Spring 1950

# South Dakota Farm and Home Research

Agricultural Experiment Station

SOUTH DAKOTA

# FARM and HOME Research

Vol. 1, No. 3 Spring 1950

# Dear Folks:

"The Challenge of a Changing Agriculture" formed the basis for the addresses and discussions at the recent Farm and Home Week held at South Dakota State College. Participating in the presentations were South Dakota farmers, homemakers and college scientists. While the weatherman did not extend his full cooperation (two days of snowfall and the worst blizzard of the winter), nevertheless the attendance at some of the meetings was beyond our expectations. Especially gratifying was the large number of younger farmers who attended.

Trips were scheduled to various departments of the college, and from the interest shown by our visitors, it raises the question as to whether it might not be desirable to organize the Farm and Home Week activities around a feature of this kind. The Extension Service's exhibit of "Farming in the Fifties" created as great an interest on the campus as it did when displayed at various communities throughout the state. The crop show was outstanding.

This issue of *Farm and Home Research* offers some very timely suggestions for dealing with some of the farm problems, and reports the results of several research activities that will be of interest to the reader. We hope you like it.

Cordially,

I. B. Johnson

Director

SOUTH DAKOTA
FARM and HOME Research

A REPORT OF PROGRESS

Vol. I SPRING, 1950 No. 3

## *In This Issue*



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## Our Cover

Exploring the wonders of a whole crate of little chicks is Barbara Sue Fine, 2-year old daughter of Dr. and Mrs. L. O. Fine. Barbara Sue's father is an associate agronomist at the State College Experiment Station and soil scientist for the USDA.

The chicks with the striped effect down the back are from a hatch of crossbred chicks being developed at the Experiment Station, and are a result of crossing a New Hampshire female with a very light plumaged Barred Plymouth Rock male.

Dr. D. G. Jones, who is in charge of the experiment, says that when these crossbred chicks feather out, they have a plumage as light as the Plymouth Rock male, or even lighter. There is no stock available at the present time.

# JAMES *Hulless* OATS

By J. E. Grafius and V. A. Dirks

A new oat like a new car is expected to have some improvements over the old model. After becoming the proud owner of a new car we begin to discover some of the faults as well as the advertised virtues. The purpose of this article is to give the background of the development of James hulless oats and to acquaint the farmer with its good and bad points. James is a mid-early, stiff-strawed, hulless oat, with resistance to stem rust, leaf rust and smut.

Hulless oats are desirable as feed for swine and poultry. Varieties of hulless oats have been known for many years, but because of susceptibility to smut, none of them gained favor with the farmers of this area. Recognizing the problem, Mathew Fowlds, a member of the Agronomy department of South Dakota State College, produced, after a decade and a half of work, a smut resistant variety of oats from the cross of (Markton-Richland) x (Swedish Select-Kilby Hulless). This variety was named Nakota. It produced an excellent yield, but—like all varieties, had its weakness.

Nakota was released in 1935. It had been produced and tested under the dry conditions of the 30's, when leaf rust was not a problem. In 1941, with

the advent of higher rainfall and greater relative humidity, leaf rust became a major problem in oat production in eastern South Dakota. Nakota proved to be extremely susceptible. Reluctantly, the farmers dropped the hulless variety in favor of new varieties of common oats that were resistant to leaf rust.

### Breeding for New Rust Resistant Oat Started

If common varieties of oats could be made resistant to leaf rust by hybridization, then a hulless variety could also be made resistant. Two sources of resistance to leaf rust were known—Bond and Victoria. A cross was made between Nakota and a Bond derivative and the breeding program was initiated. However, it was learned that Dr. H. C. Murphy, USDA pathologist, had bulk third generation material of a similar cross, Nakota x (Double cross-Bond). Requests were made for this material and seed was obtained in the spring of 1942. This generosity on the part of Dr. Murphy and the Iowa Agricultural Experiment Station advanced the release of a new rust and smut resistant hulless oat for South Dakota by three years.

It was fortunate that the seed obtained from Dr. Murphy was an unselected bulk lot. This meant that a large number of different types existed in the population and that after the $F_5$ (the fifth generation of selfing) many true breeding types could be selected. Plant selections were made in 1943.

In 1944 the seed from about 2,000 plants were seeded in the individual 5-foot rows and rigorously culled during the season. Only true-breeding hulless types that were early, stiff-strawed and resistant to leaf rust were saved. At the end of the season, only 100 rows were marked to be saved. These 100 rows were further eliminated by yield tests in replicated rod-row plots in 1945. Sufficient seed was available by 1946 to test the remaining lines for yield in rod-row plots at the field stations at Highmore, Eureka and Cottonwood as well as at the main experiment station at Brookings.

In the winter of 1946-47, eight of the superior lines were tested for smut reaction. In this same year increases were started of two of the remaining adapted, hulless types that were resistant to leaf rust, stem rust and to all known races of smut. Subsequent statewide performance testing narrowed the field to one variety which was named James.

### New Oat Early and Leaf Rust Resistant

Seed and plant characteristics of James can be described best by comparing it with the varieties shown in Table 1.

In comparison with Nakota, James shows an improvement in earliness, lodging resistance, leaf rust resistance and test weight. The increase in test weight is largely due to increase in leaf rust resistance. It should be pointed out that James, like Clinton and Mindo, is susceptible to Race 45 of leaf rust and Races 3 and 7 of stem rust. While no good tests on shattering are available, field observations indicate that it is equal to Nakota which was satisfactory in this respect.

### Yields Are High

In calculating the yields of hulless oats (Table 2) it is necessary to adjust for hulls in order that the data may be comparable to that from common

Table 1. Average plant and seed characteristics of James, Clinton Vikota, Mindo, and Nakota, grown at Brookings, 1946-49.

| Variety | Date headed | Lodging resistance | Height inches | Test* weight lbs./bu. | Stem rust resistance | Leaf rust resistance | Helminthosporium victoriae resistance |
|---|---|---|---|---|---|---|---|
| James | 6/18 | R† | 33 | 45.0 | MR | MR | R |
| Clinton | 6/18 | R | 32 | 36.8 | MR | MR | R |
| Vikota | 6/18 | MS | 30 | 33.5 | MR | R | S |
| Mindo | 6/15 | R | 30 | 36.4 | MR | MR | R |
| Nakota | 6/20 | MS | 34 | 40.9 | MR | S | R |

*The legal test weight for hulless oats is 42 pounds per measured bushel.
†R—resistant, S—susceptible, MR—moderately resistant, MS—moderately susceptible.

Table 2. Yield comparisons in bushels per acre of James with four standard varieties at four locations in South Dakota.

| Variety | Brookings 1946-49 | Highmore 1947-49 | Cottonwood 1947-49 | Eureka 1948-49 |
|---|---|---|---|---|
| James* | 82.0 | 74.8 | 36.6 | 30.5 |
| Clinton | 75.4 | 64.4 | 31.4 | 30.0 |
| Vikota | 63.5 | 70.5 | 37.1 | 31.4 |
| Mindo | 72.4 | 69.0 | 38.8 | 31.0 |
| Nakota* | 68.2 | ------ | ------ | ------ |
| Least significant difference | 5.1 | 5.6 | 5.0 | 4.5 |

*Hulless, adjusted for hulls by dividing by 0.7.

oats. This adjustment was made on the assumption that approximately 0.3 of the weight of common oats was due to the hull and that the remaining 0.7 was due to the groat.

The average yields of James, when adjusted for hulls, compare favorably with the yields of the standard varieties, and at Brookings the 4-year average for James exceeds all others by a statistically significant difference. This variety is best suited to eastern South Dakota and should be restricted west of the Missouri river to small acreages for a special purpose crop and to areas in the Black Hills.

## Cultural Practices in South Dakota

James oats should be seeded at the rate of 50 pounds per acre.

No special equipment is needed for harvesting. James may be cut with a binder, windrowed, or direct combined in accordance with the best practices for common oats in the particular area. Hulless oats should not be cut green as this will cause the oats to be light weight and hard to thresh.

For feed purposes no special cleaning is necessary. For seed purposes, it is best to scalp with a fanning mill and then use a Carter disk.

Storage under South Dakota conditions presents no serious problem as hulless oats that have a moisture content of 13 percent or less have been found to store well.

## Information on Release

About 2,000 bushels of James will be released to the County Crop Improvement Associations in the spring of 1950. The seed is limited and no direct sales to individuals will be made. Limited quantities will be available in 1951 for individual farmers through purchases of seed from the County Crop Improvement Associations. (Project 25 and 181. Leader: V. A. Dirks, Agronomy Department.)

