre. Blue stem will shell much more readily than fife. In my opinion, they pretty nearly weigh in the balance. I would grow some of each.

Mr. Barnes: How about the strength of each?

A. The blue stem is a little stronger of stem than the fife.

Q. Will the blue stem and the fife cross?

A. No, sir, they do not fertilize themselves.

Mr. Hays: A man who was one of your successful and prominent farmers, and who has been sent to Bismarck where he has served his second term as Commissioner of Agriculture, will now address you. I take pleasure in introducing to you Hon. H. U, Thomas. His subject is,

THE BENEFITS TO BE DERIVED FROM THE TRI-STATE. GRAIN GROWERS' CONVENTION.

BY HON. H. U. THOMAS,

Commissioner of Agriculture, North Dakota.

The benefits to be derived from a Tri-State Grain Growers' Convention are almost inestimable to the farmers of this great Northwest. Not only for today, but tomorrow, next year and so long as the sun shall continue to shine upon and the God-given rain to water and make fertile these beautiful valleys and plains. The knowledge we gain will be put into practicable tests and the dross separated from the bulk and the pure gold handed down to our children and the rising generation as a legacy greater in value than the gift of "bonds and stocks," which are today, and tomorrow are a thing of beauty to look upon rather than to realize upon. One of the chief benefits is to cause the farmer to think; think for himself, think for his neighbors and to think for mankind in general. The mind is one of the most peculiarly wonderful phenomenon of our physical nature. Unfathomable in its flexibility and ingeniousness. How may we separate the mind and the soul, that God-given attribute "breathed into the nostrils of man" when he was but "dust from the ground." And this part of us that is divine cannot but bring us to the highest point of Christian living and acting, if we only exercise the privilege accorded to us. By the incessant, contant and accurate workings of the Solar System, and beyond, we are shown that there is a

divine creator that in eternity has planned and thought out this earthly existence. By the use of his mind man becomes determined, progressive and aggressive. Never waiting for something to turn up, but on the contrary always turning the something up, either for his good, that of another, or for the public in general. You hear men say "Farmers do not and cannot become great men because there is nothing in their line of work to create thought, for what they do only requires manual labor." True there is much labor, yet much less labor would be required if more thought were put into use.

The questions that arise and are brought out at a meeting of this kind are not particularly to be answered here, but to be taken home and digested at your leisure and your pleasure.

The raising of wheat is one of the principal industries of this Northwest and how to secure a good yield and a profitable one is the question. Every farmer should raise what grain he needs for his own consumption, but I am sorry to say that it is not always done. Too many farmers buy more feed than they raise. How many of you know the best sort of ground to sow wheat on? How often should it be sown upon the same ground in succession? How do you, and how should you prepare the ground? Have you carefully studied what kind of wheat is best adapted to the soil on your farm? What part of your farm is best suited for flax, corn or barley? Do you put into the soil enough seed to ensure a good crop? Are you sure you plow deep enough to keep the soil from washing and for the purpose of holding the moisture? Have you kept account of what it cost you to raise an acre of wheat, oats, barley or flax? And what profit there is in it at the present market price per bushel? Have you ever thought it necessary to improve your seed? Do you keep an account of what you do each day? Do you open a wheat, flax and other grain account?

This subject has not been selected in order to provide a discussion or to produce any thought except on educational lines. The fact that none of us think as thoroughly and as deeply as we should, will not admit of discussion for one moment, and it seems that the farmers, who are the bone and sinew of our nation, are less given to mental labor than those of some other occupations and such should not be, especially when it comes to putting it into practical use in their every day life. All professions and business corporations have their conventions and assemblies, for the purpose of discussing the best plans of conducting their business, or improving upon their methods, and why should not you grain growers, on whose shoulders rests such a responsibility as the feeding of the world, get together and in an intelligent way discuss your business and your profession, and if possible at least determine whether you can grow two bushels of grain where you have been growing one, an A 1 quality where heretofore it has been second or third rate.

My experience along the lines of farming leads me to believe that it is absolutely necessary at this day and age of the world, for the farmer and grain grower to meet in convention or institute, and exchange views and discuss the same. We are living in a very progressive age and the wheels of progress are making many revolutions in a single year, and he who fails in whole or part, to observe and inform himself upon the leading topics connected with his business, is liable to be turned under and eventually ground to powder by the car of progress. It is not the educated few that need to be reached, but the massess, and while the agricultural paper is doing a good work, yet many who read cannot so fully understand and separate the true from the false meat contained in

an article, however well written it may be, as they can by having it brought out by discussion and interchange of ideas. Education is not only necessary, it is indispensable, if we would be successful in our business. Not that every man must be a college professor in order to be a successful grain grower, but he must have a knowledge acquired either by years of persistent endeavor and experience, or acquired through the medium of a grain growers' convention of a few days.

We find now and then a farmer who thinks education is not necessary in farm labor. For the benefit of such let us compare the farmers of the United States with those of some of the European countries. Why is it that we can do more work with less labor, make more money with less capital invested. Why are the arms of this country the nursery in which the majority of our great men are reared? The answer undoubtedly is that the farmers of this country are better educated. But we must all acknowledge that there is plenty of room for improvement, and I know of no better way by which the masses can be reached in so short a time than through a grain growers' convention.

Prof. Hays: It is a great thing for agriculture that we have such men as Mr. Thomas to take the place he has held with such good results,

I have the pleasure now of introducing another young man. We have a county down in Minnesota that sends a great many students to our school of agriculture. It has always been noted for its number of students and its good students. I wanted an assistant, and I picked out the best one from that county, and this young man was my choice. He is both tall and good looking. I have the pleasure of introducing to you Mr. Andrew Boss of the University of Minnesota.

Mr. Boss: I am almost sorry that Mr. Hayes made the statement that he did, because I want you all to have a good idea of the Southwestern part of Minnesota, but after that statement I am afraid you will not have it.

THE RELATION OF PASTURES AND MEADOWS TO GRAIN GROWING.

PROF. A. BOSS.

The relation of pastures and meadows to grain growing does not appear, to the pioneer settlers of a rich and fertile state, to be very close. The soil appears so fertile, the crops are so thrifty and grain ripens so nicely that a thought of anything bordering on crop failure or exhaustion of the natural fertility of the soil rarely enters the mind. Sooner or later, however, the mistake will be seen, and the intimacy of this relation will assert itself. Within my own experience in Southern Minnesota, I have had ample and satisfactory proof of the truth of this statement. That part of Minnesota was settled early in the sixties, and for a period of fifteen or twenty years the farmers of that section enjoyed bountiful crops of wheat. The large yields coupled with very much better prices than we now obtain led to the almost exclusive growing of wheat. If any one thought of a change of crops, it was to rotate with oats and an occasional farmer would be found bold enough to raise a five or ten acre field of barley. Since the acreage of wheat was ten or twelve times that of both oats and barley the change of crop on each portion of the farm would occur as often as once in twelve or fifteen years.

As far as the rotation was concerned there was no benefit derived.

for it has been pretty definitely settled that so far as the exhaustion of the soil fertility goes there is practically no difference in the small grain crops.

Corn was almost unknown and the only meadow was the wild prairie sod with an occasional small field of timothy, usually left in grass for eight or ten years when once seeded. Tame grass pasture was very little used.

In consequence of this continual cropping to grain the soil became unfitted for the production of good crops of grain. The land became cloyed, so to speak, and could no longer grow good crops. Wheat became sickly and lost its far famed "golden grain" color. The straw was weak and short, making it difficult to cut with the self binders, then just introduced; and almost impossible to bind by hand when cut with the self-rake reaper or the Marsh harvester, so extensively used at that time. Insect and fungus diseases attacked the straw also, making it very brittle and likely to crinkle. Notwithstanding the fact that this bound-up condition of the land came on gradually first affecting those fields that were somewhat lacking in natural fertility, this continual cropping to wheat was persistently followed until in 1885 or 1886 there came a lotal failure of the wheat crop. The year following was very nearly a repetition, though a small yield was obtained in some places.

While the immediate effect of these crop failures was very severe, driving many of the old settlers to new territory, the disaster was really a blessing, as it led to a change of methods in farming, which has put the farmers of that community on a safer line of farming, and made it one of the wealthiest sections of the state. This method embraces the growth of live stock and consequently the extensive use of tame grass pastures. With the exception of an increased acreage of the cultivated crops, of which corn is the most important, this is the only difference in the methods of farming or in the crops raised, and yet the fertility of the soil is rapidly being regained and its mechanical condition greatly improved.

Pastures and meadows are to grain growing what the balance wheel is to the engine. They serve to hold in check the abuse of the land, to equalize the distribution of the farm labor and to regulate the amount of each crop grown. Indirectly, they create uniformity in the system of cropping, which insures a more steady income throughout a number of years.

On our wind-swept prairies trouble is often experienced with the soil drifting in the wind. Grass aids largely in the prevention of this trouble by filling the soil with roots. The soil particles are thus bound together so that they cannot drift to so great an extent, at least.

Wheat uses nitrogen, potash and phosphorus extensively and by constantly drawing on the soil for these elements they soon become exhausted, whereas, if a mixture of crops had been grown, there would have been an abundance of them for all time to come.

There are many other places in the farm economy where the use of grass will correct many of the errors in the plan of cropping.

The man who would succeed as a feeder of live stock does not subject his animals to a diet of corn alone, nor of bran alone. If he did his animals would soon break down and be unable to make use of their food. What does he do? He makes up a rotation of corn, bran, barley and hay and for the sake of keeping the animals in good thrifty condition, he adds a pound or two of oil cake or eight or ten pounds of roots as a laxative or regulator.

Pastures and meadows have the same effect upon the condition of the

land as do the roots and oil cake upon the condition of the animal. During a rotation of five years, if one year's crop be a hay crop, allowing for three grain crops or, better yet, two grain crops, and one cultivated crop such as corn or roots, the land will be kept well supplied with plant food, and in good mechanical condition for producing any crop sown upon it. It is not so much a matter of what is taken from the soil as it is a matter of what is left in the soil for the succeeding crop and the form it is left in.

It is a fact that grain crops, when sold from the farm, instead of being fed upon it and the manure returned to the fields, remove more of the elements from the soil than do the grass crops. Grass crops usually make a better root development than grain crops, and consequently there is more vegetable matter left to decay in the soil after grass than after grain. This is especially true when clover can he grown and is used as a part of the grass mixture. Prof. Snyder, of the Minnesota Station, calculates that there is as much plant food left in the soil in the roots of clover as are removed in the crop of hay. This fact of itself is enough to insure clover a place in the rotation where it can be grown, and yet I doubt if the nitrogen stored up by this crop is a greater factor in the production of a good wheat crop than the better mechanical condition of the soil obtained by the penetration of the roots and their consentient effect upon the disintegration of the soil particles, and upon the liberation of plant food.

While the true grasses do not have so appreciable an effect on the land, there is always a very noticeable improvement in a grain crop following either a meadow or a pasture of tame grass. This is in part due to the favorable condition afforded all forms of bacterial life, which is so necessary to the proper assimilation of plant food.

The chemical and mechanical condition of the soil, the humus and bacteria added to the soil and the effect of the penetration of the roots into the soil—all have a more or less active influence on the crops which follow the introduction of grass into the farm crops, but the greatest value in the free use of grass lies in the fact that it compels us to raise more live stock and to feed large quantities, not only of grass and clover, but also large quantities of cultivated and grain crops. In this way only can we hope for an equalization of the building up and the tearing down process. Grain crops sold from the farm soon deplete the elements of plant food; grain crops raised and fed on the farm, and the manure returned to the land deplete the elements but little, and when the extensive use of grass is added to the feeding of live stock, the fertility of the soil is added to instead of depleted.

The thing that is. needed in our system of farming is not less grain, but more live stock and incidentally more meadow and pasture land. Closely analyzed this means to grow more bushels of grain per acre on fewer acres. This can be done only through a rational plan of cropping the land and includes the art of crop rotation which in reality is the science of crop production. "Rotation of crops" defined is that part of agricultural science which teaches us, not what crop does best after each other crop, but what crop best prepares the land for each succeeding crop? The one is a tearing down process, the other a building up process. Studying the question from this standpoint, we find that grass can usually be depended upon to put the land in good condition for a grain crop, since it best brings about the conditions essential to grain production. Cultivated crops, preceding grain also give good conditions for growth, but, unfortunately, Minnesota and Dakota are not in the corn belt, strictly speaking, and the other cultivated crops are not used extensively enough

to amount to very much in balancing up the rotation on a large farm. Grass then must he depended upon as the regulator to keep the land in good heart and to provide the conditions, either directly, through the humus and plant food added to the soil, or indirectly, through the medium of live stock grown and fed on the farm. In either event the result will be beneficial and lasting, and will go far towards bringing about the solution of the problem of building up our agricultural interests upon which the success of our state and our nation so largely depends.

Minnesota and the Dakotas have long been known as the "breadbasket" of the world. If they would retain this reputation, it is time to begin to build up the soil. While we are still raising good crops of grain is the time to make the shift from grain alone to grain and live stock. There is wealth in live stock if properly managed, and to learn to manage takes time. Increase the live stock slightly at first, sow those grasses which make the best pasture and meadow, cut down the acreage of grain gradually until that happy medium of mixed or diversified farming is readied which will maintain the natural fertility of the soil and the "Bread "Baasket of the World" will also become the meat box and milk pail of the world.

QUESTIONS.

Q. By Mr. Hays: What would be the best grass for pasture in this locality?

A. I am not as familiar with Dakota as I am with Minnesota, but I would say timothy, clover and in addition to that use the new Austrian brome grass.

