MINNESOTA FEED SERVICE

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Improving Livestock Through Breeding

C. J. Christians*

With the U.S. population increasing and production costs continually rising, livestockmen need to produce high quality products more efficiently than in the past. Improvement through breeding is the challenge to the purebred breeder. In accepting this challenge, he must satisfy demands of all segments of the industry.

BEEF IMPROVEMENT

The commercial beef producer needs cows with long, productive lifes; he wants a high percent calf crop of heavy, high-grading calves. The feeder desires rapid and efficient feedlot gains. The packer and retailer are interested in the maximum amount of high quality edible beef. And the consumer demands that this edible portion be tender, flavorful, and juicy.

Because the rate of genetic improvement in beef cattle is relatively slow, the purebred breeder can achieve these goals only with a long range breeding program. He must be concerned with genetic traits of economic importance such as fertility, mothering ability, growth rate, efficiency of feed use, carcass merit, and longevity.

During the past 10 years, various state and national organizations initiated beef improvement programs. These programs are based on the long approved practices of selecting *top* bulls and mating them to the *best* cows available. But without adequate and accurate records, superior animals cannot be identified.

Because few Minnesota breeders were participating in national programs, the Minnesota Beef Improvement Program was initiated in the spring of 1965. The response by breeders was excellent; 52 herds with 2,540 cows were enrolled during the 1st year. Forty-two breeders of these herds provided adequate identification for evaluating 1,838 calves for weight and conformation. In 1966, participation tripled with 124 herds in the program (see figure 1). Table 1 presents the average performance of the beef herds evaluated.

Table 1. Minnesota Beef Improvement Program summary, 1965 and 1966

Year	Number of herds	Number of calves	Average 205 day weaning weight (pounds)	Average weaning grade*
1966	124	4,113	416	12.9
1965	42	1,838	419	12.9

* Grade: 13 = average choice; 12 = low choice.

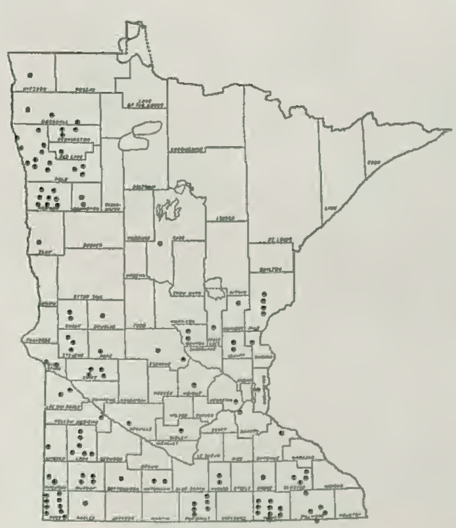

Figure 1. Locations of herds enrolled in the Minnesota Beef Improvement Program, 1966.

The Minnesota program emphasizes several traits of major economic value. The necessary records each beef producer must keep are:

1. Birth Record—The birth date is needed to determine growth rate at weaning time. Adequate *identification* of the calf, cow, and sire is essential. Cattle may be identified with hide brand numbers, horn brands, ear tattoos, ear tags, or neck chains.

2. Weaning Record—The weaning weight or gain per day from birth indicates the individual's potential to gain rapidly and efficiently; it also reflects the dam's milking ability. Conformation score at weaning is a measure of carcass desirability and structural soundness of the animal. Slow gaining, low grading calves should be eliminated as replacements; poor producing cows and bulls should be culled.

3. Yearling Records—The yearling conformation score usually indicates carcass desirability more accurately than does the weaning score. Yearling weight, a measure of growth rate, can indicate efficiency of gain. Carcass information on progeny should supplement the yearling data in evaluation of the sire.

4. Reproductive Performance and Longevity Record—Progeny records kept during the productive life of cows and bulls provide information on reproduction rate and calving intervals. Selection of replacement heifers and herd sires should be made from cows with high reproduction records.

How Much Progress To Expect

The amount of genetic improvement made in a well-planned breeding program depends on: (1) heritability, (2) selection differential, (3) genetic association, and (4) generation interval.