By D. G. Jones and Wm. Kohlmeyer

# DUBBED HENS LAY

Removal of most of the comb and wattles of the chicken is known as dubbing. Cockerels, which are to be saved for breeding males, are quite commonly dubbed in many sections of the United States. The practice has been found beneficial in prevention of freezing damage even in sections having milder winters than South Dakota.

Because dubbed males are less likely to be affected by low temperatures and less subject to injury from fighting, they commonly give higher fertility than normal males. There has been no information available on the effects of dubbing females in a climate where winters are as cold as those of South Dakota.

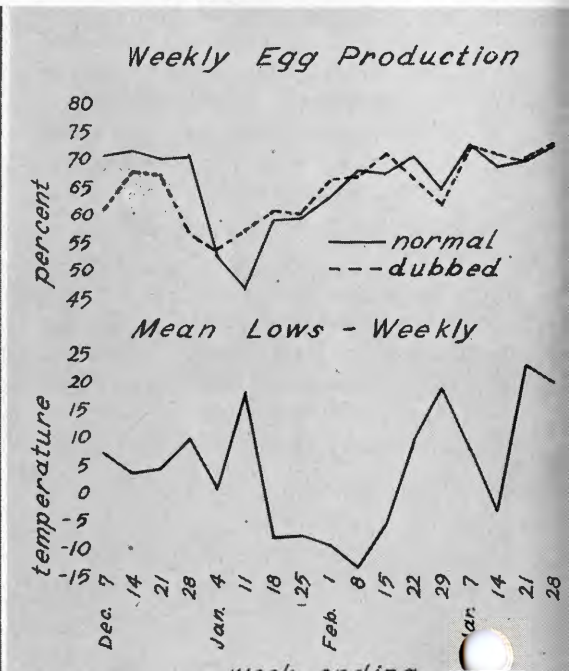
### White Leghorn Pullets Used

To obtain information on the effect of dubbing females, two pens of normal and two pens of dubbed White Leghorn pullets were housed at the North Central substation at Eureka. These birds were compared in respect to egg production and mortality from November 1, 1947, to September 14, 1948. The experiment was repeated with a similar group of pullets from October 1, 1948, to September 21, 1949.

Leghorns were chosen for this work because the mature females usually have a large comb and wattles. If freezing damage does occur due to low temperatures it is reasonable to expect that it would be more severe in females with large combs than in those with small combs such as those commonly found in New Hampshires or White Plymouth Rocks. To insure as nearly complete removal of the comb and wattles as possible, the dubbing was postponed until the pullets were nearly sexually mature. The pullet illustrated shows the completeness of comb and wattle removal.

The laying house was of rammed-

Normal White Leghorn pullet




Graph 1. Percentage egg production and mean low temperatures

earth construction. All pens received a free-choice grain and mash laying ration with water and oyster shells. In these and other details of management, their care was not greatly different than that of the average well-fed South Dakota farm flock. Daily records were kept of egg production and mortality for each pen. To eliminate the effects of differential mortality in the various pens, percentage egg production was calculated on a hen-day basis.

### Dubbing Operation Not Serious

Although the dubbing operation causes some loss of blood, it is not a serious operation since no deaths occurred as a result of dubbing in either year. The dubbed pullets were slightly slower in coming into production which is probably a direct result of dubbing the birds when they are nearly sexually mature. This delay could perhaps be avoided by dubbing earlier, but earlier dubbing would not permit such close trimming.

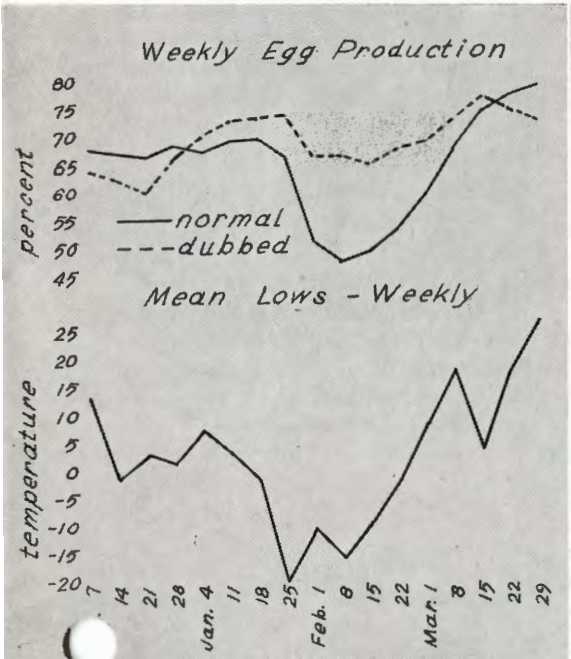
The effect of cold weather on egg production in the two groups is clearly revealed by the graphs. Graph 1 shows the percentage egg production for weekly periods from December 1, 1947, to March 29, 1948. The mean low temperatures for the weekly periods are plotted on the lower part of the graph. Graph 2 gives the same data for the corresponding period in 1948-49. Inspection of the graphs will reveal that there is a lag of about one week between a drop in temperature and a drop in egg production.

An interesting and rather surprising result was that an early season cold snap depresses egg production, but later on in the winter the birds may actually be increasing in egg production at temperatures considerably below those recorded at the earlier period. This is an excellent example

# MORE WINTER EGGS

1948-49

**Graph 2. Percentage egg production and mean low temperatures**




**Dubbed White Leghorn pullet**

of physiological adjustment to cold.

### Egg Production Increases

During the winter of 1947-48, there was little difference between the dubbed and normal birds in egg production with the exception of a one-week period. However, during the winter of 1948-49 the dubbed birds laid better than the normal birds during most of the period. The response of the birds in the two groups to changes in temperature are quite similar, but in 1948-49 the dubbed birds were much less seriously affected than were the normal birds. As might be expected from the appearance of the graphs, a statistical analysis reveals there is a significant difference in egg production of normal and dubbed females in 1948-49, but no difference in 1947-48.

The explanation for the difference in the two years would seem to be found in the fact that the winter of 1948-49 was more severe than that of 1947-48. During 1948-49 the mean low temperatures were lower and they lasted for a longer period.

It is evident that in some years South Dakota farmers might expect to get more winter eggs from dubbed White Leghorn pullets than from normal ones. Almost identical numbers of birds died in the dubbed pens as in the normal pens so it is evident that dubbing does not influence mortality. Likewise, on the basis of yearly egg production there was no difference between the normal and dubbed birds. (Project 194. Poultry Dept.)

## ❖ ❖ FOWL CHOLERA ❖ ❖

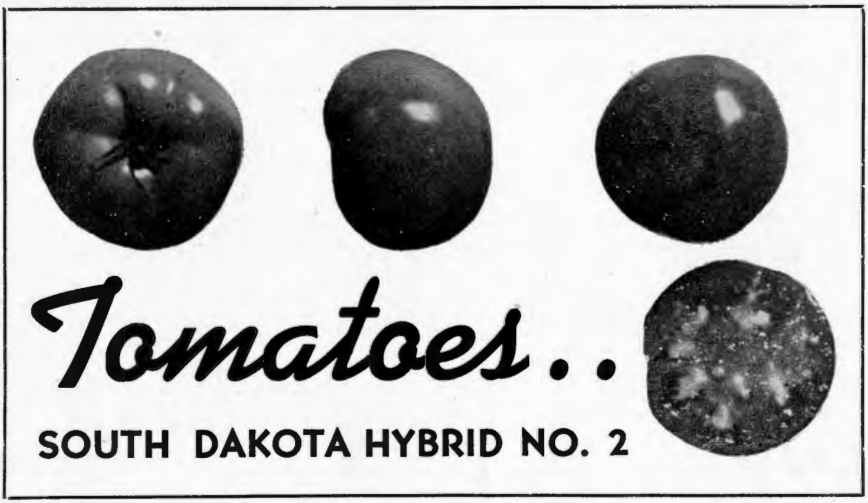
J. B. Taylor and G. S. Harshfield

Losses from fowl cholera are seen every month of the year, but outbreaks are much more prevalent during the fall months. The most logical explanation of this seasonal prevalence is the exposure given to young birds brought in contact with older birds in housing in the fall. "Healthy carriers," (apparently normal birds which carry the fowl cholera organism in their respiratory passages) are known to be present in flocks.

Since carrier birds are often the source of infection for new outbreaks, it would be desirable if they could be identified and culled from the flocks. A test similar to the rapid, whole blood stained antigen test for pullorum disease has been used in flocks where fowl cholera has occurred. This test has identified a few of the carriers, but has not been accurate enough.

