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South Dakota Farm and Home Research

Agricultural Experiment Station

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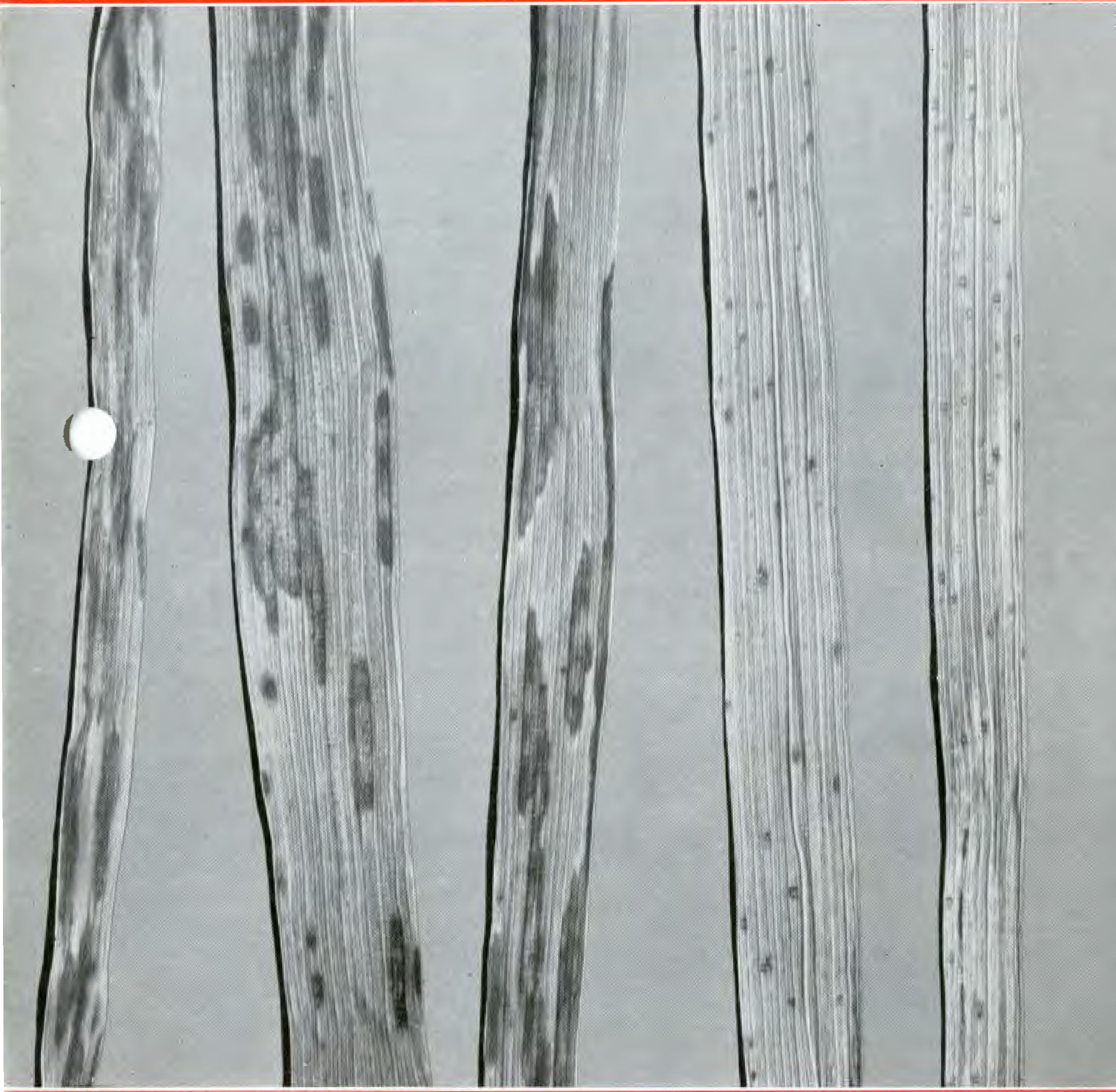

GRASS DISEASES see page 102

SOUTH DAKOTA
FARM and HOME
Research

A REPORT OF PROGRESS

Vol. VII SUMMER 1956 No. 4

IN THIS ISSUE

Published Quarterly by the South Dakota
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I. B. JOHNSON, *DIRECTOR*
EVERETT METCALF, *EDITOR*
SOUTH DAKOTA FARM AND HOME RESEARCH will be sent free to any resident of South Dakota in response to a written request to the editor, Agricultural Experiment Station, South Dakota State College, Brookings, S. D.

Tell Your Neighbor

Would you help us, please? We feel some of your neighbors may not know about *South Dakota Farm and Home Research,* or "the Quarterly" as we often call it.

This publication is a good way for South Dakotans to keep up to date on the latest information from their Experiment Station. Please tell them about it. You, of course, know that it is available free to anyone in the state.

And surely there will be information that will interest everyone as the 13 departments report timely research findings on these topics—agricultural economics, agricultural engineering, crops and soils, livestock, animal and crop insects and parasites, poultry, fruits, vegetables, shelterbelts, plant diseases, dairy, home economics, rural sociology, veterinary, biochemistry.

Why not show your neighbors your copy of the Quarterly. Tell them they can receive it too by writing the Experiment Station Editorial Office, South Dakota State College, College Station, Brookings, or their county agent would be glad to order it for them.

On the Cover

Grass diseases cost South Dakota farmers and ranchers considerably more than they realize. The disease shown is brown leaf spot on brome grass.

Cooperative research by the Plant Pathology and Agronomy Departments shows satisfactory resistance can be obtained through breeding, testing, and selection.

Compare the size of the destructive spots on susceptible strains commonly grown on farms and ranches (three leaves at left) with the small spots on the two leaves of a resistant strain.

Turn to page 102 for details on a number of grass diseases.

SOUTH DAKOTA PLUMS

by Beth Alsup,
Lida Burrill,
and Grace Wangberg

You can add color and variety to your meals with South Dakota-grown plums. They also contribute variable amounts of ascorbic acid as well as small amounts of other vitamins and minerals.

Many varieties of plum trees are suited for our climate. You may be familiar with the small, tart red or purplish fruit of the wild plum tree that grows along ravines or in pastures, groves, and shelterbelts. Cultivated varieties have been developed that can be grown in this state. These trees are hardy and produce fruit that can be used for eating fresh, cooking, or preserving for winter use.

Plum trees are usually small, often about the size of a large bush. They start to bear younger than apple trees and are good producers, though not as long-lived as many fruit trees. As they are stone fruit trees, you should keep them cleanly cultivated.

Most plum trees are not self-pollinating so you'll need another tree for a pollinizer. Pollinizers may also bear good fruit. Recommended pollinizers are South Dakota and Kaga for true plum trees and Compass and Nicollett for cherry-plum hybrids.

Plums make delicious jelly.

Plum Varieties

Here are the varieties, suitable to South Dakota, you will want to consider when you select plums for your orchard.

WILD PLUM

South Dakota—probably the best known native wild plum. It is especially hardy, serves as a good pollinizer, and produces a delicious fruit with red skin and yellow flesh.

PLUM-PLUM HYBRIDS

Waneta—a hybrid of the Japanese (California) and the native wild plum. The Waneta is large, purplish-red, very juicy, and sweet.

Underwood—a hardy, early-ripening tree which produces large, red, sweet, juicy fruit.

Kaga—a hybrid of the wild plum and the apricot plum of China. Serves as a good pollinizer and produces an apricot-flavored plum for eating fresh or cooking.

Tecumseh—especially hardy and early ripening. Bright red or bluish-red skin and yellow flesh.

CHERRY-PLUM HYBRIDS

Sapa—a very productive, early-bearing bush tree which bears a dark, almost black-to-the-pit plum. Delicious for eating fresh, cooking, or jelly-making.

Opata—deliciously sweet to eat fresh. It has a light greenish flesh and blue skin.