Q. How long would you leave this down?

A. Not more than two years.

Q. Would it not be wise to leave the bromus longer?

A. It might be, as the seed is scarce and high priced.

Q. Would these seeds be good mixed?

A. Yes, sir, in the proportion eight pounds of bromus, four pounds of timothy and four pounds of clover can be grown.

Q. How much bromus seed per acre can be grown?

A. I hardly know; we get from 200 to 300 pounds per acre in Southwestern Minnesota. You would get a better yield here, probably from 400 to 600 pounds per acre.

Prof. Shepperd: Right here, our yields have run from 200 to 250 pounds per acre on our experiment farms; from Brandon to Indian Head from 200 to 250 pounds per acre. Let it produce a seed crop the first year. It will produce a light seed crop, but I should not cut it the first year.

Q. Would it hurt the bromus to cut it?

A. No, I think not. Bromus develops largely from the root. If you cut it very close you might lose some.

Q. f\tn you rut it high and still have a seed crop?

A. You could cut it high.

Q. You suggest a seed mixture, what would be the first crop?

A. Timothy and clover.

Q. The second year?

A. Largely bromus and some timothy.

Q. The next year?

A. Ninety-five per cent bromus.

Q. Why would you plow it the second year?

A. In order to get it back into good crop condition.

Q. Wouldn't Kentucky blue grass be better than the bromus for per-manent pasture, say fifteen to twenty years?

A. I don't know as to that; we have a bromus pasture five years old. It is just as good today as ever.

Q. What makes the best crop to plant after bromus?

A. Either wheat or barley; barley is preferable. The barley comes on first. Get the grain out of the way, just as fast as you can.

Q. Has red clover been raised in North Dakota with success?

A. Mr, Shepperd: Mixed with timothy, it has been on the Experiment Station ground—a field of five acres or more, since I have been there. It has helped my timothy and I have figured that I got the clover thrown in. We left the second growth to catch the snow and protect these clover plants and make them live.

Q. How does Alsace clover?

A, It has not yielded quite so well with us. It seems to be suited to a moist land rather than to a hard surface.

Q. How much seed would you use of bromus?

A. Fifteen pounds per acre.

Q. How much does it cost a pound?

A. Various prices, about 15 to 20 cents per pound.

Q. How do you thresh this bromus seed?

A. With the ordinary grain thresher—put an oat sieve under and shut off the wind.

Q. Has Ridge grass been tried in these three states?

A. We have tried it at the Experiment Station grounds and I have called it a failure. And there is the same report from Minnesota. It will live over the winter part of the time.

Q. How may this bromus be sowed?

A. The most satisfactory way is by hand. It will not run through the grain drill well when mixed with the seed. It should be planted one-half an inch to one inch in depth.

Mr. Shepperd: One of our North Dakota farmers, J. O. Smith of Casselton, told me how to seed with an ordinary drill, and it seems to me it is better than seeding broadcast. He takes a three-quarter inch board and drives wire spikes through, one above each feed hole and nearly touching it, and lays it across the machine. He fills the seed box one-half to two-thirds full of seed and puts a small boy on the drill to move the board back and forth. It is very successful if you do not fill the box more than two-thirds full. You can carry seed on top of the seed box, and put it in when you need it.

Q. How early in the spring would you sow bromus?

A. Just as early as the land is workable.

Q. Is the sod hard to kill?

A. No, we have not found it so.

Q. Would you sow land that is poor or rich to bromus?

A. The rich land if I wanted a big crop. It does well on dry land, it may do also on other land.

Q. I put out bromus on summer fallow last year with nurse crop?

A, Bromus would do all right on that.

Q. Would it pay to sow without a nurse crop?

A. It would.

Q. What is the effect on wheat crop after bromus?

A. I can not give you any figures. It would have the same effect that other grass would; I should look for an increased crop.

Mr. Shepperd, of South Dakota: We sowed twenty acres and it came up fine. The wind came and cut it on the edges and rolled it all out of the field, and we lost the whole crop.

Mr. Hayes : We have another noted gentleman here who used to live in Minnesota. He was, I believe, land commissioner for the Great Northern and the Northern Pacific railroads. He has put many people into this country, and he knows about the history of how you came here. He has settled on the Cheyenne River and is engaged in diversified farming, raising horses, sheep, hogs and cattle. He has a nice son, a young man, that you are going to hear from in the matter of agriculture after a time

I take pleasure in introducing to you Col. J. B. Power; his subject is "Diversified Farming."

Mr. Chairman, and gentlemen of the convention: I would a great deal rather have been introduced as the pioneer shorthorn breeder in this state and as personally helping to settle the same.

A good deal has been said by different speakers in regard to livestock in connection with the wheat growing, and instead of using the term diversified farming, I would rather call it cattle raising with wheat raising.

COMBINATION OF WHEAT AND LIVE STOCK.

EXCLUSIVE WHEAT GROWING NOT PROFITABLE. CONDITIONS IN NORTH DAKOTA PROMISE MUCH FOR DIVERSIFIED FARMING AND INCREASE OF LIVE STOCK, IN CONNECTION WITH WHEAT CULTURE.

BY J. B. POWER, of the Helendale Farm.

The subject matter of this paper was presented to the Grain Growers' Convention last March, and by request of the committee is again brought to this meeting, for the conditions then governing and the arguments arising from those conditions are the .same today as then. So far as obtainable the statistical matter is brought up to date.

Wheat growers are not, the only ones interested in wheat. The elevator companies, commission men, railroad companies and millers have more or less to do with it before it reaches the mouth of the consumer. All are trying to make some money out of it, and it is supposed that all do make a little, but the coming' together of so many representatives of all these varied interests suggest that for some reason there is not as much money in it as is wanted, and no doubt all these gentlemen will be glad to obtain information that will bring to each separate interest a larger margin of profit than is now made. If such is the outcome of this meeting it will be a grand success and we will all be glad that we came.

These varied interests are more or less conflicting. The producer wants more bushels to the acre, better grades, less dockage, lower rates of transportation and better price. The elevator men want to control grades and dockage. The commission men want larger margins. The railway companies claim that rates must be maintained or they will have to go out of business. The miller wants better price for flour and for bran and shorts. The consumer wants lower prices.

It is not my purpose to attempt any suggestions that will harmonize all these conflicting interests, but will present some of the conditions that

are great barriers in the way of the grain growers progress, barriers that can be removed to his advantage, if not to all the other interests.

Taking the risk of being considered disloyal to the "Land of Golden Grain," I will say, that under the conditions now surrounding the farmers in our state, wheat growing as a business by itself is not, in some localities, and as a rule, in our state at large, very profitable to the man who produces it. If not profitable, why not? How can it be made so? These are two dominant questions that we all hope will be answered in satisfactory ways by the addresses and discussions that will be heard at this convention.

Some claim that our profits are absorbed by excessive charges of the elevator and railway companies, if those charges were reduced we could make some money growing wheat. While this may be true to an extent, and reduced charges for handling will help somewhat, the main trouble will not be removed. The failure to make money in wheat raising is not in, these things alone. I cannot but think that some reductions in present rates can be made by elevator and railway companies without forcing them into bankruptcy, at the same time recognize the fact that it costs an elevator company as much to handle a thousand bushels of 50-cent wheat as it does to handle a thousand bushels of $1.00 wheat, that it costs the railway companies as much to haul 50-cent wheat as it does $1.00 wheat, and every fair minded man will admit that there is a limit below which these handling and transportation charges cannot go, let the price of wheat be what it may, neither is it practicable to make flexible rates to correspond with the fluctuating price of wheat. We must look somewhere else for our money making factor, and we are certainly leaning on broken reeds if depending upon such aids for our desired margin of profits.

To a large degree we must and can work out our own salvation. Some facts obtained by a study of the conditions and situation in our state may give us some valuable suggestions. From the latest statistics in the office of the Commissioner of Agriculture and Labor, kindly furnished me by Commissioner Thomas, I find we now have in our state some 39,119 farms, embracing 9,542,500 acres, of which 5,877,000 acres, only 60 per cent, are under cultivation; 3,767,700 in wheat, 597,800 in flax, the remainder to oats, corn, barley, rye and root crops, i. e., principally feeding crops. As we do not raise enough feeding crops to supply home consumption, we have, therefore, to look to our wheat and flax crops as our only money producers. A further examination of these statistics show that in the past six years, i. e., '93-'98 inclusive, the average area sown to wheat during those years was 3,481,000 acres, the average harvested 3,117,000 acres, i. e., some 364,000 acres, a fraction more than 10 per cent of what was sown, was not harvested. The average yield for those six years was 12.96-100 bushels per acre. The average price on the farm for the same time was close to 53 cents per bushel. The average gross proceeds have been $6.87 per acre. It is generally admitted that $5.50 per acre, including labor, wear and tear of machinery, interest, taxes and incidental expenses, is a fair average cost of production. This leaves us the munificent margin of $1.37 per acre, from which we have to make good the loss on the 10 per cent not havested, taxes and interest on the 40 per cent not cultivated.

These figures do not apply to our best wheat producing lands in and adjoining the Red River Valley, where the average yield is up to the maximum and from where the slate has made its reputation as a wheat producer, but I am not confining myself to individual farms or particular lo-

calitics. These facts pertain to the state at large, or more closely localized, to the eastern one-fourth part of the state, in which we find over 72 per cent of our farms, where we raise over 86 per cent of our wheat and where we find over 75 per cent of all of our live stock. As a matter of fact, the great majority of wheat growers outside of the Red River Valley do not realize enough to barely pay the cost of production, and in some years every acre of wheat they put in makes them a loss. I will leave these facts for your consideration, without comment, except to suggest that we cannot expect, reductions in the handling and carrying charges of our wheat, sufficiently large to make good such losses.

Now in the face of all the competition from other wheat growing countries of the world, I doubt if we want to increase the aggregate wheat crop of our state. We always have to meet the prices made by the amount of the world's production, however low that may be, and we certainly cannot do business with any satisfaction on the average of the small margin of profit for the past six years.

The best wheat producing lands in the state are occupied and practically all under cultivation. Thousands of acres that are not good wheat lands are being sown to wheat, at their best they will not produce profitable crops for only a few years. Continuous cultivation to wheat will impoverish the richest land, and the good crops from newly cultivated lands will not more than make good the diminished yields on worn out fields. In fact, we have about reached the maximum of our wheat production. To keeep up this maximum both in quantity and quality we must renovate the old fields and preserve the productive power of the new ones. To make legitimate profits we must reduce cost of production and increase yields on reduced areas, without materially increasing our aggregate production.

How to do this brings us squarly up to the problem of diversified farming. Increased yields on smaller fields means putting down to grass, crop rotation, fertilizing worn out fields better preparation for ground careful selection of seed, more thorough work in every way, and the utilizing of every acre now in grass with live stock of some kind. Or to express it in the popular round robin style, raise more corn to feed more stock, make fertilizing material to enrich fields so as to grow more corn to feed more stock and again grow more wheat,

For a moment let us look into this matter of live stock now on our farms, see where we are, and what there is to encourage increase of this industry.

Excluding for the present the counties west of the Missouri river, used almost exclusively for ranching, I find reported as the stock on our 39,000 farms, some 204,660 head of horses, an average of little more than five to a farm; 237,700 head of cattle of all ages, an average of only about six to the farm; 123,100 sheep, a fraction only of a little over three to each farm, and 75,100 hogs of all ages, less than two to each farm. From these figures it would appear that we have barely enough horses to do our farm work, and we well know we are not raising enough meat producing animals to supply home consumption. At the same time we have within the boundaries of these same farms over 3,665,000 unused acres, except as pasture for a few head of cattle and sheep I have enumerated, only one animal to every ten acres, upon which, however, taxes and interest have to be paid every year. Every idle acre is idle capital, non-dividend paying property is always a burden.

Outside the boundaries of these farms, and now including the

counties west of the Missouri, we have within the borders of our state over 30,000,000 acres of vacant land, that as a rule, is covered with a rich growth of nutritious grasses. This is but partly occupied by range stock; as shown by assessors' returns numbering only 86,800 cattle, 118,000 sheep and 86,800 horses, that is, an average of only one animal to every one hundred and thirty-five acres.

From these figures it is plain that there is plenty of room in North Dakota for expansion in the live stock industry.

The more closely we investigate this subject the stronger the conviction that the future wealth of our state will not come from any great increase of wheat area, but by the utilizing of our idle grass land in connection with better cultivated wheat fields. The productive value of our wheat lands is well known the world over, that of our grass lands is not so generally recognized, even by people of our own state, but the few that have made a study know the rich returns that can be made from these idle acres, surely so at prevailing prices for all meat producing animals.

Now, looking to the possibilities, or, as I may say, the necessity of adding to the live stock on our farms (and by live stock I mean all meat producing animals), it may be well to consider the probabilities of a continuation of the present good prices. A study of the statistical publications by the Department of Agriculture gives us much valuable information on this point.

Without going into the full detail of these statistics, it will suffice to say that in 1892 the United States had reached its maximum number of cattle and nearly so in its sheep and hogs. In 1899 we find the decrease to have been as follows: In all classes of cattle, except milch cows, 9,657,000 head, over 25 per cent; in sheep, 5,824,000, 12 per cent; hogs, 70,922,000, 29 per cent; in milch cows, 426,000, nearly 3 per cent. These statistics show that today there is in the United States not only the smallest aggregate number but also the smallest number per capita than at any time in the past twenty-five years.

This great decrease in numbers can be made good only by breeding, necessarily a slow process

During these same years there has been a great increase in exports. In cattle on the hoof this increase has been some 313,000 head, some 48 per cent. .In meat products, i. e..., fresh dressed, canned and salted, an increase of over 500,000,000 pounds, nearly 27 per cent.