Various sulfa drugs have been tried in experimental birds and in farm flocks to check the death loss that accompanies acute outbreaks. Sulfathiazole, sulfaquinoxaline and sulfamethazine have proved effective in checking the losses from death during the period that the drugs were supplied. Often, however, additional deaths occurred after the sulfa drugs were discontinued. Where fowl cholera infection existed in flocks as a chronic disease, control of death loss has not been satisfactory with these agents.

Sanitation measures should include frequent removal of sick and dead birds, thorough cleaning of the poultry house and the feeding and watering equipment. The cleaning operations should be carried out during the period that the drugs are supplied to the flock. (Project No. 141. Veterinary Department.)




By S. A. McCrory

Home gardeners will like the South Dakota hybrid No. 2, a solid, meaty tomato of a size that is ideal for canning. It is a medium small fruit, about two inches in diameter, and will fit nicely into home fruit jars without cutting. Its smooth surface, free of cracks, make it very attractive. Also one of the earliest tomatoes, it yields a high percentage of marketable fruits with very few culls.

The desirability of growing a well-adapted hybrid tomato is now well known to people who have planted South Dakota No. 2. After undergoing testing for three years at various locations in the state, this hybrid has demonstrated its ability to produce early fruit as well as a high total yield.

Performance tests were conducted at Brookings, Yankton and Redfield in 1949. Cut worm loss, hail damage and drought reduced yields materially, and early frost shortened the picking season at Redfield and Brookings. It is not our intent to show differences in yield at the different locations, but to rank the various hybrids in different sections of the state.

The yields given in Table 1 are expressed in tons per acre. However, it should be kept in mind that this experiment was disturbed by the causes mentioned. Results are based on three randomized replications of 12 plants each with a spacing of 4 by 5 feet.

### Cost of Hybrid Tomato Seed Justified

Getting enough seed of this hybrid has presented a problem. Some experimental work conducted during the past two years by the Horticulture department has indicated that this is a time-consuming and rather expensive operation.

Crosses were originally made from greenhouse-grown plantings. This operation consists of planting the pistillate plant, (the one producing the fruit) and in a nearby location planting one pollen-producing plant for every ten pistillate plants. As the flowers develop, the crossing technique requires timely visits to remove any of the pollen-bearing part of the blossom

Table 1. Tons per Acre Yield at the Following Locations

| Variety | Brookings | Yankton | Redfield |
|---|---|---|---|
| Chatham | 3.58 | 3.17 | 3.00 |
| Earliana | 1.01 | 3.82 | 2.83 |
| Firesteel | 4.11 | 4.78 | 3.67 |
| Long Red | 1.82 | 3.39 | 1.23 |
| Sioux | 2.97 | 9.56 | 1.34 |
| Stokesdale | 1.09 | 6.87 | 1.72 |
| Victor | 3.38 | 7.82 | (3)3.84 |
| Main Crop | 1.00 | 2.30 | .81 |
| Early Crop | 2.40 | 5.51 | |
| South Dakota No. 2 | (1)*4.49 | (3)11.26 | (1)5.23 |
| Stokes Crop No. 5 | 1.83 | 4.73 | .83 |
| South Dakota No. 23 | (2)4.44 | (2)11.85 | 2.57 |
| Red Rival F | 1.14 | 6.80 | |
| Red Knight | 3.75 | 7.95 | |
| South Dakota No. 3 | (3)4.21 | (1)13.18 | (2)3.92 |
| South Dakota No. 21 | 3.97 | 10.91 | 3.32 |
| N. D. No. 49 | | | 3.06 |
| M. D. X-A $F_6$ | | | 1.71 |
| L. B. R. 104 $F_6$ | | | 2.89 |

*Numbers in parentheses denote rank for yields.

before there is danger of its fertilization. The following day the cross is made by a hand operation. Immature blossoms or any that may have fertilized themselves are removed and a tag carrying the date and record of cross is then attached to the flower cluster. This same technique is necessary for plants growing in the field.

The number of seed obtained in the greenhouse and under field conditions did not differ materially. Approximately one seed per gram of fruit, or 450 seeds per pound, were obtained. For a variety such as South Dakota Hybrid No. 2, four different flower clusters can be crossed during a growing season.

Since not all the blossoms develop uniformly, an average of two fruits per cluster is a fair number to use for crossing. These will generally run about four to the pound, or two pounds of fruit per plant. There are approximately 10,000 seeds per ounce for this hybrid, or 160,000 seeds per pound. At the above mentioned rate, 350 pounds of fruit will be required to produce about one pound of seed.

A spacing of 3 by 4 feet is a desirable distance for a planting when the plants are grown with the aid of stake supports. At this spacing, a planting large enough to produce a pound of seed would occupy approximately one-twentieth of an acre. An additional space would be needed for the pollen-producing plants.

The number of man hours labor required to care for such a planting will vary depending upon the type of labor available, so that figures are difficult to quote. For example, girls of high school age who did much of this work improved their skill materially after a few weeks of work. A planting of one-half acre would need two workers for the first cluster with additional helpers the following week until five or six would be needed at the peak of the growing season.

It is not practical to make crosses later than the 20th of August in the Brookings area, since we may expect frost by September 25. (Project 49. Horticulture Department.)

# 'HOPPERS 1950

By H. C. Severin

For the 5-year period, 1937 to 1941, it is estimated that in South Dakota alone, grasshoppers caused a loss of $43,203,000 to the growers of cereal, forage and truck crops. Grasshoppers vary in abundance in South Dakota over a long series of years, occurring in outbreak numbers over large areas during some years and doing an immense amount of damage, and in other years occurring in negligible numbers in some of these same areas. This much is certain, however, grasshoppers occur in damaging numbers somewhere in the state every year.

Control measures practiced by farmers and ranchers in the past ten years have been very influential in keeping down grasshoppers in South Dakota and have undoubtedly affected the grasshopper expectancy for 1950. Grasshopper infestations in South Dakota for 1950 are expected to be about the same as during 1949.

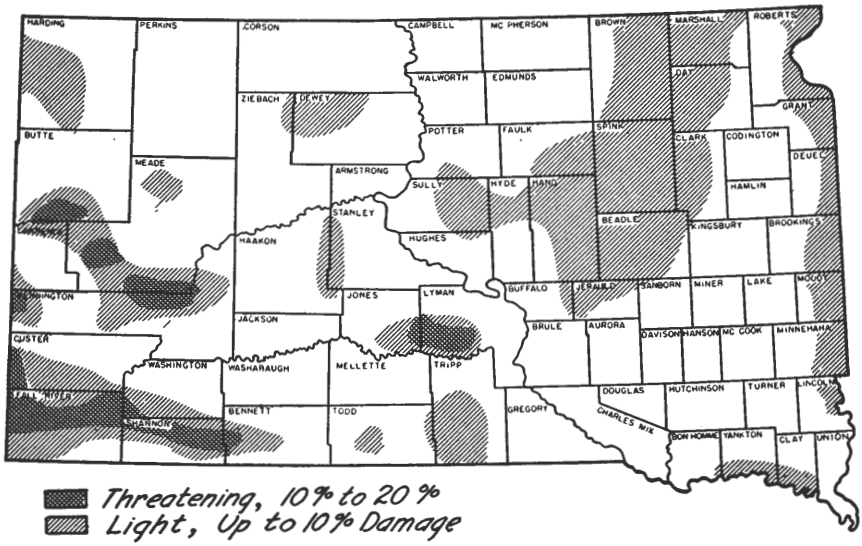
### Where to Find Egg Beds

One hundred and fifteen different kinds of grasshoppers live within the borders of South Dakota, but usually only five of these become injurious to crops.

The differential and two-striped grasshoppers prefer to lay their eggs in grassy areas—roadsides, ditch banks, grassy borders of grain fields, weedy idle land, and grassy borders of corn and sorghum fields. Eggs may also be laid in grassy borders of alfalfa fields or even throughout alfalfa fields if the stand of alfalfa is poor. The lesser migratory grasshopper often lays most of its eggs amongst the roots of grain stubble, but some may also be laid in grassy headlands, fence rows, pastures, and similar locations.

### Methods of Controlling

The use of early maturing varieties of grains is especially important during years when grasshopper outbreaks are forecast, for this may spell the difference between a good harvest or a very poor one. The Agronomy depart-




**The 1950 grasshopper outlook. The situation can change with the weather. Map prepared by U. S. Bureau of Entomology and Plant Quarantine in cooperation with the State College Extension Service**

ment of South Dakota State College, the Extension service agronomist, or the county agent are in a position to offer sound advice on this matter.

Using resistant varieties and substituting sorghum for corn are highly desirable practices to follow in areas where a severe grasshopper outbreak is forecast. Here again, advice should be sought from the agencies mentioned.