Honeydew—an early ripening hybrid with light greenish flesh and a shiny dark purple skin. Delici-

Table 1. Ascorbic Acid Content of Plums Grown at the South Dakota Experiment Station

Variety	Color		Ascorbic Acid (mg./gm.)	
	Skin	Flesh	Fresh	Frozen*
Champa	Dark purple	Light	17.7	......
Tawena	Bright red	Light	13.4	......
Honeydew	Medium purple	Light	12.6	9.6
Sapa	Purple	Dark	11.3	10.8
Etopa	Dark purple	Dark	10.2	10.2
Enopa	Purple	Light	9.6	8.1
Ojibwa	Red	Light	9.2	9.5
Cheresota	Dark red	Light	9.0	7.5
Opata	Medium purple	Light	8.7	7.9
Febling	Bright red	Light	8.7	......
San Sota	Red & yellow	Light	8.1	10.9
Underwood	Red & yellow	Light	6.8	......
Wastista	Red & yellow	Light	6.4	......

*Held in frozen storage for approximately 1 year.

Plum slump—a colorful hot dessert.

ous for cooking and jelly-making.

Plums contain varying amounts of ascorbic acid, as well as small amounts of other vitamins and minerals. We made ascorbic acid tests on 13 varieties grown by the Horticulture Department in 1952. Amounts of ascorbic acid per 100 grams of fresh fruit varied from slightly over 6 grams to more than 17 grams (see table 1). About a year later we ran tests on plums that had been frozen. We found that they lost very little of their ascorbic acid during frozen storage.

How To Freeze Plums

Plums freeze well either whole or pitted with sugar added. If you have little storage space, you should pit the plums before freezing. However, freezing plums whole and unsugared has certain advantages. The color in light-fleshed varieties will be better preserved and there is less time from the tree to the freezer.

Use only well-ripened, fresh plums for freezing. Here are the general preparations.

Whole plums, plain—Wash the plums and remove any over-ripe or partially spoiled plums. Shake off excess moisture and pack in freezer cartons. Freeze immediately. Pitting is easily done by halving or quartering while still frozen, just prior to using.

Pitted plums, sugared—Wash the plums and remove spoiled or overripe plums. Halve or quarter plums and remove pits. Add 1 part sugar to 6 parts plums. Pack in freezer cartons and freeze immediately. This amount of sugar will not completely sweeten most varieties so additional sugar can be added when preparing plum dishes.

Plum Recipes

Though these South Dakota-grown plums are seldom seen in stores, you may have or want to plant some on your farm, particularly in a shelterbelt. Therefore, we've developed and standardized some recipes for their use.

PLUM COBBLER

¼ cup butter
1½ cups sugar
1 cup flour
½ tsp. salt
½ cup milk
1½ tsp. double acting baking powder
2 cups plums (pitted, fresh or frozen)
2 tsp. lemon juice
1½ cups boiling water and juice

Cream butter and ½ cup sugar. Sift together flour, salt, and baking powder. Add milk and dry ingredients alternately to creamed mixture. Spread batter in 4x6x3 inch pan (or 8x8x2 inch pan). Cover with plums. Sprinkle 1 cup sugar and lemon juice over plums. Pour the boiling water and juice on top of the plums. Bake at 350°F. for 1 hour.

Continued on page 116

nitrogen requirements

IN THE JAMES RIVER BASIN

L. O. FINE[1]

THE CROPPING SYSTEMS normally used in east central South Dakota are primarily nitrogen-depleting. That is, the combined operations of tillage, seedbed preparation, and actual crop removal tend to steadily decrease the nitrogen content of the soil.

This progressive decrease of the total nitrogen in the soil is reflected in the amount of nitrogen that occurs in simple forms available for crop use. In time the level of available nitrogen becomes so low that crop yields and quality are seriously reduced. The soils are then known as "nitrogen-deficient soils."

Table 1. Reduction in Total Nitrogen Content of Soils in the James River Basin as a Result of Cropping*

Soil Type	Original or Virgin (% Total)	After Cultivation (% Total)
Houdek loam	0.279	0.169
Beotia silt loam	0.290	0.204
Harmony silty clay loam	0.340	0.294
Cavour silt loam	0.292	0.199

*Data from "Descriptive Legend for Spink Co., S. D. Soil Survey" by F. C. Westin and G. J. Buntley. J. R. McHenry, analyst, Soils Laboratory, USDA, Mandan, N. D., 1951.

On fields where return of crop residues, growth of legumes, and return of farm manures have been faithfully practiced, nitrogen deficiencies are seldom observed. With our extensive type of farming, however, only a part of each farm normally receives this kind of attention.

To illustrate how serious this reduction in nitrogen content of soils is, a few analyses are quoted in table 1, showing what has happened as a result of cropping for the past 60 or 70 years.

It is seen that the total nitrogen content of the above soils has dropped as much as 43 percent as a result of cropping operations. In practically all soils, the fractions of the soil nitrogen lost first are the more easily decomposed, leaving resistant, less easily mineralized compounds, further aggravating the nitrogen problem. Thus, both the reduction in total amount of soil nitrogen potentially available to crops and the loss of the best parts first combine to leave us in a predicament which now requires im-

[1]Joint employee: Agronomist, S. D. Experiment Station, and Soil Scientist with the Soil and Water Conservation Research Branch, USDA.

mediate attention on practically all of our land in the east central part of the state.

The question naturally arises, how can we determine the nitrogen needs of crops, and how can we meet these needs?

There are at least five means of detecting and evaluating the nitrogen needs, as follows:

1. The appearance of plant deficiency symptoms—firing of lower leaves of corn or a pale green color of most any crop in the active growth stages.

2. Reduced or declining yields of crops when drought or other factors are not directly responsible.

3. The use of field test plots.

4. Soil tests and soil treatment history.

5. Plant tissue analyses and tests.

Field test plots are used extensively and soil and plant tissue tests are put to limited use in study of nitrogen needs of soils in the James River Basin by Agronomy Department and U. S. Department of Agriculture personnel. Results and general recommendations from experiments in the northern part of the basin conducted on development farms operated by the U.S. Bureau of Reclamation are presented to help farmers understand this fertility problem. Much of the data are from irrigated crops and thus are of value to present and prospective irrigators in the area.

Short Term Experiments

Table 2 presents the yield responses of several 1-year experiments conducted at the Huron and Redfield development farms with various crops in recent years.

The data of table 2 indicate the general trend of diminishing return for each added increment of nitrogen with most crops; however, results vary with crop, year, and location. The fact that fallowing makes soil nitrogen available to the succeeding crop is well illustrated by the lack of fertilizer response of corn after fallow.

Long Term Experiments

Longer term rotation experiments, also combining various fertilizer applications, have been conducted at Redfield since 1949. The nitrogen responses of corn and wheat obtained in two rotations, one of which was irrigated and one not irrigated, are shown in figure 1.

This is the way potatoes responded to fertilizer in the James River Basin. Nitrogen made quite a difference.