The present home consumption in the United States is estimated at 5,500,000 tone annually (147 pounds per capita). Nearly one-third of the yearly consumption of meats in Great Britain has to be imported, and the United States is looked to for 75 per cent of this. Canada supplies one-tenth and South America and other meat producing countries supply the remaining fifteen per cent.

This great decrease in numbers has been in the face of increasing population, and in the past two years a largely increasing purchasing power by the industrial classes of our country, and this increased demand for hime consumption together with the large and steadily increasing export demand gives us every assurance that it will be a number of years before we can possibly have a surplus of meat producing animals that will bring back the low prices of 1891 and 1892.

There is no need to fear the foreign competition in cattle that we have in wheat. It is not necessary to produce statistics to prove this statement, it is enough to say that it will take years of improvement by careful breeding to bring the cattle of other countries up to the standard of

American beef that is in so great demand in the English markets, and the cost of transportation will always be in our favor.

I have perhaps gone into the detail of this phase of the question more than is necessary, but the people of our state are very slow to recognize the value of cattle on the farm and by the presentation of these facts they may be induced to give them a trial. Our farmers think they cannot make any money from stock on $10 to $30 lands. Farmers in the older states and the English farmers say that if it were not for stock they could not make a living on their $50 to $100 lands.

The conditions as shown by the foregoing statement of facts are certainly encouraging and seem to warrant a sure profit for many years to the grower of cattle, and I think strongly emphasize my statement that and I will add, that North Dakota is the best agricultural state in the Union to make the most of such a combination.

We are asking better grades on our wheat, less dockage and lower rates of transportation. To an extent we can control these items ourselves without the aid of corporations. It is true that in wheat culture we have to take the risks of storm and unfavorable climatic conditions, but, as a rule, clean well tilled fields with clean good seed will give good wheat. If we clean our good wheat before marketing, keep at home for feed the weed seed and small broken kernels that makes the $7 to $8 per ton screenings, that we now give away, our wheat will go to market at its full value without dockage. Instead of shipping dirty go-cent wheat at m cents a bushel, paying 20 per cent freight, send forward clean 6b-cent wheat and pay only 16" per cent freight. Ship n car toad of fat cattle or hogs for the same distance and pay only some 5 per cent freight.

From the facts obtained by careful study of statistics and conditions, I can nut come to any conclusions than those set forth in this paper, and from them, int, will now advance the following suggestions:

First. Live stock supplies fertilizing material—with all the live stock that our farms will support we can preserve the fertility of our lands and get larger yields and better wheat.

Second. Save the many thousands of dollars we now pay out every year for imported feed, by raising all we need for home uses.

Third. Cover our vacant grass lands with live stock and supply home demand for meats, saving the thousands now paid out for what is grown on farms in other states. All surplus we may have will be readily taken by outside buyers at good price.

Fourth. Clean our wheat before marketing, feed the screenings to our own stock and save the full value of what we now give away.

Fifth. Do not increase the aggregate of our wheat areas and be satisfied with minimum yields, but by better cultivation of smaller areas produce maximum yields and better quality, at less cost. .

In this presentation of my subject I have endeavored to suggest some of the reasons why our farms are not paying a better profit, also some of the ways by which more profit can be obtained, and now leave the matter for such consideration as you may see fit to give it.

Mr. Hayes: Colonel Power did not go down alone there in Rich-land County. When he got through with his railroad work, he took his boy with him on the farm. That boy grew up on the farm and settled down with him to make a success there. The Colonel sent him down to the School of Agriculture in Minnesota, where he graduated, and after the college was started here he took further work in this college. He

has kept on with the farm, and later married one of Fargo's prominent daughters. He has been taking an interest in the live stock shows and has been pushing them. This matter was brought before us and Allie Power was made secretary. I now introduce to you Mr. Power, and he will read the report of the committee.

Mr. Allie Power: I will simply read the proceedings as had yesterday. Protestor Shepperd will talk to you about the show and breeding.

REPORT OF THE STOCK COMMITTEE.

The committee as appointed met and elected J. B. Power temporary chairman.

Mayor Johnson guarantees that Fargo city will furnish gratis sheds and forage necessary for all stock shown.

A permanent organization was effected. The name of this organization to be "The Northwestern Stock Breeders Association."

Prof. J. H, Shepperd, FARGO, was elected president; J. B. Power, of Power, N. D., secretary and treasurer.

These officers, together with Mr. McCanna, of Cando, to appoint eleven vice-presidents.

FARGO was selected as the place in which our stock show and sale is to be held. The time selected for the show to be held was June 26, 27 and 28.

It was also resolved that the membership to this association be given to all interested in live stock.

Mr. Hayes: What about the stock entered for this show already?

A. From correspondence I have had with the breeders of the state and the Northwest, we have promised now to us something like 200 head. A great deal of this stock will be shown by breeders and will be stock that will not be sold.

Q. What is the plan of sale so far as considered?

A. We had not thought of any auction feature, but we probably could get a large herd of shorthorns that could be sold, but there is nothing definite.

Q. Would there be market enough for people to bring in bunches of animals?

A. It would seem to me that there would be an excellent market, providing the show would be so advertised that attendants would know that they could get what they wanted in that line. I think there would be no question about well bred stock being sold. A carload of draft horses bred and raised in North Dakota could be sold.

Mr. Shepperd: If John Jones of Barnes County wants to invest in a bull—there will be animals on exhibition for sale purposes at Fargo. Jones would have this stock to look over and he could take his choice. It is better than a county fair, for he is not coming here for a blue-ribboned affair. They will be here with the cattle stock as they are—not all dressed and shined for special occasion.

Now the plan is to have the men who are interested in live stock become members. The secretary is authorized to take your name and take one dollar. This is necessary to make this matter known and to advertise it, etc.

You will see the advantage of being a member. This show will be held somewhere else next year probably, and if you are a member, you can

much more easily get it to your town, than it you were not. There will be cheap rates here, and with the light membership fee, you will be able to review the stock from three states in one bunch here all at once. So that the membership fee is nominal enough so that each one may join.

Prof. Hayes : Gentlemen : It has been with a great deal of interest that I have watched the development of your Agricultural College and watched the wisdom with which your board of directors has selected its men. You have a man who is doing some practical scientific work for you. He has done some international and national work along the line of smut. I take pleasure in introducing to you Prof. Bolley, who will tell you about stinking smut and how to prevent it.

THE STINKING SMUT OF WHEAT.—THE. COMMERCIAL SIDE OF THE QUESTION.

BY HENRY L. BOLLEY,

Professor of Botany and Zoology, North Dakotaa Agricultural College and Experiment Station, Fargo, N. D.

THE BAKERS OBJECT TO SMUT. This summer I have had opportunity to investigate the commercial side of the smut question. I find that there are a number of people who are jointly and severally affected in their business operations by the occurence of this disease in the staple food crop. Without mentioning the consumers, the chain of commercial interests affected is represented by the bakers, millers, elevator men, railways and farmers. Each of these great interests has its own good and sufficient reasons for desiring that the wheat crop of the country might be freed from the attacks of this disease.

The baker's reason is evident. Smut is becoming so generally present in wheat that it is hard to get even best grades of flour which are free from it. The bakers trade demands white bread. A very small admixture of smut in the flour darkens the baked product very perceptibly. A baker's woes, it is said, commence in the raising quality of the dough. It is said that smutted flour acts much like new half sour flour, making a poor quality of kneading dough which "never seems to tire of raising" is "stringy" and "runs" all over. In other words, the flour from such wheat is not amendable to the usual bakers methods, and he does not want it nor care to pay for it.

THE MILLERS OBJECT TO SMUT. It brings into his already dusty occupation, an unnecessary amount of dirty dust. Even in the slightest amount, it cuts down the grade of his output, and interferes with his reputation as a miller and tends to ruin his foreign trade. Thus he must be at extra expense every day that by chance a smutted lot of grain does not get into his rolls. This matter of flour grades is easily seen to be one of great importance upon inspecting the care taken in one of the great mills. There one will see rooms and offices set apart for testing the quality of the flour at every stage of the process of the manufactory. By the baking and dough tests, there made, one readily sees why smut injures the grade of flour. One milling firm runs six large mills in which there is a water test made of the flour every fifteen minutes, seven doughing tests each day, and one regular baking test of regulation loaves. The grade of the output of the mills are constantly compared, and the head millers meet daily to inspect the products and con-

sult with the experts in the testing laboratories. Besides these practical tests the chemist and microscopic is also at his work there. (This is here mentioned to call attention to the exacting demands upon the modern miller.)

Smut in the wheat thus causes extra care in handling the samples received, and if the wheat is used at all demands the introduction of expensive methods and machinery. Thus, there are the extensive and expensive machinery of the wheat scourers, the "scourings" from which in most of the mills show a blackened mass of dust, which seems chiefly made up of powdered smut and the hairs of the grains. If, however, the wheat has enough smut balls in it to be evident upon handling, these scourers fail to do the work and the output of flour is ruined for first quality, besides, the rolls, bunting cloths, and all apparatus gets infected by the smut so as to injure much other flour from good grain.

To avoid this, large mills have undertaken to wash wheat. The success is not great. All screenings and light weight wheat is lost in the operation. Such screenings are worth from six to ten dollars per ton to the miller, but cannot be dried and are allowed to go over into the river at a loss of two cents per bushel. The extra cost of running the washing process adds another cent per bushel, for the wheat must not only be washed but dried, and the machinery is complex and costly. When it is all accomplished and admitted as possible, it is found that only one-fourth to one-half volume of such washed wheat can be used and yet allow of the making of 1st grade patent flour.

One of the chief and most important qualities demanded of a flour is that it shall have good keeping powers. Most of our commercial mills must put out a grade of flour and other mill products which must be at once bagged and shipped upon long voyages, perhaps, three to six months in transit. The washing process by its nature when done most carefully, endangers this quality of the flour.

Upon careful examination of a sample of washed and dried smutted wheat I find that some smut spores adhere to the washed grain. There are also in every smutted crop of wheat some grains which are part smut and part flour. The process does not remove these. No doubt, these last two facts account, in part, for the fact that only a small percentage of washed wheat may be used. The millers do not desire that others should try to clean up smutty wheat for them; for ordinary processes of fanning and scouring only result in more thoroughly painting the grains of wheat with smut. The millers earnestly desire unsmutted wheat.

THE ELEVATOR COMPANIES HAVE WOES OF THEIR OWN. Their purchasing agents have to live with the wheat raisers and have to do business with both farmers and millers, and such a man must be well balanced indeed if he can be satisfactory to both. They have to consider the value of wheats of all qualities, weed seeds, etc. Of all these the smut causes most trouble. He must protect the company. He must please the farmers. Some samples of wheat with lots of smut balls in are worth more than others with little if any smut. Some samples of No. 1 Hard quality must be rejected, because, though, having but a little smut, it is there in a different condition than in other samples. The elevator men do not like smutty wheat. They must handle it separately at a cost. An oversight of a load or two and the agent may easily spoil the selling grade of several car loads. If the purchasing agent buys at too high grade, the state inspector has an opportunity to show his company that he has made a mistake in judgment and that they have lost

money on the deal. Smut in the crop introduces a large element of speculation into the business of the elevator *men.* A small amount of unbroken smut balls in a sample of wheat when purchased seem quite innocent, but by the time the wheat reaches the terminals, the constant re handling results in breaking up the balls and in painting the wheat grains of an entire lot so thoroughly as to discredit the sale of the same.

THE RAILROADS HAVE AN INTEREST IN THE QUESTION, A railroad only prospers in proportion to the prosperity of the farmers and trades people along its lines. They must charge as much for hauling smutty cheap wheat as for wheat of best quality. Besides the disease very greatly lessens the amount which they have to carry. Smut is one of the drawbacks to the growth of wheat in the Northwest, and thus influences the reputation of the state to the detriment of future development of their landed and carrying interests.

WHO PAYS FOR THE LOSS? The farmer, the elevator man, the miller, the baker and the state by the loss of reputation, all pay for the loss occasioned by this disease of wheat. The farmer pays the greater part, because he grows the smut and must sell to others who have opportunity to try to protect themselves by a sufficient margin. This is an element of good citizenship, to protect ones interests, and ought to be expected of any man who buys to sell.

The farmer ought to object to the growth of smut for all of the foregoing reasons. Especially because he is in position to object with best hope of success. He can prevent the appearance of smut in the crop which he has for sale. Then the excuse for grading down the quality of the wheat cannot exist. The chief reason, however, why he should pre-vent the growth of smut is to remove the element of gambling with nature, as to this feature of his farm work. Sometimes one may sow smutty seed and reap a crop which the elevator man may accept, but what was the loss in yield? This loss in yield is the greatest element. I have known crops of wheat grown upon the same soil from the same quality of seed, which was seeded upon the same day to give a great variation in yield according as the treatment for prevention was successful, particularly successful, or a failure.

Often a crop which has been found to have but a few actually smutted heads in it, has been found to possess much shrunken and light wheat, and to give a much reduced yield and low grade. Smut was in the straw, but did not reach the heads before maturity of the grains.

THE REMEDY OF THE EVIL EQUALS PREVENTION. Stinking smut of wheat can be entirely prevented by a treatment of the seed grain before sowing so as to kill the smut spores (seeds of the smut plant). This can be done without injury to the germinating qualities of the seed grain. Indeed, I have found that the treatment, here recommended, actually increases the yield of wheat, even when applied to No. 1 Hard, unsmutted wheat. My records show increased yield for treated seed over untreated seed varying from a half a bushel to twelve or fifteen bushels per acre according to how badly the seed used was smutted. Thus one plot of wheat seeded upon the same ground and upon the same day, using smutty wheat, treated, and untreated, showed for the treated sample a yield of twenty-seven bushels of hard wheat, for the untreated plot a yield of seventeen bushels of a lighter grade of wheat. This untreated plot showed twenty-eight per cent, of actual smutted heads.