Poisons in baits, sprays and dusts have been used successfully for killing grasshoppers for some time. Since chlordan and toxaphene have become available, these poisons have supplanted to a large extent all other poisons, to date, in South Dakota and most other states.

### Killing Young Hoppers Gives Best Results

When poisons are used it should be remembered that it is a much easier job to kill the young hoppers than it is to kill mature grasshoppers. Oftentimes it is possible to kill young hoppers on their hatching beds, and since such beds are frequently localized in the borders of grain fields or along roadways rather than in grain fields, it means considerable saving of time, labor and materials if the hoppers are destroyed before they invade a cultivated field. In addition, if this is done, all damage to crops will be avoided. Should grasshoppers hatch throughout a field, then the only recourse is to treat the entire field. Baits can best be applied through bait spreaders. Sprays and dusts may best be applied through power sprayers, dusters or by planes.

### Chlordan

**Sprays**—In general, 1 pound of technical chlordan should be used per acre. Young hoppers can be killed with three-fourths pound chlordan per acre, but for longer residual effect and for older nymphs, 1 pound per acre should be used. For adults, and

when vegetation is sparse and dry, 1½ pounds of chlordan may be desirable.

**Dusts**—When chlordan is applied as a dust, some of it is lost because of wind drift. As a consequence, increase the dosage by one-fourth pound in each of the recommendations mentioned.

**Baits**—Chlordan may be substituted for sodium fluosilicate in preparing baits. These baits may be prepared in either a wet or dry formulation, according to the directions of the United States Bureau of Entomology and Plant Quarantine.[1]

### Toxaphene

**Sprays**—In general, 1½ pounds of technical toxaphene should be used per acre. Young hoppers can be killed with 1 pound of toxaphene per acre, but for longer residual effect and for older nymphs, 1½ pounds of toxaphene should be used. For adults, and when vegetation is sparse and dry, 2 pounds of toxaphene per acre may be desirable.

**Dusts**—When toxaphene is applied as a dust, some of it is lost because of wind drift. As a consequence, increase the dosage by one-half pound for each of the recommendations mentioned.

**Baits**—Toxaphene may be substituted for sodium fluosilicate in preparing baits. These baits may be prepared in either a wet or dry formulation, according to the directions of the United States Bureau of Entomology and Plant Quarantine.[1]

**CAUTION:** Remember that chlordan and toxaphene, like most other insecticides, are poisonous. Precautions should be taken in handling them and in feeding recently sprayed forage to livestock. Alfalfa recently sprayed with chlordan or toxaphene should not be fed to milk cows or to beef cattle that are to be slaughtered in a short time. (Project 18, Entomology Department.)

[1]Wakeland, Claude and Parker, J. R. *Grasshopper Control Improved by New Insecticides*, U. S. Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Ec.—7, February 1949.

**Showing the devastation to a corn field which can result from a severe grasshopper outbreak.**

# South Dakota's VITAMIN C FRUIT

By S. A. McCrory

Strawberries are the one fruit grown in South Dakota which equals citrus fruit in vitamin C content. A 3½-ounce serving, or approximately one-sixth of a quart of strawberries, is generally considered adequate for the daily requirement of vitamin C.

However, in observations made at the Experiment Station, much variation in vitamin C content was found between different varieties. In general, those that produce fruit on long stems are higher in vitamin C content than those that bear fruit on short stems. Fruit exposed to the direct rays of the sun is higher in vitamin C content than that shaded by the leaves of the plant. Also, fruit harvested on clear days contains a higher vitamin C content than fruit harvested during cloudy weather. Everbearing varieties produced fruit containing as much as 20 percent more vitamin C in the June crop than was found in ripe fruit in late September. This evidence is further proof that light is a very important factor in producing strawberries of good quality and with a high vitamin C content.

Eight commonly grown varieties of strawberries were observed and are ranked in Table 1 according to their vitamin C content.

**Table 1. Ascorbic Acid Content of Strawberry Varieties**

| Variety | Mg. Vit. C/100 Grams |
|---|---|
| Fairfax | 66.20 |
| Burgundy | 65.43 |
| Mastodon | 64.52 |
| Dunlap | 63.95 |
| Premier | 56.31 |
| Gem | 55.67 |
| Aberdeen | 49.10 |
| Pathfinder | 49.10 |

Table 2. Ascorbic Acid Content of Fruit Exposed to Direct Sun and Fruit Shaded by Leaves

| Variety | Mg. Vit. C/100 Grams | |
|---|---|---|
| | Exposed to sun | Shaded by leaves |
| Burgundy | 66.26 | 64.60 |
| Dunlap | 65.38 | 62.53 |
| Aberdeen | 53.98 | 44.23 |
| Gem | 64.96 | 46.39 |
| Mastodon | 65.48 | 63.57 |
| Fairfax | 66.76 | 65.64 |

It was decided to sample fruit exposed to the direct rays of the sun, and, from the same plants, select fruit shaded by leaves. Six varieties were used in this study and are described in Table 2.

With the exception of Aberdeen, there is little difference between varieties in vitamin C content when the fruit is exposed to the direct rays of the sun. The Aberdeen variety is a poorly colored fruit and was not found to contain much vitamin C.

It is well known that strawberries harvested during cloudy weather are of poor quality. To measure the influence of cloudy weather on vitamin C content, strawberries were sampled on clear and cloudy days. The fruit taken from an exposed position, as well as that taken from under the leaves, shows a higher vitamin C content on clear days than during cloudy weather. This would certainly indicate that, for high quality fruit, exposure to full sunlight is necessary.

The value of everbearing strawberries has sometimes been questioned. In the Gem and Mastodon varieties the vitamin C content is materially lower with the fall crop than with the June crop, which is quite in keeping with the idea that light is directly responsible for synthesis of Vitamin C.

The fall crop of everbearing strawberries is generally highly prized by the grower. Usually the peak of the yield for the fall crop at this location comes in late September. The vitamin C content of fruit collected on June 10 and on September 25, from comparable plants of Gem and Mastodon varieties, is much greater in June, as shown in Table 4.

Table 3. Ascorbic Acid Content of Fruit Harvested on Clear and Cloudy Days

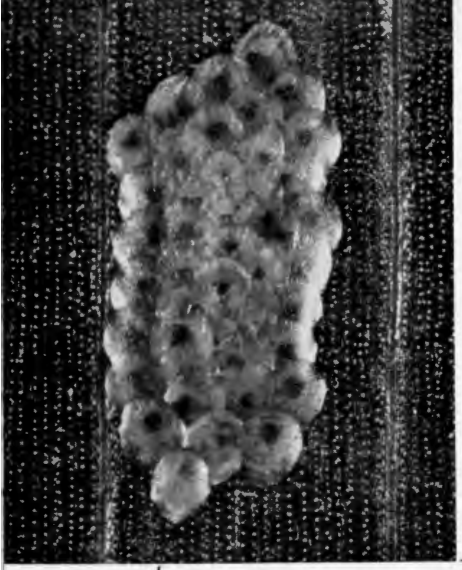
| Variety | Mg. Vit. C/100 Grams | | | |
|---|---|---|---|---|
| | Cloudy day | | Clear day | |
| | Exposed | Shade | Exposed | Shade |
| Gem | 59.73 | 53.7 | 65.35 | 47.37 |
| Fairfax | 62.56 | 61.75 | 66.76 | 65.64 |
| Burgundy | 59.94 | 59.32 | 68.86 | 65.64 |

# . . . Strawberries

To make practical applications of this it seems that, with everything else equal, it would be advisable to select varieties of strawberries producing fruit on a long fruit stem. Locate the planting in full sunlight, space the plant so as to avoid a crowded condition, and see that no weed growth shades it. (Project 145. Horticulture Department.)