(Continued on page 2)

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Table 2. Beef cattle heritability estimates

Level of heritability	Characteristic	Average percent
High	Dressing percent	70
	Rib eye area	69
	Tenderness	60
Medium	Feedlot gain	45
	Efficiency of gain	40
	Cow mothering ability	40
	Birth weight	40
	Pasture gain	30
	Weaning weight	30
	Cancer eye susceptibility	30
	Weaning conformation	25
Low	Calving interval (reproductive efficiency)	10

Heritability is the portion of the average superiority of selected parents that they pass on to their offspring. It is an estimate of the proportion of the total variation in animals that is due to heredity. The average estimated heritabilities for some economically important traits are given in table 2. For example, cow reproduction efficiency has a low level of heritability, so improvement of this trait by selection is very slow. But selection for measures of carcass merit, the most highly heritable traits, results in relatively rapid changes.

Selection differential is the difference between the selected individuals and the average of all the animals in their herd. It is influenced by the proportion of the total number of animals selected, the number of traits selected for, and the variation present in the initial population. Selection differentials with high values usually can be obtained in sire selection because a relatively low proportion of males are chosen for breeding purposes. Only major, economically important traits should be included in the selection program.

Genetic association may exist between two or more traits. Therefore, if selection is practiced for one trait, associated traits could improve automatically.

Generation interval is about 5 years in most beef herds. The generation interval can be shortened and yearly progress increased by replacing breeding stock that do not breed regularly or develop rapidly enough to calve at 2 years of age.

How To Use Records

The records obtained on each animal in the improvement program can help the breeder to:

- Decide which cows to cull.
- Evaluate sires.
- Select replacement heifers.
- Attract prospective buyers interested in improving their herds.

For example, actual records obtained on four sires in one farmer's herd showed the following differences (each sire sired about 30 calves). The top bull sired calves weighing an average of 575 pounds at 205 days and grading average choice. The average weight of the lowest sire's progeny was 404 pounds at 205 days; they graded choice. At 30¢ per pound live weight, this difference equals $51.30 per calf. If we project this situation over 3 years, with 33 cows being bred to each bull per year and assuming a 90-percent calf crop, the top sire would produce a $4,571 greater return than the other sire.

SWINE IMPROVEMENT

Many Minnesota pork producers are actively involved in the Minnesota Swine Improvement Program (see figure 2). The program mainly is conducted at the Minnesota Swine Evaluation Stations in Austin and New Ulm. General testing procedures were discussed in the spring 1963 issue of *Minnesota Feed Service.*

As shown in table 3, considerable progress has been made in numbers and quality of pigs evaluated at the stations. The fact that 347 more market pigs were tested in the spring of 1966 than in 1958 indicates that breeders are beginning to realize the value of performance records.

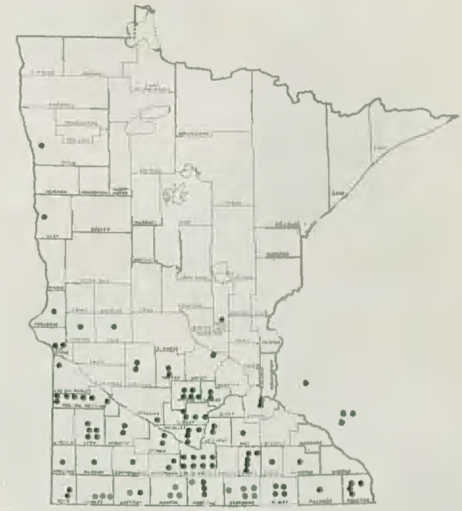

Figure 2. Locations of herds enrolled in the Minnesota Swine Improvement Program, 1966.

During the 1958-66 period, the growth rate did not change, but age at 200 pounds was reduced because pigs weighed more per day of age when they were started on test. Feed conversion efficiency improved slightly and the loin eye area of carcasses increased 0.58 square inches. Although backfat thickness did not change appreciably, the percent of ham and loin increased 5.2 percent.

Data from the evaluation stations show that swine improvement can be made through a strong selection program. However, only a few pigs can be evaluated from each herd, and they may not be representative of the entire herd. Therefore, a sound on-the-farm testing program must supplement data obtained at the central station. Improvement depends on how each breeder utilizes his records when selecting parents for the next generation.