There are several ways of preventing the growth of smut which are

effective and cheap, three or four of which have been developed at this station during the past seven years. I need give only the one which I now consider the cheapest, simplest and most effective. The cost of this treatment as demonstrated by our own work and that of hundreds of other farmers during the past two years is somewhere in the neighborhood of three-fourths of one cent to two cents per acre for wheat.

METHOD OF TREATMENT. Use liquid formaldehyde at the rate of one pound of the liquid to forty or forty-five gallons of water. Wet the wheat thoroughly all over in any manner which you find most convenient, either by dipping or by sprinkling and shoveling. I have found that the latter method is very much the cheapest and most rapidly accomplished. It is equally efficient, if one will carefully see that a thorough case of shoveling is done while the grain is being sprinkled, thus insuring a thorough dampening of the surfaces of all the grains. The treatment will be more certain of being effective if the grain is left piled for two or three hours after treatment. If, however, the treatment is well done, one may commence to seed the grain at once; for one ought not to put on so much water as to make the grain a dripping mass.

CAUTION. In purchasing formaldehyde buy it of a. responsible druggist and ask him to guarantee that the product is what is known as standard formaldehyde. Standard formaldehyde is usually labeled 40 per cent strength. This is the strongest solution of formaldehyde upon the market. Formaldehyde of less strength would make your treatment operations a doubtful process.

Do not use more than fifty gallons of water for a pound of formaldehyde nor less than forty gallons. A solution of less strength than the one recommended is not sufficiently strong. A solution stronger than the one recommended is liable to injure the growth of the wheat.

Do not leave wet grain in a pile long enough to get hot, the germination may be ruined or the yield at least considerably injured. It is usually a good plan to treat the seed which is to be sown in the afternoon in the morning and that which is to be seeded in the morning, in the afternoon.

Do not put treated seed into bags which have held untreated seed, or drill the treated in a drill which has just been sowing smutty grain without cleaning the drill.

After treatment, the grain will be slightly swelled. One should know-how much seed he has submitted to the treatment, then find out how much there is by measurement when he is ready to drill it. This will allow one to set the drill so as to throw as much wheat per acre as he wished to sow of dry seed. When properly treated a bushel and a peck of wheat becomes equal to about a bushel and one-half through swelling.

One can estimate the amount of formaldehyde he will need to buy if he remembers that according to the care with which he handles the grain and saves the solution he may treat from fifty to one hundred bushels of seed wheat with each forty-five gallons of water.

"Changing" seed wheat is a pernicious farm practice. One pays a fancy price and gets an unknown bargain. Grow your own seed wheat. Grade it up, and keep it clean. One should breed seed wheat as one breeds animals. Improve your own stock. It will not "run out."

In this connection, it should be noted that elevator agents purchase wheat from all patrons, sometimes a smutty sample, sometimes a clean one. For milling reasons, he tries to keep them in separate bins, but

has to elevate all samples through the same shoot, spout, or "leg"; hence all samples become more or less infected. In some localities I have ascertained that the farmers are in the habit of storing their seed grain in the elevators. Many purchase their seed wheat from elevator companies. It should be kept in mind that this is a sure means of getting some or much smut in a crop.

HOW TO AVOID DAMAGE WHEN YOU HAVE A SMUTTED CROP. If you have not taken our advice, and find yourself with a crop which shows that there are smutted heads in it before harvest time, you should not allow the grain to become dead ripe. The smut balls when thoroughly ripe readily break open in the threshing and after the handling of the grain. It is this broken up smut which is most detrimental to the milling qualities of wheat, if the smut balls are not broken during the handling the blast of the fanning mills and cleaning machinery readily blow them out. Elevator men do not cut down the grade very much if smut balls are unbroken.

If you have a smutty crop to thresh be careful to select a day when the grain is thoroughly dry and when there is a good dry atmosphere and a good breeze. If the grain is damp or the atmosphere is damp and muggy when you are threshing a very small amount of broken smut balls will be sufficient to paint all of your grain with smut spores. The elevator men and the millers are then pretty certain to grade, your wheat rejected regardless of its quality as wheat.

I have visited some elevators in almost every locality in North Dakota during the harvest and autumn of this year, and find that there is scarcely a sample of wheat which has come from untreated seed that does not show some smut. I find also that because of the dry harvest and threshing time so much of the smut has been blown out of the wheat during the threshing process and that the wheat is also uniformly of so high grade in some localities that the purchasing agents of elevators have paid but slight attention to the amount of smut in making out their grades. I hope this may not deceive the farmers of Minnesota and North Dakota into thinking that their wheat will do for seed next year unless they are quite certain that there was no stinking smut at all in it previous to harvest. The fact that an elevator man may be willing to accept the sample of wheat and call it "No. 1 Hard" is not sufficient evidence that it has not enough smut spores in it to make your crop go rejected next year if you happen to be unfortunate in weather conditions.

If there are not sufficient details given in this to satisfy you that you ought to treat your seed wheat write to the experiment station for its regular bulletins in the matter or ask such questions as you may desire.

If you intend to take our advice and treat your seed grain this coming season, but are not quite satisfied as to whether it will do any good or not, after you have seeded all of the treated seed sow a few acres of ground to smutted seed, provided your neighbor will allow you to do so, without getting very angry about it.

THE SMUTS OF OATS, BARLEY, MILLET AND CORN, AND THE LOOSE SMUT OF WHEAT: Oats, barley and millet each have one or more kinds of smut of their own, that is one kind of smut does not affect more than one kind of plant. The same treatments recommended for wheat seem to be successful in thoroughly preventing occurrence of smut upon those three crops. The method of treatment is the same, only, as the smut spores get inside of the chaff

which covers the actual seed, more liquid must be applied so as to allow the same to soak in under the scales or chaff coverings of the grains

MORAL SUASION. These smut diseases, especially that of stinking smut, may be gotten rid of in this region. All of the people in these two states are concerned and there must be some unity of effort in order to get rid of such a persistent pest. Each farmer should use his influence, the powers of moral suasion, upon his neighbor to get him to so handle his farm operations as to cease to raise smut, which may blow over upon all the surrounding farms and undo the work of those who do make stren-ous effort to avoid its occurence in their crops.

Prof. Bolley: I have here .samples of wheat, one came from pure seed and the other came from seed that had been inoculated. I hubbed the smut balls in my hands with the wheat seeds. You can readily see the difference.

I also have two loaves of bread, one made from pure flour, the other made from flour containing smut.

QUESTIONS AND ANSWERS.

Question: Which tastes the best?

Answer: No difference can he detected,

Q. Can you smell it?

A, No, sir.

Q. How much less does the ordinary smut wheat bring in the market?

A. I couldn't say as to that.

Prof. Hayes: How often is it necessary for a farmer to treat his wheat?

A. I should treat my wheat every year with formaldehyde. It can be obtained here in Fargo for 50 or 60 cents a pound, in ten pound lots.

Q. How often can you use the solution?

A. Over and over again until it is used up.

Q. Is there danger of getting formaldehyde that is not up to the standard ?

A. I don't know as to that. I would say, go to a druggist that, you can rely on and ask him for a standard formaldehyde at 40 per cent strenght.

Q. Isn't the bluestone treatment as good as any other?

A. The bluestone will not get as good a yield as the formaldehyde treatment will; nearly four bushels better out of a twenty-bushel crop.

Q. What strength?

A. One pound of formaldehyde to forty-five gallons of water.

Q. How much wheat will the forty-five gallons cover?

A. It depends on the man; I am able to apply forty-five gallons to seventy-five bushels of wheat. Be sure and get the whole surface of the wheat grain wet.

Q. Using the dipping process, is it only necessary to get the grain wet ?

A. Yes, sir; get all the air bubbles out of it.

Q. Will the seed be injured by leaving it a length of time in the solution?

A. You can leave it two hours, but it will swell your grain if you leave it too long.

Q Will the formaldehyde have the same effect on the seed if you allow it to dry on the seed?

A. It will.

Q. Is it necessary to thoroughly wet the crease in the grain?

A. It is.

The convention here adjourned until 7:45 p. m.

EVENING SESSION.

Mr. Randall: I am glad to see the house so well filled again tonight. I believe we have a program of unusual interest, and we will now listen to a short paper by Mr. J. H. Reed of Amenia on the "Uses of Stubble."

THE VALUE OF STUBBLE.

BY J. H. REED OF AMENIA.

I have been asked to say something to this convention on "The Value of Stubble". Now a thing is not of value to us unless we can make use of _it or exchange it for something we can use.. Robinson Crusoe, on his lonely island, ran his fingers through his pile of gold and silver *coins* and exclaimed, "worthless stuff" The grain of our stubble fields is of no value unless we can find a way to use it.

He that saves one grain out of two that would be wasted is a benefactor of mankind.

How much grain are we wasting per acre on our Red River Valley farms? is a question I have lately been asking all my farming acquaintances and I find the concensus of opinion to be that we lose each year enough grain to re-seed the land.

I will, for the sake of "making some conservative figures, put the amount below what the average of the replies I have received would make it, and say that one bushel and four quarts of wheat, two bushels of oats, and two bushels of barley per acre are scattered on the ground and lost.

In the year 1898 there was, in Cass county, 488,000 acres of wheat. With a waste of one and one eighth bushels per acre, we lost 549,000 bushels. In the same year we had 71,000 acres of oats and wasted 142,000 bushels.

In the whole state of North Dakota, in 1898, we had 3,700.000 acres of wheat, which means a loss of 4,162,000 bushels. We also had about 620,000 acres of oats and lost 7,240,000 bushels. I believe the per cent of waste on flax and barley is still greater and startling as the statement may seem, we are actually losing (if my figures and those of the Commissioner of Agriculture are correct) from eight to ten per cent of all the grain we raise.

Can this grain be saved or is all this waste necessary and unavoidable?

Our harvesting machinery is very perfect, yet. carlessness on the part of drivers, want of attention to small details, and lack of. efficient supervision over shockers and bundle teams, is no doubt responsible for some part of it. Failure to begin harvest at the proper time is, in my opinion, the great leak in our grain growing business. There is a thousand dollars lost by letting grain get too ripe where there are ten lost by cutting too green. How, many of you ever lost a hundred cents by beginning harvest too early? How many of you never lost a hundred dollars by be-ginning too late? This waste is, in great part, preventable, but to discuss it is not in order here. There is, nevertheless, an unavoidable scattering from harvester, from shock, and from bundle wagon. What shall we do about it?

In the practical and minute code promulgated by that great legislator and political economist, Moses, we find this decree: "And when ye reap the harvest of your land, thou shalt not make clean riddance of the corners of the field when thou reapest, neither shalt thou gather any pleaning of thy harvest; thon shalt leave them unto the poor and unto the stranger."

And we have reason to believe that ibis law was observed and that the poor were glad to avail themselves of its privileges, and the waste was prevented. For who can forget how Ruth, the young Moabite widow, gleaned all day on the bonaanza farm of Boaz, for a bushel or less of barley, and how he fell in love—or she fell in love—but that is another story, as Kipling sayeth. The modern Ruth would be very foolish to work in the field all day for a bushel of barely, or even of wheat, when she can earn or at least command a dollar a day and board in the farm-house kitchen; and the Cass County Boaz needeth not to instruct his young men to "let fall a few handfuls of purpose," for verily, the hobo shocker scattereth as fast as the harvester gathereth.

If, then, the poor actually cannot afford to glean the scatterings, would it not be practicable, with a wide rake, an old horse, and a cheap boy, to go over our extensive fields and save the waste. One, at least of my neighbors tried it, and the party who threshed the stack thus obtained expresses himself thus: "We threshed and we threshed and we threshed and it seemed as if we never would get done and after all we only had a few bushels to show for our work."

Are we, then, helpless? Must we submit to the inevitable and wait for interventions to perfect machinery? Or is there some cheaper labor we can employ? My grandmother, when rallied for wasting her time on worn-out garments, retorted: "A hen's time is no time," which was her way of saying, it's better to do most anything than be idle. It is hardly practicable, however, to keep hens enough, or turkeys enough, or even pigs enough, to pick up over a whole wheat farm, but then there is the sheep. Surely no more economical or industrious gleaner can be found. A flock of sheep is easy to tend, and will clean up very nearly all the grain from a stubble field, and much weed seed and other rubbish beside. The question then becomes, is there any profit in keeeping a flock of sheep the rest of the year for the sake of saving what they will pick up on the stubble? Or can we make any profit by buying sheep off the ranges, feeding them a couple of months, and then selling them in Chicago or St. Paul?

The Amenia and Sharon Land Company of this county has been working rather extensively into sheep for the past few years, and has depended considerably on stubble feeding for fitting for market, and I may say confidently that with them the business is successful. They had this past season about 17,000 sheep, in bands of about 1,500 or 1,600 each, scattered over several townships, from the last of threshing till plowing was finished. About 6,000 have been marketed, and 11,000 are being wintered on straw, millet, and corn fodder.