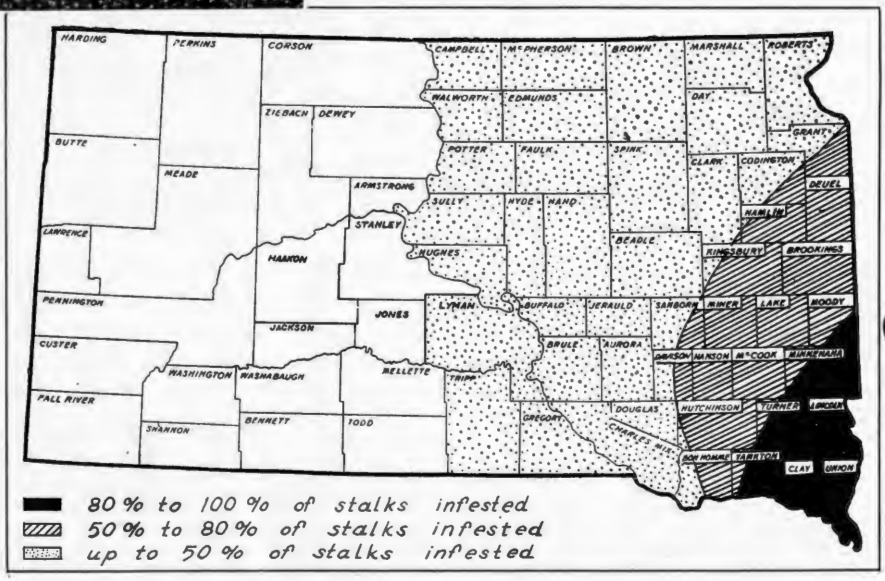
Table 4. Comparison of Spring and Fall Crops of Everbearing Strawberries

| Variety | Mg. Vit. C/100 Grams | |
|---|---|---|
| | June 10 | Sept. 25 |
| Gem | 55.67 | 45.52 |
| Mastodon | 64.52 | 43.71 |



# Controlling THE EUROPEAN CORN BORER

By Gerald B. Spawn




THE EUROPEAN CORN BORER is at present South Dakota's No. 1 corn pest. Although having only recently established residence here (it was found in South Dakota for the first time in the summer of 1946) the borer has now made its unwelcome presence felt in the entire eastern half of the state. With favorable weather conditions for its development this pest has increased in numbers and has spread rapidly during the four years it has been with us.

During the past two years the South Dakota State College Experiment Station has conducted fall corn borer abundance surveys. The survey figures were submitted to the U. S. Bureau of Entomology and Plant Quarantine for comparison with those

of other states. On the basis of these figures the Bureau estimated that in South Dakota in 1948 the corn borer caused a loss of $2,436,000 in field corn harvested for grain. In 1949 this loss figure was placed at $7,545,000.

Since South Dakota has had the corn borer for such a short period of time, the Experiment Station recommendations for control must necessarily be quite largely those of other states, revised for use under our climatic and soil conditions. We cannot expect to obtain 100 percent control of the corn borer in field corn by any single control measure. However, a very large proportion of the loss can be prevented by the use of a combination of different control methods.

### Field Sanitation Is Important

The Experiment Station recommends that stalks be plowed under in the spring, if the plowing can be completed by May 10 to 15. If this practice is to provide the utmost benefit to the farmer it must be done throughout a wide area, preferably a state-wide program, since the corn borer moths can fly as far as fifty miles.

The Station does not recommend fall plowing-under of corn stalk remains in South Dakota. Entire fields, plowed in the fall, produce a soil-blowing erosion hazard which is not believed to be justified from the standpoint of borer control.

Burning of corn stalks is *not* recommended. Our soil needs the humus provided by the stalk residue, not only to assist in maintaining soil fertility, but also for keeping the soil mellow, for providing aeration, for holding the necessary moisture and for the prevention of erosion.

### Planting Dates

The earliest and the latest planted fields in a community usually suffer the heaviest infestations of borers. Midseason-planted fields usually have the lightest infestations. These dates obviously will vary with years and will also be different in the northern and southern parts of the state. Where planting can be delayed to the middle of the planting season such a procedure is recommended. However, the farmer is cautioned to consider the number of growing days needed to bring his varieties of corn to maturity.

### Parasite Introduced

A small, wasp-like parasite *(Chelonus annulipes)* has been introduced into the state. If it becomes established it will be merely an aid in control of the borer; it will *not* solve the borer problem.

### Sprays or Dusts Give Satisfactory Results

Chemical control is the recommended emergency control measure against corn borers in field corn, using either sprays or dusts of DDT.

**(Top left) An egg mass, showing the blackhead stage. (Center left) Known distribution of European corn borer in South Dakota, Fall 1949. (Left) Newly-hatched borers on corn leaf. Photos courtesy of USDA Extension Service.**

The need for the use of insecticides should be based upon the farmer's own survey of his fields at the time the corn borer moths are laying their eggs. The Station plans to carry on a service to the farmers wherein the farmers will be advised, by radio, newspaper releases, and through county extension agents, of the developmental progress of the borers. If there are as many as 50 or more egg masses per 100 plants in corn when it is not less than 35 inches high with leaves fully extended upward, then insecticidal controls will pay.

In such cases either a two-treatment or one-treatment method is recommended, depending upon the severity of the infestation and degree of control desired. If the two-treatment plan is used then the first application should be made about seven days after the first eggs hatch. The second application of insecticide should follow one week after the first. If only one treatment is to be given, then spraying or dusting should be done 10 to 12 days after the first eggs hatch.

**Recommendations**

The use of 1½ pounds of technical DDT per acre is recommended for sprays, while with dusts 2 pounds of technical DDT per acre are suggested. The amount of stock insecticide to be used will depend upon the percentage of DDT in the stock. Use just enough to give the required amount of technical DDT per acre, and in the case of emulsion concentrates use only such emulsions as have been found safe for application to growing corn. Xylene base concentrates have produced no burning of leaves if used properly.

Where emulsion concentrates are used the stock material should be added to five to ten gallons of water per acre. Emulsion concentrate stock is recommended for use in all ground sprayers which do not have mechanical agitators in the tank. If the tank has a mechanical agitator then DDT wettable powders may be used, and not less than 15 gallons of finished spray should be applied per acre.

For aircraft application the emulsion concentrate stock is recommended, in from 2 to 5 gallons of water per acre. Concentrated oil solutions of DDT used as such are *not* recommended. DDT and Ryania (a South American plant), are both satisfactory for use as dusts.

Of these insecticides DDT is less expensive and much more readily available at present. The 10 percent DDT dust should be applied at the rate of 20 pounds per acre; 5 percent DDT dust, at 40 pounds per acre. These rates of application will give the required 2 pounds of technical DDT per acre. Row crop dusters with two or more nozzles per row are suitable for use in control of corn borers. Ground dusters providing high air velocity and volume are more satisfactory than are dusters with low velocity and volume. If aircraft are used for dusting, the flight height should not be greater than six feet from corn tops to wheels.

The above recommendations apply to first generation borers. The control of second generation borers in field corn is not ordinarily recommended because of difficulty of application. However, in fields with heavy infestations (100 or more egg masses per 100 plants) the control of second generation borers, for prevention of stalk breakage and ear dropping, will be profitable. Because of the height of the corn at the time the second brood borers appear, control applications of

sprays and dusts for this brood can be made only by use of aircraft or by sprayers and dusters mounted on detasseling machines.

**Recommendations for Canning Corn**

South Dakota does not at present produce large acreages of sweet corn for canning purposes; however, a restricted area in the extreme northeastern part of the state does produce some.

In the examination of sweet corn plants for deposits of egg masses the farmer should start making inspections of his fields when the plants reach an extended leaf height of 25 inches. Fields should be examined at 4-day intervals until egg deposition is completed. Attention should be given the undersides of the lower leaves.

If the inspection shows 20 or more egg masses per 100 plants on varieties with maturities of 75 days or less, or 50 or more masses on varieties with maturities of more than 75 days, then spraying or dusting is recommended. During very early seasons, late-maturing varieties may be so advanced in growth that treatment will be warranted at egg mass levels of less than 50 per 100 plants.

**When to Apply Insecticides**

In timing application of insecticides on canning corn, make the first application on early maturing varieties when there are 20 or more egg masses per 100 plants and one or more of the egg masses shows signs of hatching (the black-head stage). On late maturing varieties, make the first application seven days after the first evidence of hatching.

The need for treatment against second brood borers in canning corn is based upon two conditions in general:

(a) If inspection of plants shows 20 or more egg masses per 100 plants,

(b) If planting will not be harvested during the succeeding twelve days.

The grower should start examining plants for egg masses for second generation borers when examination of first-generation tunnels, in earlier planted fields, shows that moths have emerged, *or* when moth flight has been observed, *or* when advised to do so by state and local agricultural agencies. Examinations should be made at 3 to 4 day intervals, with particular attention being paid to flag-leaves, husks and undersides of true leaves. First application of insecticides should be made when the first black-head or hatched egg mass is observed. Treatments should be continued at 5-day intervals as long as there are 20 or more unhatched egg masses per 100 plants, or until 12 days in advance of harvest. Special conditions might make it necessary to deviate slightly from this schedule.

**Observe Cautions**

DDT treated fields should not be pastured following harvest; neither should stalks or husks be used for fodder or silage. Small amounts of DDT (a cumulative poison) may be excreted in milk or deposited in fat of animals being finished for slaughter.

If Ryania is used, then stalks, etc., may be used for feed, since experiments from other states indicate that Ryania when properly used in borer control does not harm animals even if they eat recently treated plants. Also it does not accumulate in milk or animal fat.