Table 3. Changes in production and carcass measurements of tested pigs, 1958-66

		Production measurements		
Spring season	Number of pigs	Average daily gain (pounds)	Age at 200 pounds (days)	Feed efficiency, pounds feed per 100 pounds gain
1958	113	1.85	152	303
1962	450	1.87	150	305
1966	460	1.85	146	292

	Carcass measurements			
Spring season	Length (inches)	Backfat (inches)	Loin eye area (square inches)	Percent ham and loin (live weight basis)
1958	29.3	1.54	3.52	22.8
1962	29.8	1.58	3.94	25.2
1966	29.7	1.48	4.10	28.0

alfalfa dehydration for rural industrialization

D. C. Dahl and P. S. Stelmaschuk*

Possibilities for new or expanded industrial activity in rural areas have received increased attention in Minnesota and other agricultural states. This article briefly reviews economic considerations that determine the feasibility of alfalfa dehydration as an industrial potential for Minnesota communities.

The successful development and location of any manufacturing operation depend upon continuing *sales outlets* for its product at *prices* that, on the average, exceed its total per unit *operating costs*. These per unit costs include procurement, processing, and distribution charges incurred by the firm. When procurement costs are high, manufacturers tend to locate near the sources of their primary raw materials. This situation is true for facilities that dehydrate alfalfa for animal meal or pellet rations.

Sales Outlets

Most alfalfa meal and pellets are sold directly or indirectly to U.S. feed manufacturers. These manufacturers combine the alfalfa product with feed grains and other supplements into "formula" feeds, primarily for sales to hog and poultry producers. Alfalfa meal and pellets also can be used separately or in mixtures for cattle and sheep. When the alfalfa product is used as a single feed, however, its nutrient cost is high relative to other grains or mixes. It is frequently included in feed rations because of its high vitamin A and protein content that, with other elements, stimulates animal growth.

Approximately 60 percent of U.S. processed alfalfa is sold eventually to domestic feed manufacturers. Another 30 percent is sold to feedlot operators. The remaining 10 percent enters into international trade as alfalfa meal.

Domestically, alfalfa dehydrators sell directly to local feed manufacturers and, through commissionmen and brokers, to feed manufacturers at more distant U.S. locations. Alfalfa meal is traded on the Minneapolis Grain Exchange. Although brokers and commissionmen also direct sales of processed alfalfa to U.S. feedlots, the dehydrator makes most feedlot sales himself. With 90 percent of alfalfa meal sales dependant upon feedlot and feed manufacturing activity, opportunities for increased volumes are determined largely by prospects for continued mixed feed sales and feedlot growth.

International sales of alfalfa meal are dominated by the imports of Japan. In 1965, nearly 90 percent of U.S. commercial exports of alfalfa meal was purchased by Japanese interests. Another 8 percent was sold to the Netherlands and Belgium.

Prices

Alfalfa meal prices fluctuated markedly over the past decade (figure 1). Price variations appear to be correlated with varied supply responses to a steadily increasing demand for the product. Alfalfa dehydration operations "flooded the market" with alfalfa meal in 1959-60 and again in 1963-65. Stable demand increases encouraged prices back up to a 10-year average of just over $50 per ton.

Seasonal price variations were not as great as annual changes. A 15- to 20-percent deviation from annual prices is the rule. From October to late April, prices are highest; from April to October, prices are lowest.

Price differences exist between alfalfa meal or pellets that are dehydrated artificially and alfalfa processed naturally by "sun-curing." The prices presented above are for artificially dehydrated alfalfa meal. Sun-cured alfalfa meal usually contains less usable protein and is discounted from $10 to $15 from these prices. However, annual and seasonal price variations have been similar to those for artificially dehydrated alfalfa meal.

Operating Costs

Alfalfa for artificial dehydrating operations commonly is produced under written contract between the dehydrator and the farmer. This arrangement permits harvesting (and, thus, product) control by the dehydrator. The dehydrator normally absorbs the cost of harvesting and hauling and pays producers on the basis of quality of the alfalfa cut. There are nine such operations in Minnesota (see figure 2).