Whether it will pay the smaller farmers to keep sheep I am not at present prepared to say. This company has the advantage in having so large a flock, of being able to afford summer ranges with suitable headquarters, shearing sheds, dipping tanks, and supervision over the whole. Another important point of advantage is in having several grain elevators which supply quantities of screenings for finishing off the muttons after they come in from the stubble fields. Now, according to our figures of

one and one-eighth bushels waste per acre, the wheat scattered on a section should be worth about three hundred and fifty dollars. I have ascertained that an average section of stubble will keep one thousand sheep on full feed about six days. At the present price of screenings in South St. Paul, it costs the feeders there $22.00 per day, or $132.00 for six days, to feed the same number of sheep. Theoretically, then, an ordinary section of stubble is worth $132.00 to feed to sheep, and I believe it to be actually worth that to the man who is going to feed the sheep until they are fit for the market. But the facts are that the time we can keep the sheep on stubble is not enough to make finished mutton, and half-fed muttons, like half-fed steers, are not, as a rule, good money makers. That is the reason of my statement that the A. & S. Land Company have an advantage over the small farmer in having their elevators. The price of feeding wethers has been so high in Montana for the past year or two that feeding has been a close, and in some cases, a losing business, but these conditions are of advantage rather than otherwise to him who is raising his own feeders.

Another point for consideration is this. If a section of land will keep a thousand sheep six days it will only keep a hundred sheep sixty days, or about the time they would naturally run on stubble. Now in the defenseless condition of our own and our neighbors' gardens and corn patches, it becomes necessary to herd these sheep, and you will readily sec that it must be cheap labor that can profitably herd so small a flock.

Now, for conclusions, for this paper will have no value unless it can be put to some use. First, then, there are now thousands of dolllars worth of grain going to waste; second, it is valuable feed, for it has been proven that sheep will thrive and fatten upon it, and as some have found a profit in it we conclude others may. On how small a scale this profit can be secured remains to be shown by further experiment.

President Randall: We will now listen to a talk on "Cereal Root Development" by Prof. Ten Eyck of the Agricultural College.

A STUDY OF THE ROOT GROWTH OF SOME OF OUR COMMON CULTIVATED FARM PLANTS.

(Address, illustrated by lantern pictures.)

BY A. M. TEN EYCK, M. S.
of the North Dakota Agricultural College.

In the summer of 1898 experiments were begun at the Station with the object of studying the root development of our common cultivated farm plants. Bulletin No. 36, published *in* January, 1899, is the report of the first year's work. In that report the roots of wheat, oats and corn received special attention. During the summer of 1899 a special study was made of the roots of flax, potatoes, sugar beets and grasses. In this paper I wish to give a brief review of the work done thus far, and I shall use the cuts largely as the basis of my discussion.

THE MANNER IN WHICH THE ROOT SAMPLES ARE PREPARED.

If you will look now at the picture of wheat roots (see Fig. I) I will describe briefly the manner in which the samples are prepared:

Dig a trench two feet wide about a block of earth in which is growing the plant or plants, the roots of which it is desired to secure as a

sample. Fit closely over this block of earth a cage, made by covering the side., and ends of a wooden or iron frame of the proper dimensions with common wire poultry netting. When the cage is properly fitted so that the top part of the frame rests firmly on the ground, Plaster of Paris stirred to a thin paste with water, is poured into the top of the frame about the base of the plants, until it is one and one-half to two inches thick and allowed to set and harden. Small wire rods (Nos. 10 and 12 galvanized iron or copper wire straightened and cut into pieces about two inches longer than the cage is wide, sharpened at one end and looped at the other) are now run through the blocks of earth the shortest way, or better, two ways when the cage is square, and made secure at one end. Water by means of a small force or spray pump is now applied and the dirt is slowly washed away, leaving the roots suspended on the wire rods. The frames of the cages illustrated are made out of two-inch stuff and are twelve to sixteen inches square, or about that width in the long cages. This is as thick a block of earth as the rods can be shoved through easily. It will be perceived that this plan will not work successfully in a soil which is loose or inclined to cave. The method requires no artificial preparation of the soil previous to planting the crop. Samples prepared in this way show the actual development and distribution of the roots which takes place under natural field conditions.

WHEAT ROOTS.

Fig. T shows a sample of wheat roots taken at maturity one hundred and ten days after the seed was planted. The wheat is a variety of Scotch Fife, known as Experiment Station 66. The sample shows a good height of straw, the heads are well filled and the wheat is plump and hard. The soil in which the sample grew has been cropped twelve years—mostly with wheat. The ground was fall plowed. The wheat was sown in drills six inches apart and given ordinary treatment.

The first thing noticed in the sample is the depth to which the roots penetrate, i. e., four feet into the soil. This was the length of the cage and was as deep as the roots were washed out. I venture to affirm, however, that many roots went a foot or two deeper. When the sample was taken the depth of the water table in that field was six and one-half feet. The roots of the wheat must have reached very nearly to the surface of the water filled soil.

The main roots of the wheat grow almost vertically downwards, giving off numerous small branches and feeders, which practically occupy the soil to the depth shown.].n the upper part of the soil, the branches form a fine not-work clearly shown in the figure. All of the deep roots are slender and thread-like and nearly uniform in diameter throughout their length, notwithstanding the fact that they give off many branches almost equal to themselves in size. The roots are given off from the base of the root-stock in the form of whorls or circles. Those of the upper whorls curve outward before striking downward into the soil, acting somewhat as brace roots.

OAT ROOTS.

Oat roots are similar to wheat roots but larger and more numerous, making a greater fibrous growth in the upper part of the soil and extending fully as deep into the ground.

FLAX HOOTS,

In Fig. 2 is shown a sample of flax roots which was taken eighty-

seven days after planting, just as the crop was ready to cut for seed. (Variety, common seed flax.) The samples grew in soil which has been cropped for sixteen years, mostly with wheat. The ground was spring plowed. The flax was sown in drills six inches apart.

Flax has a different system of rooting from that of wheat or oats. Its roots do not go so deep, (a few roots in this sample reached a depth of three feet) but it makes a much greater fibrous root growth in the upper two feet of the soil. By its intricate system of rooting it occupies the soil very completely. The crop is not so deep a feeder as wheat or oats, but it is doubtless a much closer feeding, and with drawing the water largely from the upper part of the soil, it is apt to leave the ground in a dry, unfavorable mechanical condition at the close of the season, which sometimes, perhaps, works injury to succeeding crops. Experiments at the Station have shown that on old ground, flax makes a good rotation for wheat. Many complain, however, that when flax is sown as a sod crop and followed by wheat, a poor yield of wheat is the rule. This bad result is doubtless due to the physical or mechanical effect which the flax has on the soil. The crop draws the water out of the sod and prevents it from decaying. When this land is back-set the sod turns over in hard, dry, unrotted chunks which will not work up. It is impossible to put such a field into good physical condition for growing wheat or any other crop. The flax crop has in a measure embalmed the sod, and it will not rot now as rapidly as will green sod, so that it may take several seasons for the injurious effects to entirely disappear.

BROMUS INERMIS ROOTS.

In Fig. 3 are shown three samples of Austrian Brome grass, *Bromus inermis* roots. The samples were taken July 18th and 19th, 1899. Sample No. I is one year old from the seed. That is the seed was sown in the spring of 1898 without a nurse crop. Sample No. 2 is two years old from the seed and sample No. 3 is old sod, five years old from the seed. The samples offer a valuable study both in the growth of roots and grass. It will be noticed at once that this grass is a wonderful sod producer and a very deep feeder. It should and does require a deep and well drained soil for its best development.

It ought to be a good dry weather grass. At one year old the roots have reached n depth of over four feet and have formed a very good sod. The roots of the two-year-old grass were taken to the depth of five and one-half feet as shown in the figure, and I should judge that they went at least a foot deeper. At this age the grass had formed a dense sod six to eight inches thick and the whole soil to the depth shown was fully oc-cupied by its roots. The sample of old grass was taken from a field which was a little lower and perhaps not quite so well drained as the field from which the other samples were taken. This may account for its less length of roots. What the roots lack in length, however, they make up in numbers. Such a net-work as this sample shows is the wonder of all who see it. The sod is ten to twelve inches thick and so dense in the first six inches that great difficulty was experienced in washing out the dirt; in f:ict, there are more roots than soil at this depth. The system of rooting is similar to that of wheat already described. The grains and grasses are much alike in this respect.

In studying the growth of this grass, we notice that as the soil becomes filled with its roots there is less and less growth of foliage. The same fact is more or less characteristic of all perennial grasses. Year

after year, the grass keeps sending down new roots, while the old ones continue to live and grow. The old and new roots were easily distin guished in the. two-year-old sample when it was first taken, the new roots being white and tender, while the old ones were more woody and darker in color. At the stage when sample No. 3 was taken, nearly all the available plant food in the soil has been stored up in the roots of the grass. When this sod is broken up and the grass killed, these roots gradually decay and enrich the soil for future crops.

When the wild prairie is first broken, the soil is mellow, moist and rich, producing abundant crops. After a few years of continuous cropping and cultivation, the physical condition of the soil changes; the soil grains, become finer; the soil becomes more compact and heavier to handle; it dries out quicker than it used to; it bakes worse, and often turns over in hard clods and lumps when plowed. This compact texture and bad mechanical condition of the soil make it difficult for the young roots of plants to develop properly and also causes an insufficient supply of air in the soil,, which is almost if not equally as detrimental to the crop as an insufficient supply of soil water. After a soil has been cropped and cultivated a long time it lends to run together and is very sticky when wet, but when dry, the adhesive character disappears almost entirely; the grass roots which formerly held it together are decayed and gone, and now when loosened by the plow, it is easily drifted and blown away.

The perfect tilth and freedom from clods so characteristic of virgin soils is always more or less completely restored whenever land has been laid down to grass for a sufficient length of time. After the ground is covered with sod, the puddling action of rains is prevented. As the roots grow, the soil particles are wedged apart in some places and crowded together in others, and by means of lime or other materials, the small soil grains become cemented into larger ones, and thus the open and mellow character of virgin soil is restored—and not only this, but by the accumulation of plant food in the roots, the soil is made more fertile for succeeding crops.

In our rotation experiments at the Station, four crops of wheat after two crops of timothy have yielded, as an average, nearly six bushels more wheat per acre each year than was obtained from adjacent land cropped with wheat continuously, giving even better results than were obtained by rotating with cultivated crops. Truly, laying down to grass is nature's way of renewing the soil, and from the above study we conclude that nature would choose Bromus inermis in North Dakota as the best grass to do the work.

TIMOTHY ROOTS.

A sample of timothy roots, five years old, from the seed shows a much less growth, both in depth of roots (three feet) and in thickness of sod (four to six inches), than the Brome grass.

NATIVE PRAIRIE, GRASS ROOTS.

A sample taken from .an old hay meadow which has never been broken shows a fair depth of roots (four feet) but a comparatively thin poor sod when compared with Brome grass.

CORN ROOTS.

Several samples of corn roots have been taken at different stages of growth. Thirty days after planting, at the second cultivation, the roots

from adjacent hills three feet apart already meet and interlace. The main, development in the early part of the season is laterally or to the side. A few roots have reached a depth of twelve inches, but the bulk of the growth is within eight inches of the surface of the ground. Six inches from the-hill the main roots lie within two and one-half to three inches of the surface. Midway between the hills they have reached a depth of four and one-half inches. Deep cultivation even at this stage of growth would have injured the roots.

The sample of corn roots taken fifty-five days after planting, at the last cultivation, shows that at this stage the main roots have penetrated to the depth of two and one-half feet. The number of horizontal roots has increased and their length is much greater, many extending now from hill to hill (three feet eight inches apart), inclining most of their length, but finally, at about three to three and one-half feet from the hill, they dip often almost vertically downward. The horizontal roots, as well as the vertical, send out numerous branches and small feeders in all directions. Many vertical branches from the horizontal roots have penetrated the hard layer of soil beneath the furrow slice and have already reached depths almost equal to those of the primary vertical roots. The branches in turn give off other branches and these produce fibers and root hairs so that the whole soil at this stage of growth to the depth of two feet was practically filled with roots. In this sample the main roots are three inches from the surface of the ground at six inches from the hill and about four inches below the surface midway between the rows. Numerous feeders or small fibrous roots were noticed in washing, within two inches. of the surface, and some were caught on the wires. After corn is ten inches high, it should not be cultivated deep. A sample of corn roots taken after the corn was killed by frost, ninety days after planting, showed that the whole field to the depth of three and a half feet was fully occupied by the roots. See Fig. 4.

POTATO ROOTS.

Several samples of potato roots have been taken. A sample of Early Ohio potatoes, forty-three days after planting, just as blossoms were forming and tubers setting showed a depth of roots of eighteen inches. Like-the corn, however, the early root growth is mostly horizontal and the bulk of the roots at this stage lie within eight inches of the surface of the soil. The roots from adjacent hills three feet apart already meet and interlace. Six inches from the hill some of the main roots are only about two inches-from the surface, while midway between the rows their depth is barely three inches. The roots of potatoes are even more subject to injury from deep cultivation than are those of corn,

A root sample of Early Ohio potatoes taken seventy days after planting, when the vines were green and growing and the tubers nearly full size, show the roots even nearer the surface than they were in the sample taken earlier. A large main root was caught on the wires an inch and a half from the surface, midway between the hills. Some of the main roots, have reached a depth of two and one-half feet.

Fig. 5 shows a sample of Early Ohio potato roots taken at maturity, ninety days after planting. Potato roots are very tender and brittle, and all the smaller branches and fibrous roots were broken off in the washing. The horizontal roots send down many vertical hair-like branches, which in this case often reached a depth of two to two and one-half feet. Their stub ends will be noticed in the figure. At this stage, the soil was fairly

well filled with roots to the depth of two and one-half feet. The system of rooting is similar to that of corn, but the early potato is not so great a forager as corn, rooting neither so deep nor so wide, nor occupying the soil so completely with its fibers. Therefore, it will stand close planting, and does not require so deep a soil as some other crops. But for large yields, the crop must have an abundant supply of plant food near the surface, and a mellow, open, yet moist soil, kept so by frequent and thorough cultivation.