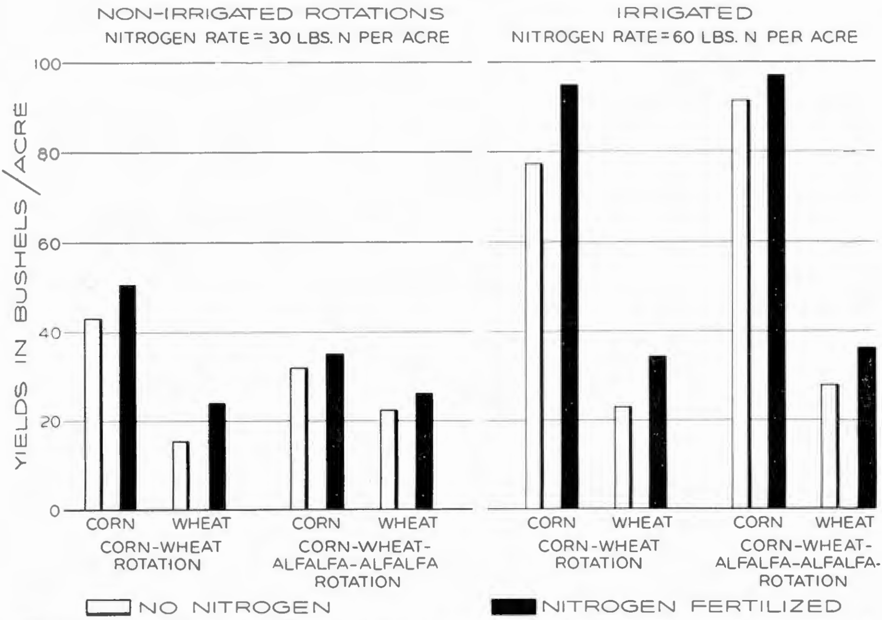


Figure 1. Seven-year average effect of nitrogen fertilizer on corn and wheat yields on Beotia silt loam, Redfield (1949-55), in irrigated and non-irrigated rotations.

It is noted that the response to nitrogen is much less in the 4-year rotations having 2 of the 4 years in alfalfa than in the 2-year rotations with no alfalfa. This is as expected and is true of the irrigated and non-irrigated crops alike. The trend of decreasing response with time in the legume rotations has been very definite, to the point that in the last 3 years corn has not shown any significant response. Yields were even slightly depressed in 1953 and 1954. Wheat yields were also slightly depressed in 1955. However, the first 4 years that the experiments were run, paying responses occurred in all rotations, irrigated or non-irrigated.

The best return for money expended on fertilizer is indicated by the use of 30 pounds of nitrogen on non-irrigated wheat, with no alfalfa in the rotation. In this case, an average wheat yield increase of 9 bushels per acre was obtained. The poorest return is for nitrogen applied on corn after alfalfa.

It will be noted from figure 1 that corn yields (not irrigated) averaged better on land not previously cropped to alfalfa than on land in alfalfa immediately preceding corn. This is true because in 1952 and 1955 corn was a failure due to drought on land where it followed alfalfa, and the zero yields are included in these averages. Non-irrigated corn not following alfalfa, however, produced good yields in 1952 and 1955. In years of more normal rainfall, corn following alfalfa

Table 2. Crop Responses to Nitrogen Fertilizers

Location	Crop	Soil	N Rates and Percent Yield Increase Over Control Plot					
			N Rate	% Incr.	N Rate	% Incr.	N Rate	% Incr.
Huron*	Brome grass	Houdek loam	40	135	80	228	160	249
Huron*	Ree wheatgrass	Houdek loam	40	134	80	174	160	233
Redfield*	Brome grass	Beotia silt loam	40	119	80	184	------	------
Redfield*	Orchard grass	Beotia silt loam	40	49	80	121	------	------
Redfield†	Potatoes	Beotia silt loam	60	43	120	70	180	90
Redfield*	Corn	Beotia silt loam	50	51	100	52	------	------
Redfield‡	Corn	Beotia silt loam	40	3.2	80	4.4	120	—5.3

*Irrigated.

†Average of five varieties.

‡Not irrigated, but following 1 year of fallow; control plots yielded 75 bu/A.

has outyielded corn on land where alfalfa has not been grown. In these experiments, the alfalfa is plowed in May and thus severely depletes soil moisture before corn planting.

The place of nitrogen fertilizer use in the James River Basin at this time appears to be primarily on small grains; secondly on tame grass hay or pasture when adequate moisture is present or irrigation will be used; and thirdly, on corn and other row crops when a legume has not been on the land in the 2 or 3 years immediately preceding. The amount to be applied in any case, of course, must be determined from soil test information, cropping history, knowledge of the soil type, and moisture conditions.

(Project 173. Leader: L. O. Fine, Agronomy Dept. Cooperative with Soil & Water Conservation Research Branch, ARS, USDA.)

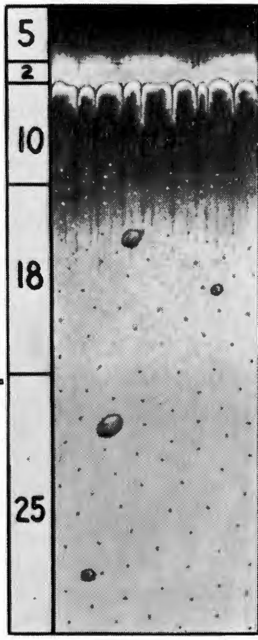
NEW PUBLICATIONS

C123 Better Agriculture Through Research
Shows the accomplishments of nearly 70 years of agricultural research in South Dakota. An interesting history with numerous pictures.

C124 Agricultural Research at the Central Substation
Reports research progress at the Highmore substation. Valuable information for farmers and ranchers in central South Dakota.

B456 Preventing Selenium Poisoning in Growing and Fattening Pigs
Organic arsenicals give protection against selenium poisoning in growing and fattening pigs. Recommendations and precautions for their use are presented.

This profile shows Cavour soil. Light area (2) is claypan.



PRELIMINARY REPORT FROM THE

CLAYPAN

RESEARCH FARM

B. L. Brage

Claypan soil is found on much of the level land in the James River Valley. This soil tends to depress crop growth. It is a solonetz complex soil and is also found occasionally in other parts of the state—mostly west of the James River Valley.

The claypan soil is usually associated with other soils. Therefore, even though the terrain looks uniform, farmers get a patchwork effect in crops that grow in these areas. In dry years, especially, crops will vary greatly in height and vigor (see figure 1).

During the summer of 1953 the Experiment Station leased 10 acres near Plankinton for a claypan research farm. The soil on this farm is a Cavour-Bonilla-Cresbard complex.

Of the three soils, Cavour is least favorable for crop growth. It is characterized by a leached gray layer (A_2 horizon) at from 4 to 10 inches below the surface and by a very compact claypan layer (B_2 horizon) just below the leached layer. The research farm has a high percentage of Cavour soil—found in the shallow swales.

Bonilla soil is the best of the three soils for crop production. This deep, friable soil is found on the gentle rises in the experiment area. When found by itself, Bonilla soil has no serious limitations. However, when it occurs with Cavour, problems arise, for each soil needs a different type of management.

Cresbard is an intermediate soil for crop production. It has a leached gray layer similar to Cavour (but usually at a slightly greater depth in the profile); however, the subsoil is more friable.

In the spring of 1954 we divided the research farm into plots. Most of the acreage is being used in a

rotation experiment. Ten rotations, four major crops, two levels of phosphorus, and two times of fertilizer application are included in the experiment. Each is replicated four times for a total of 640 plots. The rotations and crops are shown in table 1.

Conducting the Experiments

Each of the major plots (1/30 acre) is split in half. We apply 30 pounds of phosphorus pentoxide per acre to half of the plot. The other half receives no phosphorus. The sub-plots are also split. With the fertilized plots, one-half of the plot is fertilized in the fall and the other half in the spring before planting time. Legume crops in the rotation were planted in April 1954 with oats as a nurse crop. Fair to good legume stands were attained in all cases. All other crops were grown for the first time in 1955.

During the summer of 1954 we sampled the soils in the rotation experiment. Auger samples were taken from the 0- to 7-inch and 7- to 16-inch levels from each plot. Enough sample was taken for both physical and chemical studies. Soil cores and natural clods were collected from the B_2 horizon (the claypan when present).

Figure 1. A claypan area is revealed by the shorter, paler corn (center).

In 1955 we harvested all the plots for yield data. We can make only a few comparisons now because crops in some of the rotations will not be following the right crops until 1957. These yield comparisons are: (1) the effect of fertilizer on crop yields, (2) the effect of manure on crop yields, (3) the effect of subsoiling, and (4) the benefit of sweet clover and alfalfa as green manure crops. One should consider that the results were obtained from only 1 year's data.