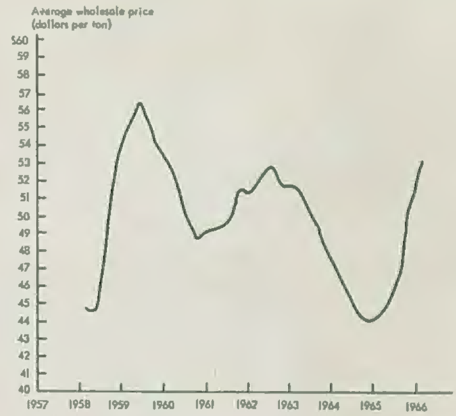

Figure 1. Moving average wholesale price of alfalfa meal dehydrated 17 percent, Minneapolis, 1958-66.

Source: *Feed Market News*. Oct. 1962 and Oct. 1966.

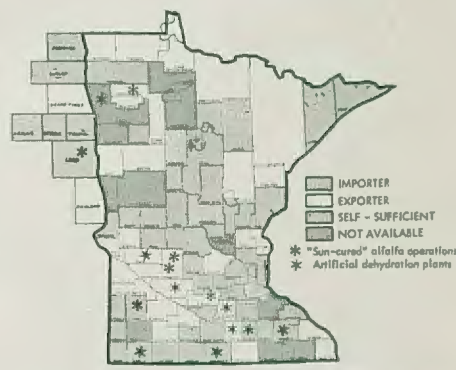

Figure 2. Hay importing and exporting counties (based on 1957-63 averages) and location of alfalfa dehydration plants, Minnesota, 1967.

Source: USDA. *Hay in the United States*. Stat. Bull. 349. ERS. 1964.

Sun-cured alfalfa dehydration operations exist at four locations in Minnesota. These dehydrators accept plant-delivered alfalfa hay for processing. Because harvesting and hauling costs are absorbed by the producer, these dehydrators pay farmers higher prices per ton than do artificial dehydrating operators. Without harvesting control, however, the quality of the hay received is lower and the processed alfalfa product must be sold at discounted prices.

The cost of processing alfalfa is lower for "sun-curing" than for artificial operations. The major cost-saving feature is the lack of the large "drying drums" found in the artificial curing operation. Pelletizing machinery is common to both types. Cost estimates for "sun-cure" operations range from $30 per ton in a 10,000 ton annual volume plant to $35 per ton in a 5,000 ton plant.

Most sales made are F.O.B. to the feed manufacturer, the feedlot, or the

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port of embarcation for international sales. Thus, transportation and handling costs must be added to the processing costs listed above.

Conclusions

Past trends suggest a continued increase in the sales of processed alfalfa. The lower per unit costs of sun-cured alfalfa products now permit price competition with feed mixes on a nutrient cost basis.

While sales prospects for alfalfa meal and pellets are encouraging, economic development planners in rural areas must carefully study possible sales outlets, price patterns and arrangements, and procurement, processing, and distribution costs before developing an alfalfa dehydration operation for their community. ■

Open Doors to Learning

Open Doors to Learning, a newly published booklet of the Agricultural Extension Service, lists many classes, workshops, clinics, and seminars being held throughout Minnesota. Readers of *Minnesota Feed Service* might find the following programs of particular value:

- Crops and Soils Workshops
- Retail Dealers' Conferences
- Soil and Fertilizer Short Courses
- Garden Store Operators' Short Courses
- Workshops on Control of Insects, Plant Diseases, and Weeds
- Agricultural Chemicals Workshops
- Pest Control Short Courses
- Beef Management and Nutrition Schools
- Beef Feedlot Tours and 1-Day Beef Cattle Feeders' Meetings
- Dairy Seminars
- Swine Schools
- Grain Marketing and Utilization Seminars
- Community Resource Development Seminars
- Industrial Location Seminars
- Communications Seminars

Dates and locations of many courses will be scheduled only after sufficient interest develops. To express your interest in the various subjects, complete the forms at the back of the booklet and mail them to your county extension office. Ask your county agent for the booklet and for information about specific educational programs in your area.