More detailed suggestions on corn borer control are available through the South Dakota Experiment Station, State College, Brookings. (FBJ Project 187. Entomology Dept.)

# Newcastle Disease

BY G. S. HARSHFIELD

A NEW, HIGHLY CONTAGIOUS poultry disease made it first appearance in 1946. This disease, named Newcastle, has been a cause of serious outbreaks in several European and Asiatic countries for over 20 years. A disease called pneumo-encephalitis which later proved to be the same as Newcastle disease, was recognized in California in the period from 1935 to 1940. In 1945, Newcastle disease was found in New Jersey and it has since spread into all of the states and also into Canada and Mexico.

### Nature of Disease

Newcastle disease may affect birds of all ages. In young chicks the first symptoms are usually gasping, coughing, rattling and difficult breathing. In these respects the symptoms resemble these of other respiratory diseases. Within two or three days some of the chicks may develop symptoms indicating nervous disorder. These symptoms vary. Partial or complete leg paralysis, tremors, circling or walking backwards, and twisting of the head and neck are the more common ones.

In older birds the same symptoms occur, but may be so slight as to escape notice by the caretaker. The most common and significant feature of the disease in laying flocks is the sudden and almost total drop in egg production within a period of three or four days. Floor eggs, soft shells or irregularly-shaped eggs are common during the drop in production. It usually requires three or four weeks before any material return of production is evident.

Death losses in outbreaks vary over a wide range. In general, losses are higher in chicks than in adult birds. We have had outbreaks in chicks in South Dakota in which over 80 percent died, but an average for this age is nearer 40 percent. On the other hand, some outbreaks in laying flocks occur with not over one or two percent of the birds dying. The average death loss in mature birds is 10 to 15

percent. All birds in a flock become infected in an outbreak whether symptoms are observed or not.

Other fowls are susceptible. Turkeys may show symptoms similar to those observed in chickens. Geese and ducks are less susceptible. Outbreaks have occurred in pheasants in captivity. We have tested blood from 70 wild pheasants and found evidence of some previous exposure to the disease virus in two.

There are several reports of people becoming infected by contact with infected fowls, either live or dressed. In humans, it results in an irritating eye infection lasting for a few days.

### Technical Skill Needed to Make Diagnosis

Sometimes, when symptoms are typical, a tentative diagnosis can be made by observing the flock. Since nervous and respiratory symptoms are also associated with other poultry diseases such as fowl cholera, laryngotracheitis, and infectious bronchitis, laboratory examination and specific tests are necessary for positive diagnosis.

**Lack of coordination of the muscles in Newcastle disease, manifested by twisting of the head.**

The laboratory of the Veterinary department has been using specific tests for the diagnosis of Newcastle disease since 1946. We have found Newcastle disease in 36 counties since it first appeared in the state and it is most probable that outbreaks have occurred in many of the remaining counties.

| Year | Outbreaks | No. of counties |
|---|---|---|
| 1946 | 3 | 3 |
| 1947 | 18 | 11 |
| 1948 | 39 | 17 |
| 1949 | 93 | 28 |

Fowls submitted to the Veterinary department for examination and tests for Newcastle disease should be live birds. They should be brought in by private conveyance, rather than shipped by rail or bus, to avoid danger of exposing other poultry. If distance is too great the blood of two or three of the sick birds may be collected in clean dry bottles and sent to the laboratory by mail. A letter and remittance of one dollar ($1.00) for the diagnostic service should accompany the specimens.

### Spread of Newcastle Disease

The disease may be spread either by direct or indirect contact. Once it is introduced into a flock none of the birds escape the infection. It is not always possible to determine the source of the infection. In the first outbreaks in the state, evidence pointed to introduction through chicks which were shipped in. It may be introduced or spread from one group of poultry to another on contaminated feed bags, crates, egg crates or litter. Visitors, wild birds, dogs, cats or vermin could mechanically carry Newcastle disease virus from place to place. Transmission through the egg is possible if eggs laid in the first few days are used for hatching.

### Control Depends On Quarantine and Sanitation

Medicines or vaccines have no curative value in flocks having the disease. Good care and feed will keep the losses at a minimum. Should there be more than one group of poultry on the farm, provide separate caretakers for the sick and the healthy birds. Provide a strict quarantine of the sick group, keeping out all visitors. As soon as the disease has subsided, the house should receive a very thorough cleaning and the litter burned. Chemical disinfection with a cresol or other dependable disinfectant should follow. There is no evidence at present of recovered birds remaining carriers of the virus.

### Two Types of Vaccines Used

Two types of vaccines are being produced commercially for protection against infection. One is a virus which has been chemically killed, but does not produce as high or as long immunity as that produced by living virus vaccines. Its advantage is that it will not introduce an active virus into the flock. The live virus vaccines confer a more lasting immunity, but can cause serious loss in chicks under 4 weeks old. In laying flocks it causes a temporary drop in egg production. There is also the possibility of spread of disease to other non-vaccinated susceptible birds. It is hoped that experimental work will provide vaccines with less serious limitations. (Project 170. Veterinary Department.)

# Losses in stands of Ponderosa Pine

By M. A. Maxon

South Dakotans have a high regard for trees, especially for the evergreens, whose dark winter beauty and dense growth are the best protection against the sweep of the winds. The hardiest and most drouth resistant of these trees are the red-cedars and the ponderosa pine, which are native to the state and occur in abundance in the Black Hills. The ponderosa pine is the Big Tree of South Dakota for it is our only dependable conifer adapted to all our climatic zones.

Despite the fact that it is highly desirable for use in shelterbelts because of its long life and dense crown, and very drouth resistant once established, the low survival of the ponderosa after planting has limited its use in regions where the soil and climatic conditions are favorable. We find a number of older shelterbelts in the south and southeast sections of the state but comparatively few in the central and western section. Yet this is a tree supposedly at home in all parts of the state where crops may be grown. Why then is it not used?

**Losses of Seedlings Extreme**

The answer lies in the trouble we have in getting the young plants through the first few years; losses of young seedlings the first year are extreme and further losses usually occur in the second and third years. Often seen are shelterbelts with a solid stand of elm, ash, or Russian Olive with many a gap in the pine rows.

How are we to overcome these losses in transplanting and insure a greater survival of the remaining plants during the first few years?

Early tests were made by Dr. Leon Snyder under an experiment station project which was set up to investigate ways of increasing the survival of

conifer plantings. A number of phases of the problem were to be studied, such as: source of seed, season to transplant, use of potted plants, seedling protection, effect of soil type and benefits of watering. In the spring of 1942, Dr. Snyder started a series of tests along these lines. These tests with potted seedlings compared with bare-root seedlings showed a slight increase in survival for the potted stock. Actual figures on this test were 87 percent survival for potted plants against 74 percent for bare-root plants.

### Wax Coating Tested

Studies of protective devices were undertaken by Dr. Snyder, using Dowax, a wax emulsion, as a coating to check loss of water from the leaves. Also tested at the same period were the plant hormones, or root-forming chemicals: indolebutyric acid, vitamin $B_1$, and the commercial preparation, "Rootone." Although the test was on a small scale, it indicated a benefit from treating with Dowax.

The war interrupted further work until 1947, when Leonard Yager and S. A. McCrory made new test plantings on a larger scale than before. Feeling that the basic cause of failure lay with the individual seedling makeup, these workers divided the plants as they came from the nursery into two groups. Those plants with a well-balanced top and root were graded No. 1; those poorly rooted or taprooted, were graded No. 2. Poorly developed, injured and dead seedlings were, of course, discarded. This graded the plants on easily recognizable points.