Effect of Fertilizer. Thirty pounds of nitrogen fertilizer increased the yield of wheat 2 bushels, rye 6 bushels, and oats 14 bushels per acre. Corn was so badly damaged by borers and drought

View of the new 10-acre claypan research farm. Rotations and fertilizer trials are now in progress here.

Table 1. Crop Rotation in the Claypan Experiment

Rotation	Crops in Rotation		
1—Rye	Corn	Oats+Alf.	Alfalfa
2—Rye	Corn	Oats+Sw. Cl.	Sw. Cl. Fallow
3—Rye	Corn	Oats	Fallow
4—Rye	Corn	Oats	Wheat
5—Rye+N*	Corn+N	Oats+N	Wheat+N
6—Rye	Corn+M‡	Oats	Wheat+M
7—Rye+N†	Corn+N	Oats+N	Wheat+N
8—Alfalfa	Corn	Oats+Alf.	Alfalfa
9—Oats+Sw. Cl.	Corn	Oats+Alf.	Wheat
10—Oats+Sw. Cl.	Sorghum	Oats+Alf.	Wheat

*The nitrogen in rotations 5 and 7 is applied to each crop in the rotation at the rate of 30 pounds per acre.

†The soil in rotation 7 is chiseled at 4-foot intervals to a depth of 20 inches after the rye and oats crops are harvested.

‡The manure in rotation 6 is applied at the rate of 15 tons per acre before corn and 5 tons per acre before wheat.

that we didn't take grain yields. Forage yields from corn were not significantly affected by the use of nitrogen fertilizer. Phosphorus did not affect the yield of any of the four grain crops or the alfalfa. Alfalfa averaged 2.5 tons of hay and 85 pounds of seed (third crop) per acre without fertilizer. This was probably the best cash crop on the experiment in 1955.

Effect of Manure. Manure did not increase the yield of corn forage or wheat in 1955. There were no detrimental effects either, although the past summer was especially hot and dry in July and August.

Effect of Subsoiling. We couldn't make a fair comparison between corn on subsoiled land and corn on land not subsoiled because only forage was harvested. There was no difference between the two treatments when forage yields were compared. Wheat yields were not increased by subsoiling either.

Effect of Green Manure. There was no increase in stover yield when corn followed sweet clover green manure or in grain yield when wheat followed an alfalfa green manure crop. Both green manure crops were turned under in the fall of 1954. The corn forage yield was considerably less when corn followed sweet clover. We expect benefits from green manure in more normal years and after the rotations have been run longer.

Fertilizer Experiments On Outlying Farms

A number of fertilizer experiments also have been placed in other areas on soil similar to that for the rotation experiment. The purpose is to determine the rate and kind of fertilizer to use on claypan soils.

Rye Experiments. We ran two experiments with rye in 1955. In one case rye followed fallow and in the other rye followed oat stubble.

Yield results are shown in table 2.

When rye followed oat stubble, the return from fertilizer was spectacular. The higher nitrogen treatments (40 and 60 pounds) increased yields 11 to 12 bushels per acre. As 40 pounds of nitrogen cost about $6, this gave a good return when only nitrogen (40-0-0) was used.

There was little, if any, response to phosphorus.

Rye following fallow yielded about 12 bushels more per acre than well-fertilizer rye following stubble. The main reason for this extra yield was that more moisture was stored by fallowing. Enough nitrogen was released by fallowing and there was enough available phosphorus in the soil to produce a crop of rye.

Table 2. Effect of Fertilizer on Yield of Rye

Treatment*	Yield in Bu/A After Fallow	Yield in Bu/A After Stubble
0- 0-0	41.5	16.9
0-40-0	39.3	15.2
20-40-0	44.4	24.6
40-40-0	43.6	29.4
60-40-0	43.3	29.0
40- 0-0	41.3	28.0
40-20-0	43.0	28.1
40-60-0	44.4	29.4
L.S.D. at 5% level	*Not significant*	

*The first figure refers to pounds nitrogen, the second to pounds phosphorus pentoxide, and the third to pounds potassium oxide applied per acre.

Placement Experiments. Two experiments were run to compare applying fertilizer with the seed and broadcasting after planting. The one with wheat was done in 1954 and the one with oats in 1955. The experiments were split plot in design and replicated four times. Each major treatment (fertilizer rate) was split in such a way that the fertilizer was drilled with the seed on one half and broadcast on the surface after seeding on the other half. The fertilizer carriers were ammonium nitrate, treble super-phosphate, and potassium chloride. Both the oats and wheat were on stubble ground.

As in the rye experiment, nitrogen was the most limiting element. Wheat yields were tripled by higher rates of nitrogen in 1954, and oats yields were increased by as much as 50 percent by the same rates in 1955 (see table 3). Neither phosphorus nor potassium had a significant effect on yield, but there appeared to be a slight trend for phosphorus to increase yields in both years.

In 1954, drilling fertilizer with the seed was the most beneficial for wheat. An average of about 2 bushels per acre more was obtained by applying the fertilizer with the seed than by broadcasting. There was no difference between the two methods on the oats in 1955.

A number of other experiments in the state show that mixed fertilizers usually give greater yield increases when placed with the seed. However, it has been noticed that nitrogen fertilizer can damage germination of small grains. So to be safe, it is suggested that nitrogen fertilizers (especially at high rates) not be placed in close contact with the seed. Corn is even more sensitive to this type of damage.

Continued on page 108

RESEARCH IS UNDER WAY TO CONTROL PASTURE AND RANGE

GRASS DISEAS

C. J. Mankin and J. G. Ross

Forage and range grasses are attacked by many destructive diseases caused by fungi and bacteria. Leaf spots destroy leaves; seedling blights cause poor seedling stands; root rots seriously reduce the yield and vigor of the plants; and smuts and ergot destroy seed.

These grass diseases not only reduce the yields but also the nutritive value of hay and pastures. They weaken plants to drought and winter injury and lower the yield of seed so much that volunteer reseeding on the range is greatly reduced.

We are carrying on research aimed at controlling these diseases. The Plant Pathology Department is conducting the research in cooperation with the grass breeders in the Agronomy Department.

Leaf Diseases

Brome grass is one of our important hay and pasture grasses in South Dakota. Therefore, we are trying to find ways to control the major leaf diseases of this forage grass (see figures 1-4).

The most destructive leaf killing disease of brome grass is brown leaf spot *(Helminthosporium bromi)* shown on the cover. Through breeding, testing, and selection for dis-

Figure 3. Purple brown spot on brome. Brown leaf spot resistant selections are susceptible.

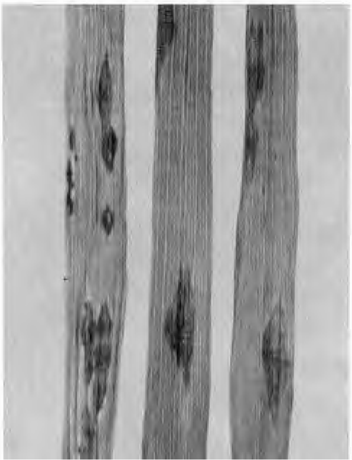


Figure 4. Eye spot on brome. Not widespread but damaging to some clonal lines or stains.

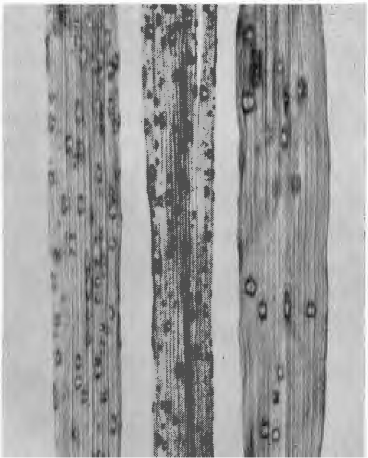
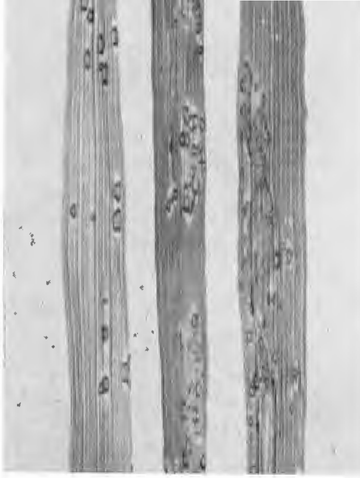


Figure 5. Seedlings of crested wheatgrass in pot at left are infected by seedling blight.