Dairy Records in DHIA

Ralph W. Wayne*

The Minnesota DHIA program was started by a group of Freeborn County dairymen through the leadership of Theo Sexauer, a vocational agriculture teacher. Since its beginning on December 1, 1910, DHIA has grown until it now covers all but three counties. At present, 5,965 members with 186,831 cows are enrolled. While this latter number represents only 16.1 percent of all dairy cows in Minnesota, it is three times the enrollment of 10 years ago.

DHIA is a self-supporting program. Cooperating dairymen invest over $1 million annually for the service. There are 184 Minnesota dairymen who have had their herds on continuous test for 20 years or more. The 85 incorporated DHIA associations employ 206 supervisors or testers, including 34 women.

DHIA offers two types of testing programs. In the standard program, the supervisor comes to the farm at milking time 1 day a month; he weighs and samples milk from each cow both night and morning. He also weighs the feed fed and collects such information as quality of feed fed, price of feed, and price of milk sold. Records from this program can be used for publicity, for proving sires, and for management and inheritance studies.

In the owner-sampler program, the herd owner himself weighs and samples the milk from each cow. He reports this information together with the other data. Since the owner and not the supervisor gathers and reports this information, owner-sampler records are private records. Although they serve the same purpose for the herd owner as do standard DHIA records, they are not used for publicity nor for the proved sire program.

In both programs, the basic data are listed on a barn sheet or report form and mailed for auditing to the dairy extension office of the University of Minnesota. If data are missing or conflicting, the report is held while the supervisor is asked to supply the needed material. After reports clear the audit section, they are transmitted to the computer center.

The final result is a detailed printed report that is mailed each month to the DHIA member. This report gives current and cumulative information on each cow as well as on the herd as a whole. For each cow, it lists the return over feed cost per day, daily and monthly production, the amount of grain fed, and a recommended feed amount for the coming month. The quality of hay and silage is considered when working out the amount of grain needed to balance each cow's requirements according to her production and body weight. Data since the last freshening also are cumulated to date, including production and net returns. Calving due dates are listed, as are indications of the time to breed and to dry off each cow.

The information also is summarized for the entire herd. The yearly herd average for all factors, based on the preceding 12 months, is recalculated each month. So information is as recent as possible and gives a quick picture of the trends taking place in the dairy herd.

Benefits of the DHIA program are shown by the improvements in the enrolled herds. In 1966, DHIA herds averaged 11,887 pounds of milk and 446 pounds of butterfat as compared to 8,750 and 306, respectively, for all dairy cows in the state. Each DHIA cow returned to her owner an average of $203 during the year for labor as compared to $89 for the average Minnesota cow. The average production per cow in DHIA in 1929 was 292 pounds of butterfat. That average level was not reached by all dairy cows in the state until 1964, 35 years later.

According to a survey of records in Yellow Medicine County, average butterfat production in DHIA herds increased by 90 pounds per cow over 10 years. After extra feed costs were deducted, a greater net labor return of $57 was realized per year per cow due to this increased production. Most of this improvement was due to the use of DHIA records which cost $6.50 per cow. A $57 return on a $6.50 investment is high interest.

Today, nearly one-half of the dairy cattle in the state are bred artificially to sires owned by artificial breeding organizations. Each proved sire, to which over 100,000 cows may be bred, is proved and located through DHIA records. Therefore, all dairymen using this service are benefitting from the DHIA program.

The DHIA record is a complete record of costs, net returns, utilization of labor, and feeding. The dairyman needs this information when culling, feeding, breeding, and making management decisions. The dairy farm is a highly specialized business that must be operated as efficiently as possible. ■

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Corn Silage for Dairy Rations

J. D. Donker*

A Unique Feed

Corn silage is unique among dairy cattle feeds because it is a natural combination of roughage (low energy feed from stalks and leaves) and concentrates (high energy feed from grain). Most feeds used are one or the other. At the usual time of harvest with the usual corn plant, over one-half of the dry matter and about three-fourths of the protein and energy are in the ear. So when 30 pounds of silage of the usual composition are fed, the silage contains 3-4 pounds of dry grain.