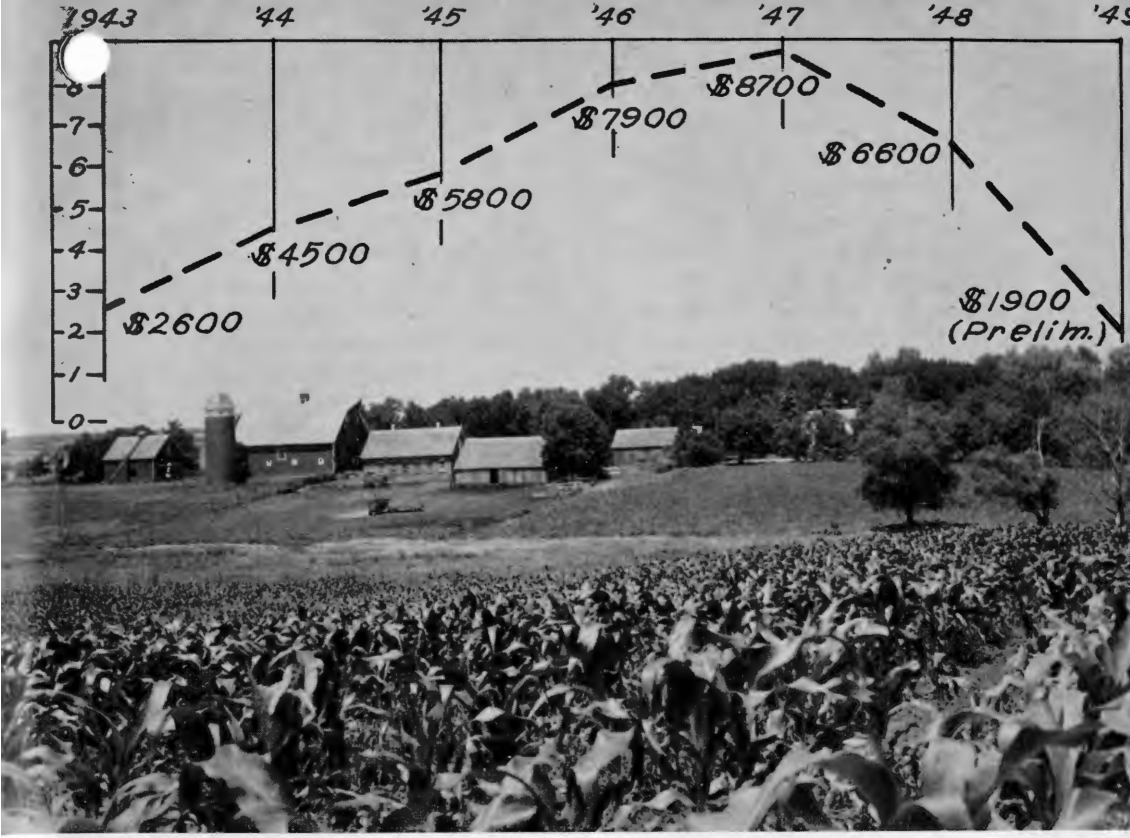
### Root-Forming Chemicals

A series of trials were then run on both these grades, again using root-forming chemicals: naphthalene acetic acid, indolebutyric acid, naphthalene acetamide and vitamin $B_1$. These materials have been widely used for root stimulation on cuttings and on transplants. Seedlings were dipped into a weak solution of these chemicals for a short period, then washed and planted. Counts were then made on their survival in the field in 1947, 1948 and 1949. Treatments with the chemicals did increase the survival of both grades of cuttings, especially those treated with naphthalene acetic acid and vitamin $B_1$, but the test showed that No. 1 grade plants had a much better record of survival than No. 2.

Again in 1949 these two most effective chemicals were tested on a large number of plants graded as before into two groups. In addition, plastic emulsions: Goodrich polyvinyl resin latex (Geon, formerly) and the same substance in a commercial brand, "Plantcote," were used to give the seedlings a thin coating to check loss of water from the leaves. Late planting and a dry summer practically wiped out these trials but again the No. 1 grade plants survived in greater numbers and most of the No. 2 died.

This then seems to be an indirect way of saying that the best plants grow best.

Although treatments with chemicals and waxes may be helpful in raising the percentage survival of transplants, the essential ability to survive seems to lie within the seedling. Plants of hardy drouth-resistant seed stock, well-grown in the nursery and so handled by the nurseryman and farmer that little loss of vitality occurs between digging and planting may be the answer to the problem, provided good care is given after planting. (Project 142. Horticulture Dept.)




**Trend in labor returns of selected farms in north central South Dakota, 1943-49.**

# Farm Income in the *Red?*

By Russell L. Berry and Maurice L. McLinn

With rapidly falling farm prices and high fixed cost something more than a government farm program will be needed to keep farmers out of the red.

Ten farmers in north central South Dakota earned only $1900 for their labor and management in 1949. These same farmers averaged nearly $7000 return for their labor and management in 1948. While these farmers may not be representative of their area, they do suggest what is happening to farm incomes.

This difference in earnings was due to lower farm prices, lower crop yields, and slightly higher operating costs on these farms. Drouth and hail made it necessary for farmers to use much of their rough feeds and grains. The decrease in their rough feeds was nearly $4000 per farm as an average. These 10 farms are the first of 50 to be analyzed for farmers in this area. A more complete report on last year's farm earnings will be made in the next few months.

In the meantime, the "something" needed to keep farmers out of the red ink is easily seen from past farm rec-

ords furnished by nearly 100 farmers located in north central and southeastern South Dakota.

These records show that farm earnings are affected by several factors. Some of these are: (1) size of business, (2) labor use, (3) crop yields, and (4) livestock feeding. All of these factors affect efficiency of production, costs, or sales. While an individual farmer cannot do much about farm prices he may be able to do something about his size or volume of business and his efficiency. At least the spread between high- and low-income farmers suggest that this may be the best place to tackle the problem of falling farm incomes.

In 1948 a few South Dakota farmers had labor and management earnings of $20,000 each, while a few actually lost money. What made the difference?

### Size of Business Is Important

Size of the farm business is an important reason for variation in farm income. Size means much more than just acres in the farm. A 40-acre potato farm may have a larger volume of business than a two-section farm. It all depends upon what is done there, and that is best measured in days—days of productive work. Using this measure of size, eleven largest farms in the north central area averaged $9,000 for their labor and management. This was twice as much as the eleven smallest farms.

The most profitable farms in the southeast were 65 percent larger than the least profitable farms. In the north central area the most profitable farms were 80 percent larger than the least profitable. The most profitable farms averaged over 400 acres in the southeastern counties and 1500 in the north central counties.

Such figures may suggest that all farmers should attempt to enlarge their farms, but this is not always true. Many efficient farmers might lose much of their efficiency on larger farms. As a result, their net income would be smaller on a larger farm. Some farmers lack the ability to manage large farms, and they do much better on small farms where their attention to detail makes them more efficient.

While some large farms make less money than the more profitable small farms, there is good reason to believe the more efficient small farmer would keep much of his efficiency even though he had a larger farm. This is particularly true when small grains and beef cattle are the chief enterprises that would be expanded. Expanding the business by adding a large poultry or dairy enterprise would generally require more managerial ability than would an increase in size of beef cattle or small grain enterprises.

### Increase in Farm Size Necessary for Efficient Use of Equipment

The tractor and combine have, in effect, reduced the size of wheat farms the same way that the airplane has reduced the size of the earth. Many of these farms are too small for efficient use of the equipment available. As a result, costs are high and fixed at the moment when they should be lowered. Adjusting farm size to fit modern tractors and combines is needed.

A recent study indicates that 80-cent wheat would give a labor and management income of $1,100 on an 800- acre wheat farm at 1944 costs, and

require only 30 days hired labor. If this same farm were operated as two farms of 400 acres each, the labor and management income would be only $340 each.

Many farms in the north central area have been enlarged by buying or renting additional land. Farms have increased from an average of 1000 acres to 1200 in the five years, 1944 to 1948. This change may be exaggerated by the turnover in farm record keepers, but it is characteristic of the general trend.

Such an increase in farm size is necessary, in many cases, in order to use Diesel powered tractors and other large and expensive equipment to best advantage.

### Size of Farm Business Increased by Adding More Livestock

Size and volume of farm businesses have also been increased by adding more livestock. In the years 1944 to 1948, the labor required to care for livestock in the north central area increased 100 days. Livestock units increased from 68 to 80 during the same time. The number of beef cows increased from 25 to 33, as an average, for the record keeping farms. There is reason to believe that farmers capable of handling 30 head of beef cattle could, in most instances, handle twice that many with little loss in efficiency. To increase the livestock numbers in this manner requires more grazing and hay land than it may be possible for the farmer to rent or buy. Buying additional land would appear to be risky, especially if credit is used.

Buying feed to produce more livestock may be the easiest way for these farmers to increase the size of their farm business. Adjustments should be made slowly until the farmer is certain that the increased volume will not be offset by less efficiency.

Shifting about 25 percent of the cropland to legumes and grasses has been proposed. This may be a profitable alternative to summer fallow or green manuring, especially, since it would permit an expansion of the livestock enterprises to increase the volume or size of the farm business.

On rented land the lack of buildings, fences, water supply, or location with respect to the tenant's farmstead may make such a program impractical. The tenant will hesitate to seed legumes and grasses on land rented by the year. The landlord may find it more profitable to let the land lie fallow. Perhaps grass and legume seed production may be the solution on some of the rented land that cannot be adapted to livestock production. There are reasons to believe that there will be a comparatively strong demand for legume and grass seed for several years.

Irrigation in the James River valley may ease the population pressure and permit an expansion of the size of dryland farms. This will be true if many of the dry-land farmers on inadequate sized farms shift to irrigation which requires less acreages. On the other hand if irrigation farmers come in from other areas there may be little opportunity to expand the size of dryland farms unless some of our present farmers find more attractive opportunities in other lines of work.