Figure 1. Selenophoma leaf blotch on brome. It is a serious disease.

Figure 2. (right). Bacterial blight on brome. It infects various grasses.

SES



ease resistance we can get satisfactory resistance. In greenhouse experiments we have inoculated different strains of brome grass with brown leaf spot. The disease is not able to produce the large type spots that typically develop in the strains commonly grown by farmers. The resistance reduces damage and the leaves stay alive and green until harvested or mature.

Unfortunately, however, many of the plants resistant to brown leaf spot are quite susceptible to purple brown spot *(Stagonospora bromi)* shown in figure 3. For the most part purple brown spot is a minor disease but it could become important if the brown leaf spot resistant selections were widely grown. We know of variation in susceptibility for most brome leaf spot diseases (Selenophoma leaf blotch caused by *Selenophoma bromigena,* bacterial blight—*Xanthomonas translucens* var. *cerealis,* and eye spot—*Ovularia pusilia),* but so far satisfactory resistance has not been introduced into a commercial strain.

Seedling Blight

Bad weather or poor seed are often blamed for poor stands of grass when the real trouble is often

Figure 6. Root development of crested wheat grass, right, is affected by seedling blight.

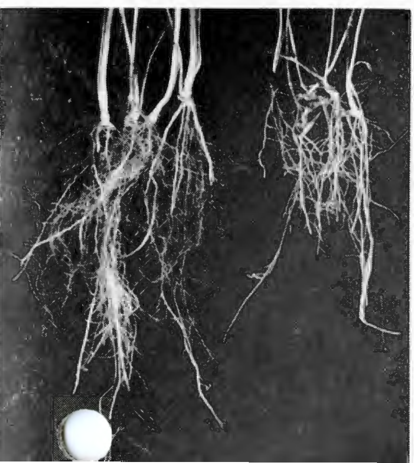


Figure 7. Left - right, smut on downy cheat grass, green needle grass, smooth brome.

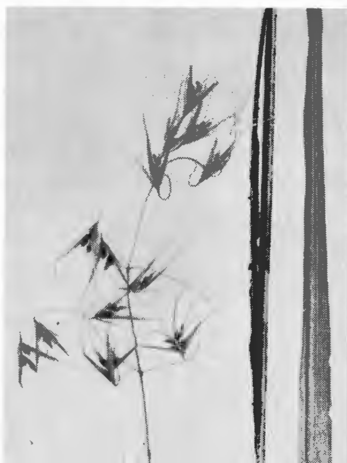


Figure 8. Left - right, ergot on brome, slender wheat, quackgrass, and desert wheatgrass.

Table 1. The Effect of Seed Treatment on the Stand of Wheatgrass Varieties Grown at Brookings, South Dakota

		Crested Wheat				Tall Wheat				Ree Wheat	
		1954		1955		1954		1955		1954	
Fungicide	Rate/Bu. and Method of Application	Av. No. Plants Emerg-ing	Percent Increase in Stand	Av. No. Plants Emerg-ing	Percent Increase in Stand	Av. No. Plants Emerg-ing	Percent Increase in Stand	Av. No. Plants Emerg-ing	Percent Increase in Stand	Av. No. Plants Emerg-ing	Percent Increase in Stand
Thiram	6 oz. Slurry	53.1	133.4	------	------	119.0	103.4	------	------	148.0	93.6
Arasan	6 oz. Slurry	54.6	137.4	------	------	121.0	105.2	------	------	158.0	101.2
Orthocide 75	4 oz. Dust	54.0	135.6	112.8	93.0	138.0	120.0	69.8	112.4	202.0	127.8
Agrox	½ oz. Dust	75.1	188.6	121.8	100.9	168.0	146.0	71.4	116.8	156.0	98.7
Ck. (No treatment)	------	39.8	100.0	120.6	100.0	115.0	100.0	61.2	100.0	158.0	100.0

caused by soil-borne fungi that attack and kill the germinating seed or young plant. This trouble can be serious and is difficult to control (see figures 5 and 6).

Here's how serious it can be. During the regrassing program of the 1930's, grass seed was sown on 153,000 acres. The stands were unsatisfactory, even after reseeding three or four times.

This failure was largely due to seedling blight, a soil-borne seedling disease. Drought was only one of the limiting factors in getting stands. We soon found that when field soil from the areas was brought into the greenhouses and planted to the same seed, the seedlings still failed, even when properly watered. However, when the same soil was treated to kill the disease organisms, the seed germinated normally and produced good stands of vigorous plants.

Seed treatment is not the whole answer to the problem of seedling blight, but you can get some improvement in the stand of crested wheatgrass and other wheatgrass species by treating the seed with fungicides such as arasan, orthocide 75, or agrox (see table 1).

In 1954 we got very good response to seed treatment and the stand was increased from 33 to 88 percent. However, we got no increase in stand in 1955. Tall wheatgrass and Ree wheatgrass responded the same way. Although one can sometimes get better stands by treating seed, he can not completely control the seedling blight because seed treatment protects only during emergence and not against late developing root rots.

Greenhouse tests have shown that certain selections of crested wheatgrass produce and maintain acceptable stands when grown in soil infested with some of the blight producing organisms. Since this resistance seems to be genetic, further breeding, testing, and selection may give strains of crested wheatgrass that are resistant to seedling blight.

Before we can make more rapid progress, we need information about the distribution, persistence, and interrelationship, and number of organisms that make up the com-

plex soil fungi that cause seedling blight of grasses. We must also find the effect of moisture and temperature on seedling blight development.

Mature Root Rot

The problem of root rot of mature grasses is important from the standpoint of maintaining vigorous grassland. We know that the depletion of stands in range grasses is often due to various root-rotting soil organisms.

The control of these diseases poses a difficult problem. Practical methods of control are needed. This prevents the use of certain possible control measures, especially on large land areas such as the range. So far little has been done about the possibility of root rot resistance. However, this is worth considering.

The limited amount of work done toward controlling root rot in mature plants indicates that the judicious use of fertilizers offers the most promise. Fertilizing pastures and seed fields is valuable, but fertilizing ranges might not always be economically feasible. However, work along such lines might give us valuable information about the control of mature root rot.

Diseases Affecting the Seed

The smuts and ergot are the main diseases that destroy grass seed when the heads are being produced. The smuts mainly infect the heads and destroy the seed, but they may also attack the leaves and stem (see figure 7). Ergot always destroys the seed (see figure 8). The seed-destroying diseases are important in range grasses because one wants some voluntary reseeding.

Smuts are quite common and widely distributed on range grasses in South Dakota. Generally, little attention has been given to the control of grass smuts. Many grass smuts can be controlled by seed treatment. When the need arises, smut resistant strains may be developed since it seems that genetic resistance is present in various species of range grass.

Like the smuts, ergot is widespread on range grasses in more or less abundance. The ergot fungus not only destroys the seed but also produces an alkaloid that is poisonous to livestock. Ergot may also be responsible for abortion in cattle grazing on the range or fed hay which has toxic amounts of ergot in the heads.

The Research Under Way

We are studying the nature, development, and distribution of the various foliage diseases of brome grass and seedling blight of crested wheatgrass. Isolations from diseased field plants have been made and pure cultures of the organisms are used to produce the disease in the greenhouse. We can then rate the disease-resistant qualities of individual selections. The disease reaction of individual selections to infection under field conditions is being evaluated each year.