Other points noticed in this study are that the new potatoes form above the old seed, also that the roots generally start from the stem, above the seed. The depth of planting, therefore, determines largely the depth at which the new potatoes are produced and also to some extent the depth of the horizontal roots.

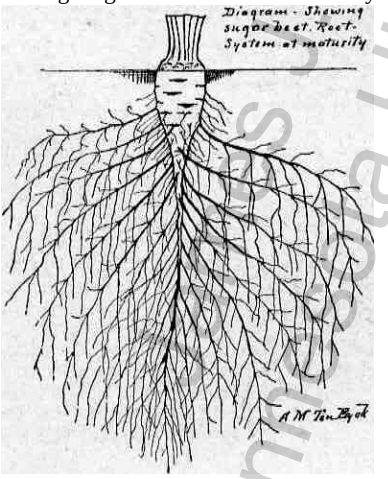
LATE POTATOES.

A sample of late potato roots (variety, Rural New Yorker No. 2), taken ninety days after planting, show a depth of roots of fully three feet, and also an extensive lateral growth. The late potato roots more freely, more deeply and occupies the soil more completely than the early potato. It requires more root room and will not stand so close planting as the early sort.

SUGAR BEET ROOTS.

A sample of sugar beet roots taken fifty-two days after planting, at the fourth cultivation, shows a depth of roots in the best plants of over two feet, but comparatively little lateral growth. The side branches of the main tap root extended outward only four to eight inches at this time, and were white and slender with enlarged ends. There was scarcely any branching in the surface six inches of the soil. Up to this stage, sugar beets may be cultivated deep without injury to the roots.

The roots of sugar beets are so tender and brittle that I have been unable in six trials at different stages of their growth to secure a sample in which the roots were preserved sufficiently to give a good idea of the root system. The following diagram was made from a study of the samples taken.



The diagram merely represents the skeleton of the root system. The sugar beet is by nature a deep feeder. It needs a deep, mellow soil, not only that the roots may secure the necessary plant food, but that the vegetable itself may properly grow and expand. In practice it is considered well to subsoil for sugar beets. The effects of sub-soiling on the Station farm is clearly shown by comparing Fig's. *6* and 7.

Eighty-eight days after planting (cultivation had been discontinued) a sample shows that the main tap root had reached a depth of three and one-half feet, and that many branches extended out about the main root twelve to twenty-four inches. These branches send outward and downward numerous hair-like branches which often reach two to three feet in depth. At this stage, the beet sends out a number of small fibrous roots near the surface, still too short, however, to receive much injury from the cultivator. The greatest amount of branching and fibrous root growth lakes place in the space between eight inches in depth and fourteen inches in depth. While corn and potatoes make a large lateral growth of roots near the surface early in the season, the tap root of the .sugar beet grows directly downward, making very little lateral growth near the surface. The very nature of the root growth of these several plants indicates the methods of cultivation which each crop should receive.

THE SOIL IN WHICH ROOTS GREW.*

The soil of the Station farm is fairly typical of the famous Red River Valley wheat lands, and, in a general way, it may be described as a very fertile, deep, black loam, underlaid by a subsoil slightly finer in texture and lighter in color, often called a clay, but which is more properly a compact, heavy loam. The whole soil is a water deposit formed by the gradual filling and draining of old Lake Agassiz, of which Lake Winnipeg alone remains.

This soil is sticky and heavy to handle when at all wet and below the depth to which it is loosened by the plow it is generally compact and gummy. Spots of real gumbo are frequently met with. The soil contains a large amount of organic matter, ten to twelve per cent in the surface foot, and has a very large water capacity, samples of the surface foot as taken from the field (not saturated) often showing over forty per cent of soil moisture.

CONCLUSION".

It is evident from the samples studied, that there is much difference between plants in regard to the growth and development of their root systems. Crops may be divided into two classes, those planted in rows and cultivated, i. e., corn, potatoes, beets, etc., and those sown broadcast or in drills a few inches apart and not cultivated, such as wheat, oats, flax, etc. The roots of the plants which constitute the last class named penetrate deepest into the soil but make only a short and rudimentary lateral growth; while the roots of the cultivated crops spread out horizontally in every direction and occupy more soil, but do not extend so deep into the ground as do those of the sowed crops. This may be the result of the different methods of culture. Or, more correctly, perhaps, the different methods of culture are the result of the different systems of rooting which are characteristic of the various plants.

*See Bulletin No. 36 for complete description and mechanical analysis.

Plant study in the past has been mainly above ground. Corn, potatoes, etc., are planted in rows and hills, so that the plants may have room to get the air and sunlight, and be properly cultivated, but when we go beneath the surface and look at the roots of plants we find other reasons, for the success of those systems of cultivation which we practice because experience has taught us they are the best. Not only do plants need room above around to get the air and sunlight, but their roots require even more room in the soil beneath, that they may properly develop and supply the-water and nourishment necessary to the life and growth of the plant.

The study of the growth and development of the root systems of plants offers a wide and profitable field for investigation. The work done by Hays, King and others on the roots of corn has revolutionized the methods of cultivating this crop, and careful study may discover many valuable facts which may lead to better and more successful methods of culture than those at present practiced.

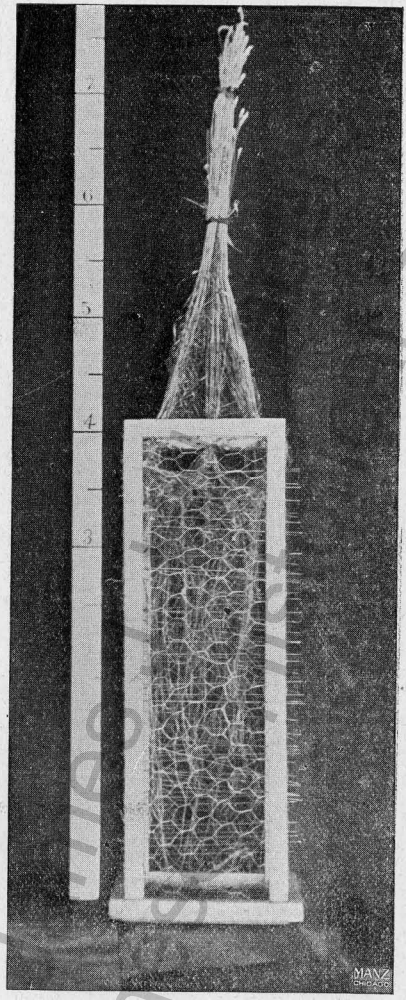


FIGURE 1—A sample of wheat roots taken at maturity, 110 days after planting.

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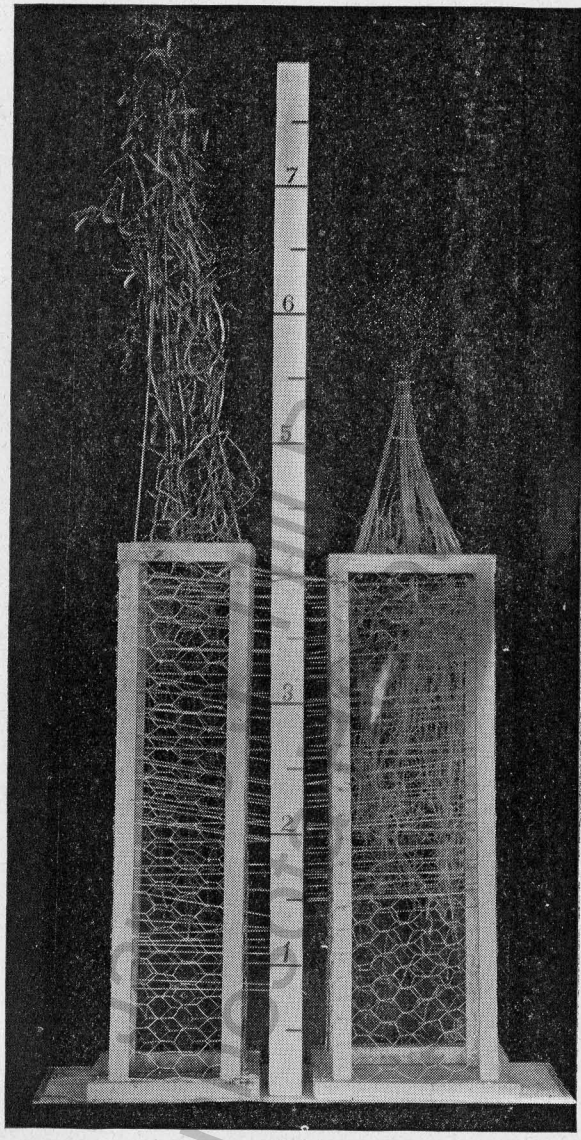

FIGURE 2—A sample of flax roots taken just as the flax was ready to cut for seed, 87 days after planting. At the left is a sample of field pea roots.

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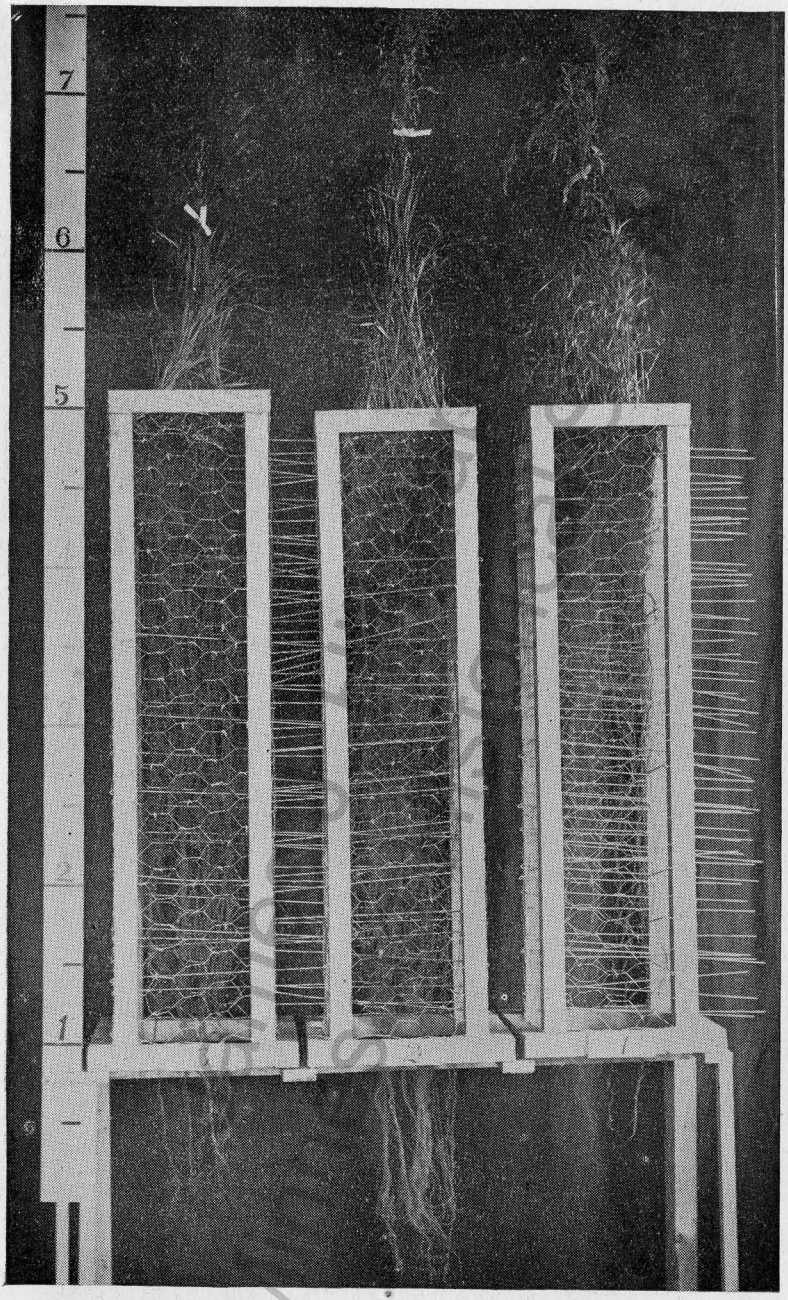

FIGURE 3—Samples of Australian Brome Grass (*Bromis inermis*) roots No. 1—One year old from the seed. No. 2—Two years old from the seed. No. 3—Five years old from the seed, old sod.