Corn silage is the most important silage material used on dairy farms throughout the United States. Several reasons, some interrelated, account for this great popularity.

- It is the most economical source of energy for feeding.
- Its production and use can be highly mechanized.
- The dry matter contains a high concentration of energy.
- It is adapted to a large variety of soil and climatic conditions.
- A large tonnage can be raised per acre.
- It is a highly palatable feed.
- Storage cost is low.

Corn Silages Vary

Due to several factors, corn silage can vary considerably in composition and/or quality as a cattle feed.

Variety or hybrid used—While some corn varieties produce mainly leaves and stalks, others produce much grain. Since the primary problem when feeding high producing cows is supplying energy, silages with heavy grain content are favored. Although such silages are not essential in some situations, they always can be used to advantage.

Planting conditions—Such factors as natural fertility of soil, applications of fertilizer, plant density, temperature, and moisture affect the corn silage. If labor, machinery, and other economic resources are to be used efficiently, the soil fertility level should be high to ensure a heavy yield. Plant density interacts with other factors, but a high grain yield is desired rather than a high forage yield. If planting density gets too high, forage yield will displace grain yield. While dry matter tonnage may be higher with high density planting, the energy content may be lower.

Cultivation—To ensure good growing conditions, fields containing corn for silage must be kept as weed free and insect free as possible.

Harvesting—Many factors such as maturity, frost, and drought must be considered. As the corn plant matures, its energy content increases. Yield also increases rather rapidly right up to full maturity. Therefore, corn generally should be harvested when at full dent stage. Moisture conditions usually are favorable at that time, allowing for maximum storage of dry matter per cubic foot of silo space.

The moisture content should be between 60 and 65 percent. If the corn is drier than this level, special attention must be paid to fine chopping to prevent mold. If the moisture content goes much above 75 percent, a sour silage develops. Such material erodes the concrete in silos and seepage losses are serious.

Whenever it is apparent that no further development will occur, droughty corn can be harvested and ensiled. Such material might contain toxic amounts of nitrate. Although nitrates decrease during the ensiling process, caution should be taken when feeding corn silage from corn fodder stunted by drought or freezing before it was fully matured.

Method of harvesting—The height of cut, detasselling, and fineness of chop are all important factors. While it is possible to increase energy content of the silage by eliminating portions of the stalk and tassel, this method is not popular. Usually, the finer the chop the better is the quality of the resulting silage. And the drier the silage is at harvest, the more important fine chopping becomes. Fine chopping improves both storage efficiency and feeding qualities.

Additives—Corn silage can be of excellent quality without any silage additive. Nevertheless, certain additives can be beneficial. Water generally should be added at the blower to ensure that the moisture content of the silage remains above 50 percent. Urea, at the rate of 10 pounds per ton of the material going into the silo, can increase the silage's protein equivalent.

Sodium metabisulfite, 8 pounds per ton, reduces danger from toxic nitrate oxide gasses. These gasses can kill animals and people when the material ensiled is high in nitrate. Adequate ventilation around the base of the silo or in the silo itself can prevent dangers from such gas.

Feeding—The interaction of temperature and rate of feeding greatly affects silage quality. If the temperature is above 50° F. and the rate of feeding is too slow, spoilage can result and the cattle will not like the silage.

Using Corn Silage

Many dairy farmers successfully use corn silage as their only source of roughage. As with any source of roughage, the concentrate portion of the ration must contain supplements to correct or make up its deficiencies.

Corn silage is quite low in calcium, moderately low in phosphorus, and deficient in protein for high producing cattle. For example, a dairy cow producing 70 pounds of milk daily with 3.5-percent milk fat requires 31 pounds TDN, 4.4 pounds digestible protein, 100 grams calcium, and 80 grams phosphorus. To supply the energy needed requires 170 pounds of good quality silage—an unreasonable amount for most cows to consume. If 100 pounds silage per cow per day are fed, the concentrate portion of the ration must contain 13 pounds TDN, 3.2 pounds protein, 55 grams calcium, and 45 grams phosphorus in order to balance needs for the cow to produce 70 pounds of milk daily. ■

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MINNESOTA FEED SERVICE

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Feed Service Committee—Harold B. Swanson, chairman; Lester Hanson, Dale Dahl, Ralph Wayne, Curtis Overdahl, Robert Berg, and Harley Otto.