Through breeding, testing, and selection, the prospects of increasing disease resistance in brome grass and crested wheatgrass for your grasslands and pastures seem quite good. (Project 250. Leaders: C. J. Mankin, Plant Pathology Dept.; and J. G. Ross, Agronomy Dept.)

SBE

sporadic bovine encephalomyelitis

G. S. Harshfield

Ten years ago an infectious disease of cattle called sporadic bovine encephalomyelitis (SBE) was recognized in South Dakota for the first time. Since then this disease has shown up in several herds in the eastern part of the state—but usually not over four or five outbreaks a year.

SBE was first diagnosed in Iowa in 1940 and proved to be an infectious disease caused by a virus.

Cause of SBE

Since the recognition of SBE in South Dakota, the Veterinary Department has been conducting experimental work on the disease. Early findings agreed with those of Iowa. By transferring five strains of virus recovered from outbreaks to chicken embryos, SBE virus has been kept for laboratory work. One strain recovered from an outbreak in 1947 has been transferred from embryo to embryo over 100 times.

The virus has been kept infective more than a year by freezing infected embryo fluids and tissues. While penicillin and streptomycin do not reduce infectivity, terramycin and aureomycin treatments of the virus either lower or destroy infectivity. The virus is quickly destroyed by common chemical disinfectants.

Through the cooperation of Dr. H. A. Wenner, University of Kansas Medical School, who conducted tests with viruses from South Dakota and Missouri cases of SBE, the virus has been identified as being in the psittacosis group. This virus is similar in many of its characteristics to the agents that cause psittacosis among a large number of birds as well as in domestic fowl and man.

Symptoms

When an outbreak of SBE occurs, it has been noted that more of the young animals than adults develop symptoms. These symptoms are also more severe and the death loss higher among calves. In 21 herds totaling 1,774 animals, 5 percent of the yearlings and adults and 25 percent of the calves developed symptoms. Of these, 28 percent died.

The first symptom is a rise of 2 to 4 degrees in body temperature. The owner usually doesn't detect this, but as the disease progresses, inactivity and depression show up.

One may notice some loss of coordination, and the animal may look stiff and knuckle over at the fetlocks. In severe cases, paralysis keeps the animal from getting to its feet. It may lie with its head drawn back. While the death rate is high among those with serious paralytic symptoms, the milder cases make a slow but complete recovery.

Symptoms have almost always been mild in calves infected experimentally. In those given the virus by mouth, it was 12 to 14 days before a rise in temperature was noticed. When the virus was injected into the abdominal cavity (intraperitoneally) or under the skin (subcutaneously), it took 5 to 7 days; and when the virus was injected into the bloodstream (intravenously), the temperature rose in 2 to 4 days. Only one calf of about 40 used in the experiment developed paralysis. In many, fever was the only symptom. These cases would not have been detected in a farm herd.

Diagnosis

SBE is best diagnosed by a post mortem examination. There is always an inflammation in the abdominal cavity and usually in the thorax and heart sac. Upon opening the body cavities, one finds a

A post mortem examination shows inflammation in the abdominal cavity.

One of the calves used in the trials.

yellowish fibrinous network covering surfaces of organs and an increased amount of yellow watery fluid. In calves experimentally infected, the inflammation in the body cavities has always been pronounced even though symptoms were often very mild.

The paralysis is caused by inflammation of the spinal cord and brain (encephalomyelitis) and the membranes covering them.

Spread of the Disease

One of the puzzling problems in the study of SBE is the sporadic nature of the disease—the way it shows up in single and scattered cases. No outbreaks in South Dakota have spread to neighboring herds, and after an outbreak subsided, the disease hasn't appeared again in the herd.

In several cases, animals were added to the herd before the outbreak. This suggests the possibility of carrier animals that spread the virus in feces or other body excretions. If carrier animals exist, infection probably occurs through the mouth or nasal passages.

By injecting water extract of feces into guinea pigs, it has been demonstrated that virus was present in 5 of 7 calves that had been in-

Continued on page 115

Claypan Soils Continued from 101

Table 3. Response of Wheat and Oats to Fertilizer and Method of Application

Treatment*	Wheat (1954) Fert. Broadcast Bu/A	Wheat (1954) Fert. Drilled Bu/A	Oats (1955) Fert. Broadcast Bu/A	Oats (1955) Fert. Drilled Bu/A
0- 0- 0	4.7	5.5	38.4	40.9
0- 0-60	4.6	4.6	47.0	45.0
0-40- 0	6.2	7.8	49.5	44.5
20-40- 0	9.8	12.3	54.3	49.3
40- 0- 0	10.6	11.3	60.3	56.6
40-20- 0	13.2	12.8	58.7	62.2
40-40- 0	12.7	15.5	59.6	65.1
40-40-60	12.1	18.2	56.2	61.8
60-40- 0	12.1	16.7	60.4	60.8
40-60- 0	10.8	15.6	61.7	62.3
L.S.D. at 5% level	3.5	6.4	11.4	9.6

*See footnote in table 2.

Corn Experiments. We placed a randomized block experiment with four replications on corn in 1954 and 1955. The corn followed oats both years. All fertilizer was broadcast and disked in before the corn was planted. In 1954 there was adequate moisture during the first part of the season, but the soil became dry during the rest of the season. A dry period in May 1955 made it difficult to get a stand and another dry period in July and August injured the remaining plants.

Table 4 shows that fertilizer neither increased nor decreased yields either year, although one might expect a decrease in a dry year like 1955.

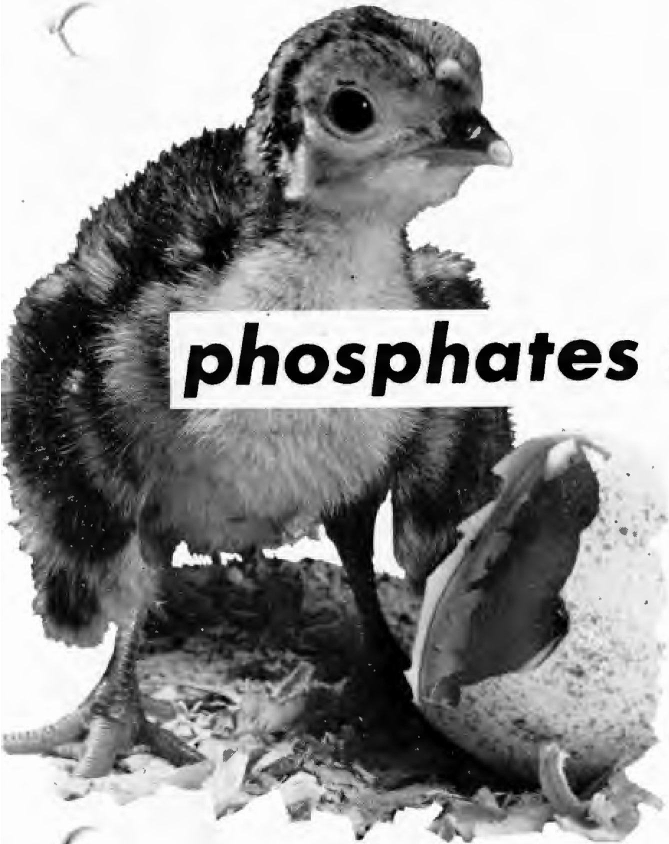
By late June 1954 the fertilized corn seemed more vigorous than did the corn without fertilizer. But by late summer the soil had supplied enough available nitrogen to the unfertilized corn, and the height and the apparent vigor of these plants were about equal to the fertilized.

It is quite common to get no yield increase from fertilizer on corn in central and western South Dakota. Generally one will be ahead if he fertilizes small grains instead, for they are usually more responsive in these areas. This wouldn't necessarily be true under irrigation. (Project 4 NC-17, Leader: B. L. Brage, Agronomy Dept.)