### Efficient Use of Labor

Labor is one of the most important costs of farming. This is true even though the farmer does not have a hired man. His own labor could be

marketed, as a hired man or perhaps as a manager of an elevator or some other business. Therefore his labor is valuable whether his farm keeps him fully employed or not.

A good manager uses his labor on the enterprises that give the greatest labor and management wage for the year. He will attempt to keep himself fully employed by adjusting the size of his business and by choosing enterprises that require labor at different times. Livestock uses labor during the winter months when field work cannot be done. Dairy, poultry and hog enterprises use much labor and are particularly suited to small farms. Table 1 shows that some farmers do almost three times as much work as others. As a result they are able to get larger farms, handle more livestock, and make more money. Similar figures can be given for the southeastern area. Again it should be remembered that half of the larger farms made less than $10,488. Some of these farms made less earnings than did smaller but more efficient farms.

**Table 1. Days of Productive Labor per Man and Labor. Earnings on 43 Farms in North Central South Dakota, 1948.**

| Days work per worker | | Number of farms | Average operator's labor earnings |
|---|---|---|---|
| Range | Average | | |
| Under 235 | 181 | 11 | 5,105 |
| 235—440 | 343 | 21 | 5,724 |
| 440 & over | 574 | 11 | 10,488 |

How can a man do more work than there are days in the year? The answers are that he may work "day and night," or he does his work more efficiently, or both. Efficiency that results from desirable size of farm, enterprises, labor saving machinery, equipment, and work methods is important.

## Judgment Needed in Adjusting Crop Yields and Livestock Feeding

Higher crop yields are desirable if the cost of summer fallow, green manure crops, grasses and legumes, or fertilizer do not exceed the value of the added yields. When grass and legume seeds are expensive it may pay farmers to prepare better seed beds and plant less seed per acre.

Feed costs are the largest single item of expense in livestock production. Farmers differ greatly in the amount of feed used to produce a hundred pounds of pork, beef, or milk. More important, they differ as to the cost of feed per hundred pounds of meat. Successful farmers consider carefully the possibility of substituting one kind of feed for another. When hay is high priced it may pay to feed more grain. When grain is high it may pay to feed more hay or to depend on pasture.

Protein supplements substitute for several pounds of farm grains. Yet when protein supplements are high in relation to grains it may not pay to feed them free choice. Choices among the grains also need to be made. Careful judgment is needed to determine what proportions of hay, grains, and proteins will be most profitable. For example, it has been found by the Animal Husbandry Department that a ration of one-third alfalfa and two-thirds brome grass, when fed to ewes, can give as good results as feeding straight alfalfa.

The ability of farmers to analyze the effect of changing price relationships on their business and to make needed adjustments will determine how they will come through farming in the fifties. (Project 137, Agricultural Economics Department.)

**Three rows of cottonwoods grown at Brookings in 1949. The row on the left is a strain highly resistant to the destructive leaf rust disease which is common in South Dakota. The middle row is a susceptible commercial strain. Note that the disease has killed all the leaves. The row on the right is another leaf rust resistant strain developed at this station.**

# Shelterbelt Cottonwoods *That Live!* . . . BY C. M. NAGEL

A NEW STRAIN of cottonwood which is resistant to leaf rust, has been developed by the Plant Pathology department of the Experiment Station. This new disease resistant strain when released to farmers, will reduce the losses in stands of the cottonwood tree.

Approximately 5,000 miles of shelterbelt and farmstead plantings have been planted in the state during the past 15 years. One of the important trees used in shelterbelt plantings is the cottonwood. Approximately 750,000 cottonwoods are planted each year in the state, and it is considered one of the more permanent types of trees used in such plantings. During recent years, as a result of the number of dead cottonwood trees which appear in many of the shelterbelts and farm plantings, many farmers hesitate to use them as commonly as they did during the 30's. Experimental evidence indicates that one of the major hazards responsible for these mortalities is the damage caused by leaf rust, which weakens and ultimately kills cottonwood stands.

Research investigations were undertaken in 1944 to work out control

measures because of the damage which occurred in shelterbelt and farmstead tree plantings by this destructive disease. It resembles in appearance the rust which attacks small grain. However, it is distinctly different in one respect and that is, it will not infect small grain, but only the cottonwood tree, in so far as is known at the present time.

In those cases where the leaf rust damage is not sufficient to kill the trees, they are so seriously weakened that other diseases become very destructive, particularly the canker diseases which girdle the bark on the branches and main trunk of the tree.

### Trees Defoliated by Rust

Leaf rust appears on leaves of cottonwood trees about the first of August. Under conditions favorable to rust infection, it becomes so heavy that both surfaces of the leaves are covered with rust, and in about ten days on highly susceptible trees the leaves turn brown and drop. Frequently, the susceptible cottonwoods are defoliated from rust by the middle of August. Once the leaves of a tree are killed, the plant cannot manufacture sufficient food, which is stored in tissues of the plant, to protect it from low temperature damage during the winter months, and the tree may starve to death. As a result, by spring the trees are either dead or in a weakened condition.

Experiments conducted during the past several years attempted to find a method of control for this destructive disease, and a search was made for a leaf rust resistant type. Several hundred strains of cottonwoods have resulted from greenhouse and field plot investigations since 1944. The strains under test included not only commercial stocks, some of which defoliated 100 percent during the peak of the leaf rust attack, but also a wide range of resistant strains resulting from greenhouse inoculation tests, which seldom lose any leaves under similar leaf rust attacks. Still other strains are virtually immune to this particular leaf rust disease.

The experiments were conducted in Brown County at Hecla in cooperation with the Brown-Marshall Soil Conservation district, and at the Experiment station located at Brookings.

### Damage by Leaf Rust Mistaken for Lack of Winter Hardiness

Under certain conditions the damage caused by disease has been confused with a lack of genetic hardiness to low winter temperatures in the case of cottonwood trees. Actually the so-called winter-killing under conditions of heavy leaf rust the previous season seems to be directly associated with this disease. Its damage during the previous seasons cuts down on the normal food production, causing a weakened condition which makes the plants susceptible to ultimate killing when they had previously appeared to possess sufficient genetic hardiness. In this connection, experiments have demonstrated that strains of cottonwood which possess sufficient winter hardiness do become injured and are killed if they have been seriously defoliated and weakened during previous seasons by the leaf rust disease.

Further trials are underway and, if these continue to prove satisfactory, plans will be made for the release of a leaf rust resistant cottonwood for planting in South Dakota. (Project 142. Plant Pathology Department.)

# Sprays Destroy Elm Tree Pest

By H. C. Severin

The Elm Calligrapha was unusually destructive to foliage of elm trees last year in Hutchinson, Turner, Bon Homme and Yankton counties. Many elm trees were entirely defoliated, while others suffered severe damage.

This pest of elm trees feeds on the foliage and devours the leaves, the amount of damage done to a tree depending entirely upon the number of insects that are present. The insect feeds both in the beetle and larvae stages; no food is taken while the pest is in the pupa stage.

**The Elm Calligrapha. From five to six thousand beetles may cluster on the trunk of an elm tree in the fall. Photo by the courtesy of Kansas State College.**

The adult stage of this pest is a beetle, slightly smaller than the common Colorado potato beetle and somewhat different in color and color pattern. The female beetles lay their eggs in the spring any place on the elm. From these eggs hatch slug-like larvae which require about three weeks to become full grown. When full grown, the larvae crawl under any protection they may find on or underneath the tree and here they transform into the pupa stage. The insect remains in the pupa stage for about three weeks and then transforms into a beetle. One generation of these insects is produced yearly.

The winter is passed in the beetle stage under any protection that the beetle may find on or under the tree, or in the soil near the tree. Loose bark on the tree, bands placed around the trunk of the tree and cracks in the tree may harbor many beetles through the winter. It is not unusual to find five or six thousand beetles clustered in a mass on the trunk of an elm tree in the fall.

One of the most effective methods that was found to destroy the beetles and their larvae in late spring and during the summer was to spray the foliage of the trees with lead arensate, 4 pounds to 100 gallons of water. This spray should be applied as soon as there is any evidence that the tree may be injured by the beetles.

To trap the beetles, a burlap bag may be tied around the trunk of the tree, but before the bag is tied in place, the bark over this area should be thoroughly sprayed or dusted with a 5 percent DDT emulsion or DDT dust.

If the beetles congregate in large numbers and can be readily reached, they may be destroyed with hot water or by spraying with chlordan, toxaphene, or Black Leaf 40. (Entomology Department.)

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