Recent Publications

This new feature in *Minnesota Feed Service* lists some recent publications of the Agricultural Extension Service and Agricultural Experiment Station of interest to people in the feed, seed, and fertilizer industry. Single copies of up to 10 different publications are available free from your County Extension Office or the Bulletin Room, Institute of Agriculture, University of Minnesota, St. Paul, Minnesota 55101.

New Publications

Pasture Renovation. Agronomy Fact Sheet 18. J. R. Justin. Tells how to renovate a pasture so it can be an inexpensive feed source for livestock.

Establishing Small-Seeded Forages. Agronomy Fact Sheet 19. J. R. Justin. Gives information on how to avoid costly failures when establishing small-seeded forages.

Turkey Rations. Special Report 25. Paul E. Waibel, Kenneth E. Dunkelgod, Elton L. Johnson, and Robert W. Berg. Discusses ration formulations for fryer-roaster, market, and breeder turkeys. Contains complete rations for starting, growing, and breeding turkeys. Also includes supplement and concentrate feeding programs designed specifically for use with local grains.

Revised Publications

How About Oats for Silage? Agronomy Fact Sheet 3. J. R. Justin. Gives recommendations for growing oats for silage; tells about variety selection, fertilization, and harvesting.

Sorghum-Sudangrass Hybrids. Agronomy Fact Sheet 15. A. R. Schmid and J. R. Justin. Gives information on the growth requirements and uses of sorghum-sudangrass hybrids.

Cultural and Chemical Weed Control in Field Crops. Extension Folder 212. R. Behrens, G. R. Miller, J. R. Justin, H. J. Otto, R. G. Robinson, O. R. Strand, and R. N. Andersen. Summarizes research on using herbicide chemicals to control weeds.

Crop Production Guide for Minnesota. Extension Pamphlet 194. Harley J. Otto, Gerald R. Miller, Curtis J. Overdahl, Lowell D. Hanson, and James R. Justin. Gives recommendations on varieties, seeding rates, dates of seeding, weed control, and fertilizer needs.

The Sunflower Crop in Minnesota. Extension Bulletin 299. R. G. Robinson, F. K. Johnson, and O. C. Soine. Gives up-dated information on the adaptation, production, harvesting, and uses of sunflowers.

Pest Control Guide for Commercial Fruit Growers. Special Report 6. O. C. Turnquist, J. A. Lofgren, and H. G. Johnson. Gives information on the control of insects, diseases, and weeds in commercially produced fruit.

Retail Dealers' Conference Handbook. Special Report 12. Prepared by extension specialists in entomology, soils, agronomy, and plant pathology. Presents up-to-date information on agricultural chemicals, fertilizers, herbicides, and plant diseases.

Varietal Trials of Farm Crops. Miscellaneous Report 24. Prepared by staff members of the Department of Agronomy and Plant Genetics. Presents descriptions of varieties and performance data.

Calendar of Coming Events

June

Crops and Soils Field Day, Lamberton	28
Crops and Soils Field Day, Rosemount	30

July

Crops and Soils Field Day, Waseca	6
Crops and Soils Field Day, Morris	13
Visitor's Day, Grand Rapids	18
Visitor's Day, Crookston	19

September

Corn and Soybean Field Day, Waseca	12
Corn and Soybean Field Day, Lamberton	13
Dairy Products Institute, St. Paul	12-14
Corn and Soybean Field Day, Morris	14
Fruit Farm Visitor's Day, Excelsior	16
Beef Cattle Grassland Field Day, Rosemount	21
Fall Field Day, Rosemount	29

October

Beef Cattlemen's Institute, Crookston	5
Beef Cattle Feeders Day, Crookston	5 (tent.)
Dairy Day, Grand Rapids	18

Agricultural Extension Service
Institute of Agriculture
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St. Paul, Minnesota 55101

LUTHER J. PICKREL, director
Cooperative agricultural extension work, acts of May 8 and June 30, 1914.

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