Table 4. Effect of Fertilizer on the Yield of Corn

Treatment*	Year 1954 Bu/A	Year 1955 Bu/A
0- 0-0	50.5	15.4
0-40-0	51.0	19.2
20-40-0	46.7	18.2
40-40-0	57.0	13.4
60-40-0	50.3	18.9
40- 0-0	47.3	18.9
40-20-0	56.9	25.5
40-60-0	51.1	25.3
L.S.D. at 5% level	*Not significant*	*Not significant*

*See footnote in table 2.



phosphates for turkeys

THE PROCESSING AND RAW MATERIALS USED APPEAR TO AFFECT THE DIGESTIBILITY

R. A. WILCOX

"THERE IS A DIFFERENCE in phosphates" says the ad of a manufacturer of feeding grade phosphate. The ad was referring to the availability of phosphorus—whether or not the farm animal would be able to digest and use the phosphorus in the supplement.

Results from several of our 1955 experiments agree with this statement. These experiments are part of a study we have been carrying on the past 5 years.

Use Eighteen Samples

We used 18 samples of phosphate for supplementing a low-phosphorus turkey diet. Four were high purity types used by pharmacies and chemical laboratories. The others were samples of products on the market that you could use in mixing animal or poultry feeds. The phosphates were classified by either source or processing of the raw material.

Of the high purity phosphates, Dicalcium Phosphate USP XIV was used in every experiment as a con-control to give us a basis for comparison. All of the phosphates were chemically analyzed for calcium and phosphorus and we figured the amount of each that would supply 0.25 percent of phosphorus in the diet from these analyses.

No fish meal or meat scraps were used, but otherwise the general ration was like regular turkey starting diets. It was as low in naturally oc-

curring phosphorus as we could make it without removing other regular ingredients. By chemical analysis, we found that it contained about 0.55 percent naturally occurring phosphorus. About one-third of this was phytin phosphorus, which is not digested by poultry.

We then divided the ration into the different diets and added the phosphates, bringing the total phosphorus of each to 0.8 percent. This is less than the recommended 1.0 percent but this recommended level includes extra phosphorus as a margin of safety. When only 0.8 percent phosphorus is in a diet, it must all be available for best growth and bone development.

The turkey poults we used were hatched from eggs from the college Beltsville Small White turkey breeding flock. Eighteen to twenty-two poults, depending on the number hatched, were wingbanded and put into each pen of the electrically heated battery brooders. Two pens in each brooder received each of the diets. The poults had free access to the diet and water at all times.

Analyze Bones

At 4 weeks of age, the poults were weighed and killed and the tibia

Table 1. Weight and Bone Ash Data of 4-Week Beltsville Small White Poults

Phosphate Source	Weight*	Bone Ash*	Weight and Bone Ash Combined*
Dicalcium Phosphate, USP XIV	100	100	100
Tricalcium Phosphate, N.F. IX	95	83	89
Beta Tricalcium Phosphate	92	89	91
Monobasic Calcium Phosphate	92	99	96
Defluorinated Phosphate			
Sample 1	92	71	81
2	72	86	79
3	93	84	89
4	102	94	98
5	76	50	63
6	77	50	64
Commercial Dicalcium Phosphate			
7	108	93	100
8	101	93	97
9	91	73	82
10	103	86	95
Imported Rock Phosphate			
11	84	69	77
12	66	57	61
Colloidal Phosphate			
13	33	22	27
14	43	29	36

*The amount of response (increase of weight and bone ash) to the addition of 0.25% of Dicalcium Phosphate USP XIV to the poult diet was arbitrarily set equal to 100. The amount of response resulting from the addition of 0.25% phosphorus from the other phosphates to the diet was compared with the control (USP dicalcium phosphate) response.

bone was removed from the left leg for bone ash analysis. We used the weights of the poults and the bone ash values as measures of the availability of the phosphorus in the supplements.

We started a new experiment every 2 weeks with the first beginning in March and the last ending in August.

The weather changed a lot in these months and affected the growth and eating habits of the poults. However, the two control pens of the USP dicalcium phosphate diet in each experiment took care of the weather effect. The weight and bone ash values of the other poults were compared to these control poults in each experiment, so one phosphate can be compared with any other (see table 1).

You can see from this table that the "Colloidal" phosphates are very low in the amount of phosphorus the turkey poult can use. The imported rock phosphates are better but still seem quite poor. The defluorinated phosphates and the commercial dicalcium phosphates vary a lot between samples. We think this is due to differences in the raw material used and in the treatment and processing of this material by the different companies. Certain impurities, such as iron, aluminum, magnesium, or fluorine, may also affect growth and bone development. The impurities vary according to source of the raw material and to the processing method

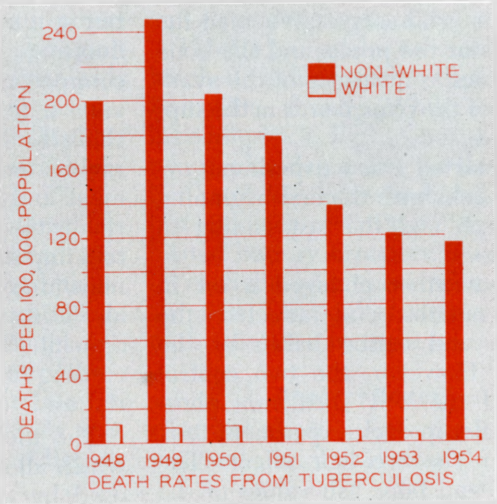
The ideal supplement is one in which all of the phosphorus can be used by the turkey poult. Of the samples we tested, the best results were from defluorinated phosphate sample 4 and commercial dicalcium phosphate samples 7, 8 or 10. These four were very good for both growth and bone development. (Project 221. Leader: R. A. Wilcox, Poultry Dept.)

NEW PUBLICATIONS

C122 Weed Contol Research in South Dakota
Presents information on various methods of weed control. Discusses a number of chemicals as well as how to adjust sprayers and measure chemicals.

C125 Weed Control Equipment
Seed cleaners, cultivating equipment, and weed sprayers are discussed in this valuable publication.

C127 Reducing Winter Injury in Red Raspberries
Presents experimental results of various methods tried in preventing winter injury in raspberries. Suggests several practices that you may want to try.



tuberculosis

AMONG SOUTH DAKOTA INDIANS

Vernon Malan

"A man apparently healthful, leaves his work and goes to his trader and orders a suit of grave clothes. 'I have the sickness,' he says. He is measured for the suit, and by the time it is finished the buyer is often ready to wear it through the long sleep."[1]

This is how a former superintendent of the South Dakota State Board of Health described the deadly effects of tuberculosis among South Dakota Indians in 1906. He said they were "withering to extinction with tuberculosis." There was hardly a home on the reservations where the dread infection did not exist.

Since that time some progress has been made in controlling the disease on the reservations, although tuberculosis is still a leading cause of death among South Dakota Indians. The death rate from the disease in 1954 was still more than 20 times as high for Indians as for the general population of the state.

Spread of Tuberculosis

Direct Causes. Crowded living conditions on the reservations are one of the main causes of the high

rate of tuberculosis. The houses are very small, many having only one room. Eating, sleeping, and visiting have to be carried on in a limited space, greatly increasing close contacts and thus providing proper conditions for the spread of the disease germs.

Most of the houses are also poorly built and hard to heat. When it's cold the family is likely to gather around the stove to keep warm, further increasing the close contact in families.

Poor sanitation in the small homes likewise encourages the spread of tuberculosis. Cleanliness is much more difficult to attain when people are crowded into a small living area. Running water and bathrooms are often lacking. Water may have to be hauled from wells some distance away.

Malnutrition seems to be another factor contributing to the prevalence of tuberculosis on reservations. An inadequate diet tends to lower disease resistance. This is particularly true among young mothers who might have been exposed to the germs many years before, but were able to resist the disease until they began to bear children. This seems to be the reason why women suffer a higher mortality rate from tuberculosis than men.