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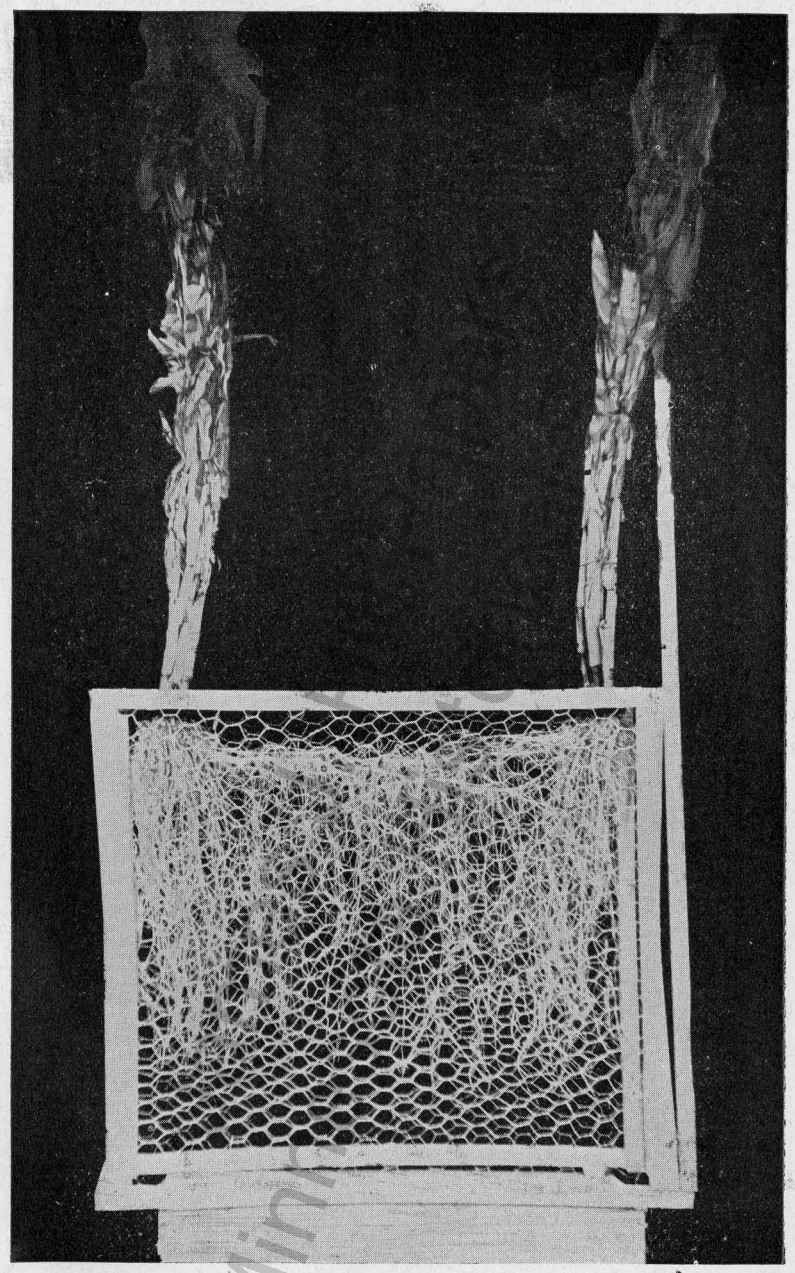

FIGURE 4—Showing the distribution of corn roots between two rows at the end of the growing season. The corn was killed by frost 90 days after planting.

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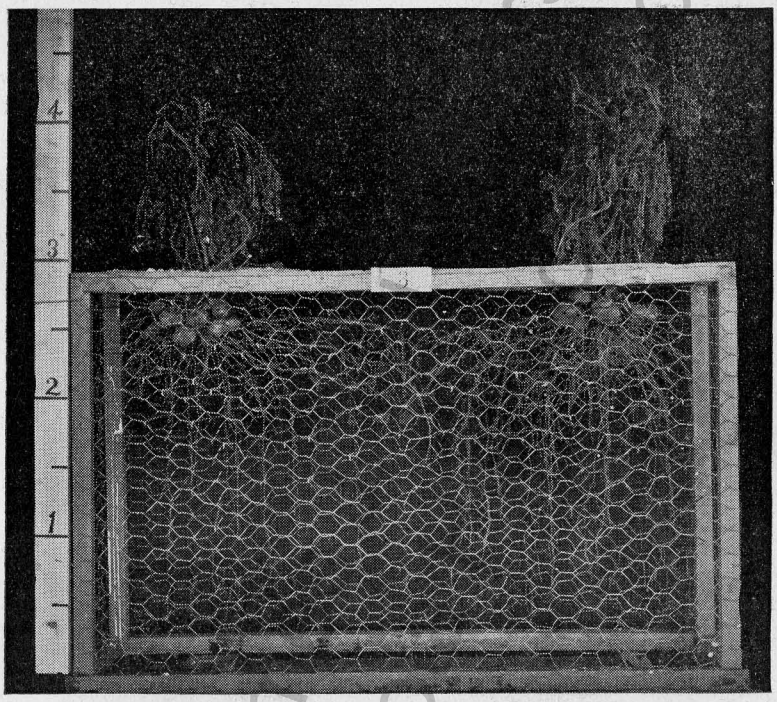

FIGURE 5—A sample of Early Ohio Potatoes taken 90 days after planting, showing the distribution of the roots between two rows.

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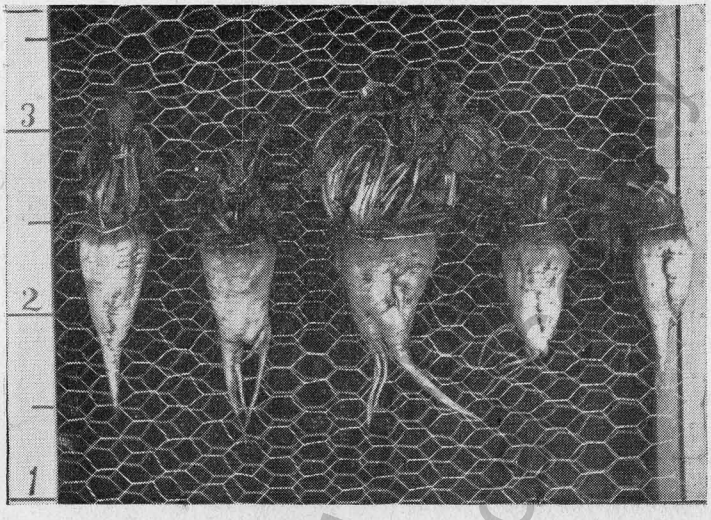

FIGURE 6—Showing type of sugar beets which grew on ground plowed six inches deep but not sub-soiled.

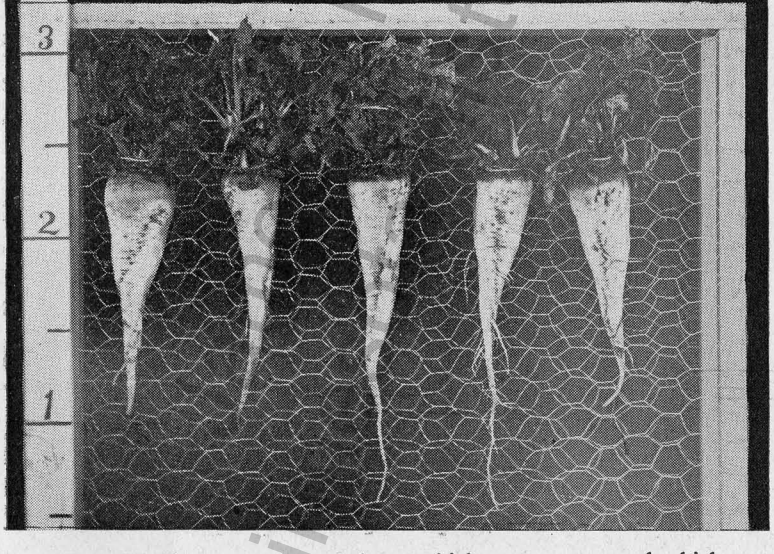

FIGURE 7—Showing type of sugar beets which grew on ground which was sub-soiled eight inches below the bottom of a six inch furrow, i. e., soil lossened to the depth of fourteen inches.

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Mr. Randall: Miss Spencer and Mr. Treat will give us a piano duet. Miss Spencer and Mr. Treat are Agricultural College students.

[Duet rendered.]

Mr. Randall: Before proceeding with the next paper, I want to say that we have a question box here that will be opened tomorrow morning. We will be glad to receive any questions of benefit to you and we will ask you to write and hand them in so that they may be assorted and given to the proper persons to be answered.

The convention adjourned till 9:3O ; A. M. Thursday.

THURSDAY, JANUARY 2?.

MORNING SESSION.

QUESTION BOX OPENED.

Mr. Randall: We will take up a number of questions. The first question is—Is it well to cross a pure bred bull with other pure breeds?

A. Mr. Hays: There has been a good deal of discussion about the crossing of breeds of animals. The policy generally recommended is to take one kind of sires and stick to them. Mixing up, has been found to make varieties, sometimes higher and sometimes lower. It is uncertain and not well to follow. A point in breeding in this country, aside from the breeding the farmers are doing, is that there is another third point that is bound to come up in this country and that is to breed new breeds for America as we have bred trotting horses for America. It is breeding for a nation; making new breeds. This should be in the hands of a few men having a great variety of animals to breed from.

Mr. Randall: The second is upon wheat raising—Q. Would you advise discing the land before seeding in ordinary years?

A. Mr. Wellman—Certainly, if it needs it. Discover the condition of the field; if it is too hard, why, disc it; and if it is in condition, sow it and get the seeds into the ground. Discing would not be necessary under ordinary conditions.

Q. Can you keep down the wild rose by discing, or is there any remedy?

A. Nothing but plowing.

Q. How deep must you plow to kill the wild rose?

A. Probably through to the other side of the world.

Mr. Randall: Plow twice in a single season is as good as anything.

Mr. Hinebauch: In regard to rosebushes. I had a piece this year full of rose bushes. This summer I gave that field a dressing down with the J. D. Tower cultivator, and in looking the ground over this fall, I didn't see any bushes except in the road.

I began about the 1st of July and kept it up for about six weeks, and discouraged the bushes by keeping the roots destroyed. We know that if weeds are going to succeed they must have soft ground, so let the seed grow and then kill the sprout.

Prof. Hays: As to weeds, let them grow and then nab them as Mr. Hinebauch tells you. Lots of men have summer-fallowed and haven't killed the flag grass, but keep on cultivating it or plowing it, if you haven't a cultivator and don't let it breathe. This is no small object.

Mr. Randall: I have a very lively recollection of this flag grass, and we did not get rid of it until we plowed it through one dry, hot summer.

Q. Is Quack grass the same as Bermuda grass?

A. No sir, it is not.

Mr. Bolton: The quack grass of the eastern states we all know pretty much about. There is a different condition in this country. Is that the same species?

Prof. Bolley: The cord quack grass, as scientific men use it, is entirely different. The quack grass of New York and New England is the one generally recognized as the quack grass. The grass Mr. Bolton has reference to is what is known as the holy grass and it is the worst kind and is a weed.

Mr. Hays: Have these varieties of the quack grass been known and the nomenclatures worked out?

A. Yes sir, the grasses are entirely different.

Q. Are there any other varieties in this state than that one?

A. No, I think not.

Mr. Childs, of Crookston, will give you a little experience of his; in corn raising in the Red River Valley.

CORN CULTURE IN THE RED RIVER VALLEY.

BY E. D. CHILDS OF CROOKSTON, MINN.

Out of the many good things to be derived from this convention are the experiences of those who have appeared before you, and some of them will be the most precious to you, as many of them will no doubt answer, the particular problem each one of you came here to have solved. Now if we only knew what your questions were, we might perhaps fit our remarks to suit them, but not knowing what they are, we can only speak of our own. If from them you can derive anything helpful to you, the proceedings of this convention will not be in vain.

I must take you into my confidence somewhat and tell you of the problems that I am seeking to solve, in raising corn, that is, growing corn in the Red River Valley., but first of all, you will permit me to amend my subject of growing corn in the Red River Valley. I am seeking to run a somewhat extensive dairy on a somewhat limited amount of grain; to take care of about 175 head of cattle and horses necessary to carry on this operation and raise the feed and pay the help from about 400 acres of land. You see while from an Eastern standpoint that is a large area, yet from the Western standpoint, it is small. And in looking about for a food crop for this stock, and experimenting somewhat along different lines, it has forced itself upon my convictions that the most profitable, is the corn crop.

In the early day when we first came into the Red River Valley, in '77, the virgin prairie about us was unbroken, and we could step out from our door and cut off the grasses; but as the years went by and settlement came in, this area of the native grass became smaller, and more valuable, until to-day, if I were to rely on the hay grass, I must haul it from at least 10 or 12 miles away—cut my grass, stack it in the swamps and haul it in in the winter and pay heavy prices for the hay. In this last year I have not relied on any hay, but have relied on my corn crop.

The question first of all is, the preparation of the soil for this corn crop, and here we must consider the conditions. The conditions required to prepare the soil where it is light and sandy is entirely different from

where it is heavy and damp. Unfortunately for me, my soil is of this latter sort. We have difficulties in the spring and summer trying to kill the weeds. The soil is of the heavy black variety. In its preparation I might say before going further—that it has been killed with weeds from long years of wheat raising before this cattle raising and corn crop-ping began. I try during the winter and spring months and in the late fall to haul out all the barn-yard manure and spread it and plow it in.

Q. How thick do you spread it?

A. We spread it rather thick—so thick that sometimes it bothers our plow. Sometimes having to plow with a walking plow. Where it is richer we spread it more thinly.

Q. Does your wheat fall?

A. We don't have much trouble.

Q. Does the wheat yield well on that?

A. Yes the wheat: yields well—as a rule our crop was over 19 bushels on the average.

Now having manured our lands, we plow it as deeply as we may be able to, according to its condition. If it is wet we cannot plow as deeply as when the season is dry. We try to get down to six or eight inches, a good depth—four inches is shallow, and five or six inches is an average depth. We harrow it thoroughly, and if it is wet, we plank it We use a plank about 14 feet long—set a little on edge and draw it over the ground breaking the lumps and smoothing it, and after the land is prepared we seed it with a drill.

We use the Havannah press drill—six horse, twenty-shoe drill with holes eight inches apart, closing four holes and using the fifth—this puts the rows forty inches apart.

I am not working with the idea that my friend Mr. Hayes advocates seeding two rows together. In this drill he would leave two holes open and close the next four, and leave two open and close the next four and so on. But with us we have heavy land and heavy stalks, so I have always deemed it best to do this, because I want to cut it with a harvesting machine. I have found it difficult to take two rows at a time, and bring them up to the platform in good shape.