Indirect Causes. Even more important in some cases than direct causes is a lack of knowledge about tuberculosis. Therefore, the Indians may neglect treatment when it is needed. When the disease reaches an advanced stage, they may look for magic cures from unscientific medical practitioners among their people.

Attitudes which influence the behavior of many of the reservation Indians are still closely tied to the old Indian culture. Failure to recognize the early symptoms of tuberculosis is often a result of their attitude that there must be some outward evidence before there is any real illness. This attitude may be a reason why some leave the hospital against medical advice while the germ is still active.

The resignation to death when tuberculosis reaches an advanced stage is also a persistent attitude of the old culture. As death approaches the Indians want to be with their families for comfort and attention, and the family tries to give them affection and happiness before they die.

Institutional Treatment

In June 1955 we conducted a series of interviews at the Sioux Sanatorium in Rapid City. Twenty-two men and fifteen women were inter-

Sioux Sanatorium, Rapid City, where the survey was conducted.

viewed. No attempt was made to interview critically ill patients or those who did not wish to cooperate. Most of the patients were young adults; 22 were under 20 years of age and two were over 50.

The patients were largely from the major reservations in South Dakota. Fourteen were from Pine Ridge and twelve were from Rosebud and Cheyenne River.

Female patients were mostly young married women. Ten were housewives, two were unemployed single women, two were students, and one was a domestic worker.

Most of the men were unskilled laborers or farmers and ranchers. Only two were semi-skilled or white-collar workers, four were students, four were unemployed, seven were common laborers, and eight were small scale farmers or ranchers.

Understanding of Tuberculosis. To determine their understanding of the disease, we asked the patients, "What is the cause of your illness? Over half knew only that they had a spot on their lungs or "the coughing disease." The rest knew that it was caused by germs, but their knowledge varied from this fact to an adequate understanding of how the germs caused the disease. A small number believed they had no disease.

Although their knowledge of the cause of their illness was limited, almost all of the patients interviewed were satisfied with the treatment in the sanatorium. A few who were dissatisfied said that they didn't like the confinement or that in spite of treatment they hadn't shown any improvement.

Almost a third of the patients interviewed had a parent, brother, or sister who had received treatment at the sanatorium or who had died from tuberculosis.

Isolation from Family. Over half of the patients interviewed said they had never had a visit from any member of their family since entering the sanatorium. Only two were visited as often as once a week.

As the patients did not know when they would be released, their plans for the future were vague. Almost half had no plans at all. Some were going to attend school, get married, or return to their farm or previous job. A few hoped to get a job or improve their work skills from a rehabilitation program.

Only a very small number of the patients felt that they were needed at home to provide financial support or other household needs. Many stated that their families were not dependent upon them or could get along with the help of other family members or relatives. The married patients with children often mentioned that their families were living with relatives. The lack of family responsibilities was most apparent among the unmarried males.

Controlling Tuberculosis

Tuberculosis can be controlled just as effectively among Indians as it has been controlled among the rest of the population of South Dakota. From the results of this study, it seems that the best method would be to provide better health education.

The conclusion of the 1952 Conference on Tuberculosis Among In-

dians is a challenge: "Our Indians, many of who have been so long neglected, are just as entitled to health protection and educational advantages as any other citizens of our country. Until both have been provided for them, our country will not have fulfilled its obligation to this minority group."[2] (Project 273. Leader: Vernon Malan, Rural Sociology Dept.)

[1]Robinson, DeLorme W., "Tuberculosis Among the Sioux Indians," *Review of Reviews*, Vol. XXXIII, No. 3, March 1906.

[2]Foard, Fred T., "Conference on Tuberculosis Among Indians, the Tuberculosis Problem Among Indians," *Transactions of the Forty-eighth Annual Meeting of the National Tuberculosis Association*, 1952.

SBE of Cattle

Continued from page 107

oculated with SBE virus and in 12 of 14 normal calves. However, it is possible that the virus found in the feces of normal calves is a type that will not infect cattle.

In New York, a virus belonging to the psittacosis group was found in a high percent of apparently healthy cattle. This virus was infective for guinea pigs but would not cause infection in cattle, except when inoculated into calves deprived of colostrum.

Calf Inoculations

Inoculation trials were made in cattle to further study the relation of SBE virus and the virus found in the feces of normal calves. Four calves were inoculated with fecal strains of virus. They were later autopsied. No evidence of infection was found in two calves, each inoculated with a different strain of virus. The other two calves, inoculated with a third strain of fecal virus, showed inflammations typical of SBE. There were SBE-infected calves in the same stable when this strain was recovered, so the "normal" calf providing this strain may have taken SBE virus into the digestive tract.

Cattle experimentally infected with SBE that recover have proven immune when inoculated again. However, seven calves inoculated with strains of virus recovered from normal calves developed lesions typical of SBE when later inoculated with SBE virus. They were not immunized by the virus from feces.

Two other calves were inoculated with virus recovered from feces of a calf 5 to 6 weeks after infection with SBE. They were immune when tested later. One calf was inoculated with virus from feces of a "normal" calf that shared a pen with an SBE infected calf. This calf was also immune later.

Results indicate that virus strains from the feces of normal cattle not exposed to SBE virus are non-infective and do not stimulate immunity against SBE virus. There is also evidence that SBE virus was present in the feces of a calf that recovered from experimentally produced SBE and also in the feces of its pen mate, which had constant contact but had not been inoculated. (Project 171. Leader: G. S. Harshfield, Veterinary Dept.)

South Dakota Plums

Continued from page 93

PLUM SLUMP

Baking powder biscuits (any recipe using 1 cup flour)

2 cups plums (frozen with sugar)

½ cup sugar

¼ cup water

⅛ tsp. cinnamon

Prepare biscuits. Combine plums, sugar, water, and cinnamon in a saucepan. Cover tightly and cook slowly to the boiling point. When boiling, cover with biscuits, place a tightly fitting cover on pan and continue to cook over slow heat for 25 minutes. Remove biscuits and pour cooked plum sauce over them. Serve hot with cream, whipped cream, or ice cream.

PLUM SNOW

1 pkg. unflavored gelatin dissolved in ¼ cup cold water

¾ cup hot water

2 cups plum puree (canned or frozen)

sugar to taste

2 egg whites, unbeaten

Dissolve gelatin in cold water. Add hot water. Stir until completely dissolved. Add plum puree and sugar. Chill until slightly thickened. Place in bowl of ice cold water, add egg whites and whip until fluffy and thick. Spoon lightly into sherbet dishes or glass bowl. Chill until firm. Serve with soft custard sauce or whipped cream if desired.

PLUM SHERBET

½ cup water

½ cup granulated sugar

2 cups plum puree (pulp and juice) or if plums are very tart use 1 cup plum puree and 1 cup sweetened apple sauce.

1½ tbsp. lemon juice (optional)

1/16 tsp. salt

½ cup top milk or cream*

Cook water and sugar slowly for 10 minutes. Cool. Run plums through food mill or strainer. Measure. Add lemon juice, salt, sugar syrup, and top milk or cream. Pour into freezing tray and freeze until firm. Remove to mixing bowl and whip with electric or hand beater until mix becomes light and creamy. Return to tray and finish freezing.

***Note:** Cream gives a smoother sherbet with less chance of tiny ice crystals forming in the sherbet.

JELLIES AND JAMS

Plums are very good for making jelly or jam either alone or combined with apple. Most plums contain enough pectin to gel without adding commercial pectin. Suggested proportions are 1¼ cups sugar to 1 cup juice obtained by the usual double extraction method. The color of the product will vary from a deep yellow to deep purple depending upon the variety of plums used. Plum pulp can be used in combination with apple pulp for a very acceptable plum-apple butter. (Project 210. Leaders: Lida Burrill and Beth Alsup, Home Economics Dept.)

Acknowledgement is given Ronald M. Peterson, Assistant Professor of Horticulture, for information concerning varieties and culture of plums.