Q. How much seed do you plant to the acre in one row?

A. About sixteen quarts to the acre of the average corn with the kernels to be dropped about six inches apart. In the press drill it may sow two or three kernels and then skip eighteen inches, but theoretically, we seek to have the kernels six inches apart.

Q. Is there any choice of seed ?

A. Almost any variety that yields good. I have used the improved Canadian corn grown in Kansas, and the large dent corn. It is not like the giant corn, and is sufficiently large and sufficiently quick in growing.

Q. How large ears do you get?

A. I don't grow for the ear especially. We seek to grow this corn until the ear begins to glaze, if the season be long enough. Sowing in rows does not set thickly to ears, as if grown further apart. Almost every stalk will have an ear and often two ears.

After seeding the corn, the next thing is cultivating, and in that I like to unhitch from the drill and hitch immediately on to a drag. For first dragging I take the Ross harrow—and on these broad prairies we can just as well use four horses as fewer. After the first harrow I use a drag with teeth made of two by four, 2O-penny spikes, in the shape of

a Boss harrow, and I find it better than a larger tooth drag. I use this until the corn begins to come up and show itself freely above the ground. After that if I use the drag, and if it clogs, it is likely to drag out the corn more or less, so I turn from that drag to a broad seeder. With this tool I like very much to go over the corn once or twice before it becomes large enough to put in the wheel cultivator.

Q. How high is that ?

A. From two to three inches—.so that you can see the rows freely.

Now the secret of a clean corn crop I found to lie in this: First, the cultivation with this wheel cultivator, then the corn is in condition so that you can scatter a little fresh earth pretty close to the corn, and thus kill the young weeds. In this way you can keep them in check for the rest of the season. If on account of wet, these weeds get a start, it is very difficult to kill them out later on.

Now we have found it very necessary to continue this cultivation with the wheel cultivator until the corn is so high that the wheel cannot get over the corn plant. We want: to go over the field at least once a week, and rather two or three times, than less. I raised no acres and we kept two corn wheel cultivators going, find along' about the middle of the season I found it necessary to put on a third cultivator and keep that at work until we could not go over the corn without breaking it down.

Then I employed the walking cultivator, the old fashioned single horse cultivator. H is not always necessary, but this season on account of being so wet and backward, we did not begin to plant until the 22nd day of June. You can imagine my anxiety, with no hay in sight, the necessity of my raising fodder off that no acres of corn. The result justified my action, because when we came to gather it we found a thousand tons of good succulent fodder.

Q. How deep did you run your cultivator the first time you cultivated your corn?

A. Theoretically, a light cultivation is the best, for the reason that we saw last night in the illustrated lecture, but in actual practice we have to depend on the condition of the soil and the condition of the weeds, I have sometimes, on account of" wet weather, when the weeds would got such a start, had to get underneath them. I had to cut down deep at the sacrifice of some of the corn roots. Cultivate so as to kill your weeds. Don't be afraid that you have killed your corn, though you may have put it back some.

Q. Have you ever tried raising sugarcane?

A. I have tried it somewhat, but on this soil it comes so slowly at the beginning that the weeds get the start of it, and it is very hard to keep the weeds down while the sugar-cane is coming forward; but once having reached that point, it grows very rapidly and is of great value for fodder.

The other day there was mention made of a corn cultivator with a bundle carrier. I am using the old-fashioned one, but I have no doubt they are a good thing. We cut our corn and it is thrown to one side by the harvester as it passes over the field. Then our wagon passes along and the men throw it onto the wagon and it is hauled to the cutting box, where it is cut into pieces from an inch to an inch and a half in length, and then thrown into a silo and kept. I have two silos that hold 300 tons each. We have put up 600 tons, and have stacked some fodder dry. I have today only a hundred tons standing; in the field that will stay there

as long as it takes to empty the first silo, which we shall do the first week in March. Then I intend to cut it and throw it into the silo.

Mr. Sargent, of Amenia: Do you find the silo profitable and how do you construct it?

A. I find it profitable. We filled our first silo in '98 and we had to milk eighty-five cows the year before. During the season of '98 and '99 we milked on an average the same number of cows. We did not feed quite as much grain the last year. We opened our silo on the 10th day of January and fed the last of it the last day of July. We compared our books during that period, and we found that it cost $942.64 more the first year than it did the second year.

Q. Were the numbers the same?
A. Yes, sir.
Q. You sold the milk in town?
A. What we could of it, and the rest we made into butter.
Q. What proportion?
A. About half.
Q. How do you build a silo?

A. There are so many different methods of building silos, and it depends so much on the size of the herd to be fed, and so much on the amount of money that you want to put into it, that I cannot answer that question to suit all the conditions. I will tell you about mine. The building will occupy fifty feet of space. There are square and round ones. We think the round ones are the best. Have a good foundation, one that will not settle or change the form of the building. We dig a trench nine inches below the surface, and build a wall two feet in thickness, commencing nine or ten inches below the surface, and build it eighteen inches above, so that we may be sure that no melting snows can get in or any water soak through into the bottom. We fill the space within the wall with sand and stones and mortar, so that we may have a solid foundation. Then we lay planks 2x10, cut in the arc of a circle, twenty-four feet in diameter; they are for the sills and are laid in mortar so as not to let air or water get in. On this sill we erect a circular tank. That tank is set in cold tar and pitch, one-third pitch and two-thirds coal tar, so that water cannot get in. This tank is hooked with round hooks. We used hog hooks last year. They can be tightened. This tank is thirty-two feet high. There are thirteen rows of hooks, four at the bottom, 7/8 inches in diameter, and at the top they are 5/8 inches in diameter.

Outside of the silo and eighteen inches from it, we set up 2x4's for a skeleton and close this in with thin siding around the whole silo. The cost was about $475. The stone were hauled about ten miles.

The value of the corn plant for fodder lies in the corn stalk almost entirely. My experience is that the value of the plant is all in the stalk at time of glazing. If you can get the animal to eat the whole plant, you get all the value; but if the stalks are thrown out on the prairie the cattle eat the leaves and leave the stalk, which is the best part of it.

If you feed 750 cattle I guarantee that if you go around two hours afterwards you will not pick up a bushel basket full of waste from the whole feed.

Q. Doesn't the silo freeze easily?

A. No, it does not with us. It went down, to 40 below zero once, and there was only a ring of frost on the outside of the silo of about three or. four inches.

Q.' Is your silo inside of your barn?

A. Outside, exposed; there is one edge in the barn.
Q. How do you feed it to the stock?
A. It is raked from the top, the whole top being raked off and then thrown down onto the floor and carried to the stock and fed.
Q. Do you feed it to the horses?
A. It is profitable to feed it to the horses, or any animal that will eat the corn plant.
Q. Do you feed it entirely to horses, is it profitable?
A. I would not say as to that—it depends. But with the horses, we are feeding them on dry corn, and they do just as well.
Q. Do you put salt in your silo?
A. We never have. We keep salt in front of the cows all the time.
Q. Is it good for the sheep?
A. Yes, sir.
Q. How much do you feed at a time to horses ?
A. That depends on the horse. I will say in a general way that the horse won't hurt himself if you feed him, only what he will eat up clean.
Q. Do you feed grain with your ensilage?
A. We do this year, because the ear wasn't very well matured on account of the late sowing.

Col Power: A question has been asked which I wish to answer, and the question is this: What advantage is to be derived by our farmers generally to become members of the Live Stock Breeders' Association, and what are we going to get out of it by becoming members? Every man who wants live stock on his farm wants to know where to buy, and the breeder wants to know where to sell. The secretary will be in direct contact with all the buyers and sellers and those who raise cattle, who raise horses and sheep, and those who want to buy. Every member can be put in direct communication with the buyers and sellers, and thus he may know where to go. These are the things at present; what will be gotten out of it in the future will depend on the association.

Mr. Randall: The president of the National Grain Growers' Co-operative Association is here this morning, mid we will now have the pleasure of listening to his address.

ADDRESS OF M. P. MORAN,

PRESIDENT OF THE NATIONAL GRAIN GROWERS ASSOCIATION, BEFORE THE TRI-STATE GRAIN GROWERS' ASSOCIATION AT FARGO, NORTH DAKOTA,

To the president and members of the Tri-State Grain Growers' Association, Gentlemen:

I desire to express my appreciation for your kind invitation to appear before your association and address your meeting. It is needless for me to say that 1 am always interested in any gathering of farmers or meeting that has for its object the betterment of the cause of agriculture in general, and that which benefits the Northwestern farmer in particular. I further beg leave to state that the association which I have the honor to represent rejoices in any and all meetings that are called for the purpose of advancing the cause of the grain growers. I can therefore cheerfully and conscientiously say that your aims and purposes, as I understand them, are in perfect harmony with the ideas of our association, and as their representative, I will be pleased to co-operate with your association in

every honorable way to advance the interests of the farmer, and to that end I pledge you the active and earnest co-operation of the National Grain Growers Co-Operative Association.

It may be well that I should give you some idea of the character and nature of our association.

In the first place it is a great national society of farmers who are directly engaged in the growing of grain. Our association extends all over the wheat belt. It is the aim and purpose of our society to aid in every way the industry of agriculture in general and wheat raising in particular.

We aim to educate our members in every way to stand together as one-man, and by intelligent and business like co-operation secure all the advantages that a great society can obtain.

We desire to secure proper legislation, that will advance the interests of the farmer, as we believe that upon the prosperity of the farmer depends the prosperity of the nation and its citizens.

We desire to bring to the attention of our law makers the sad fact that the condition of the American farmer is a most precarious one, and unless some legislation be enacted at once the great industry of agriculture of this nation will be reduced to adversity and distress duo to unprofitable farming. We desire to call the attention of our national legislature to the fact that the great industry of agriculture which represents a majority of all the citizens of this nation and in round numbers about 400,060-ooo, people, produces about four billion dollars of wealth from the soil annually, that the investment of capital in the industry of agriculture represents more than double all other investments in this nation. We desire to obtain such relief and remedy as will give to the industry which is the bulwark of this nation, and the foundation of all its prosperity.

We aim to educate our members in a political sense to secure these reforms from all political parties, and we are anxious to aid any political party that will give us these measures of relief as a party, but will not aid any representative of any party who opposes those measures, as we hold the individual responsible to our association for his acts.

We aim to aid the friends of the farmer in every way irrespective **of** what political party they may belong to.

We also aim to defeat any legislator who votes against our measures, as we claim that these measures are above and beyond the limits of any party question, and is a great national question that appeals to the patriotism and statesmanship of our law makers.

We desire to organize and educate the farmers to look after their own interests by sending farmers from agricultural districts to Congress and the legislatures instead of electing lawyers, bankers, merchants etc., to represent such districts.

We desire to educate farmers to diversify their farming instead of raising unbroken crops of wheat, and thus in a few years destroy the fertility of the land.

We desire to educate farmers to raise clean grain and sow pure seed, to test machinery and adopt that which will be most effective in cleaning the grain after it has been threshed, and in this way to avoid the tremendous loss sustained by the farmers by our system of dockage which amounts to over 200,000 bushels last year as shown by the inspection department records of the state of Minnesota.

It is our aim to secure the active co-operation of all agricultural so-

cieties on some general proposition that all farmers can agree on irrespective of politics or section.

Among those propositions we have agreed that we can all be benefited by extending our foreign markets, to absorb our vastly increasing surplus crops before the surplus reaches a point that will leave vast volumes on our hands and by its very magnitude destroy the value of growing crops and future surplus accumulations.

We desire such legislation as will secure for us these markets, and we desire to secure these markets with the nations of the Pacific whose trade we have fair prospect of acquiring.

We are in favor of building American ships and aiding them to com-pete with the ships of foreign nations through subsidies or bounties on the actual freight actually carried on outward trip.

We are opposed to the Shipping Bill now before Congress known as the Fry Payne Bill as it grants subsidies to American ships on the basis of speed and capacity for every one hundred miles sailed on outward and inward trip. This would mean practically a bounty on imports and neutralize the: tariff and without any guarantee that a ton of freight would be carried, the high rate of speed would prohibit carrying bulky and heavy cargoes. We have agreed that it is to our interests to combine and resist the encroachments of railroad combines who grant rebates to large shippers, and by this unfair advantage they aid in establishing elevator combines that can strangle competition and in this way secure the grain of the farmer at local points at prices far below its just value. We believe that the most successful way to fight these combines is to organize a bigger one, We have in preparation a great farmers combine that we hope will destroy the Grain Trust and place in the farmer's hands the right of naming the price that he will sell his product instead of leaving it to gamblers and bucket shops to name and destroy the value of his crops.

Among the effective means we have taken to destroy combines and to secure many advantages through the organization of co-operative enterprises such as creameries and farmers' elevators, within our societies and educating the farmers to patronize them instead of the combine elevators. We have achieved great success in this direction during the past year by being able to start or build 93 new farmers' elevators during the year 1899, this, with the 143, farmers' elevators that we have record of previous to the year 1890, makes less than 250, of these elevators in the states of North and South Dakota and Minnesota, while the total number of elevators covering the same territory is about 3600, and as a result of these farmers' elevators we have estimated that the average price throughout the above named territory has been advanced fully three cents per bushel on the entire crop. We further contemplate to build or establish a farmers' elevator at every station throughout the wheat belt, this in fact is the direct mission of the National Grain Growers Association. **It is** also the mission of our association to keep a careful watch on the interest of agriculture and advance its cause in every way such as educating farmers to improve their methods of farming, improve the quality of their seed, sow clean seed, improve their herds of livestock, secure better prices for their products, secure terminal and foreign markets, to influence legislation in a non-partisan manner that will aid the cause of agriculture, in this brief practical way I will be pleased to co-operate with your association in advancing the greatest of all industries in this nation, the industry of agriculture.