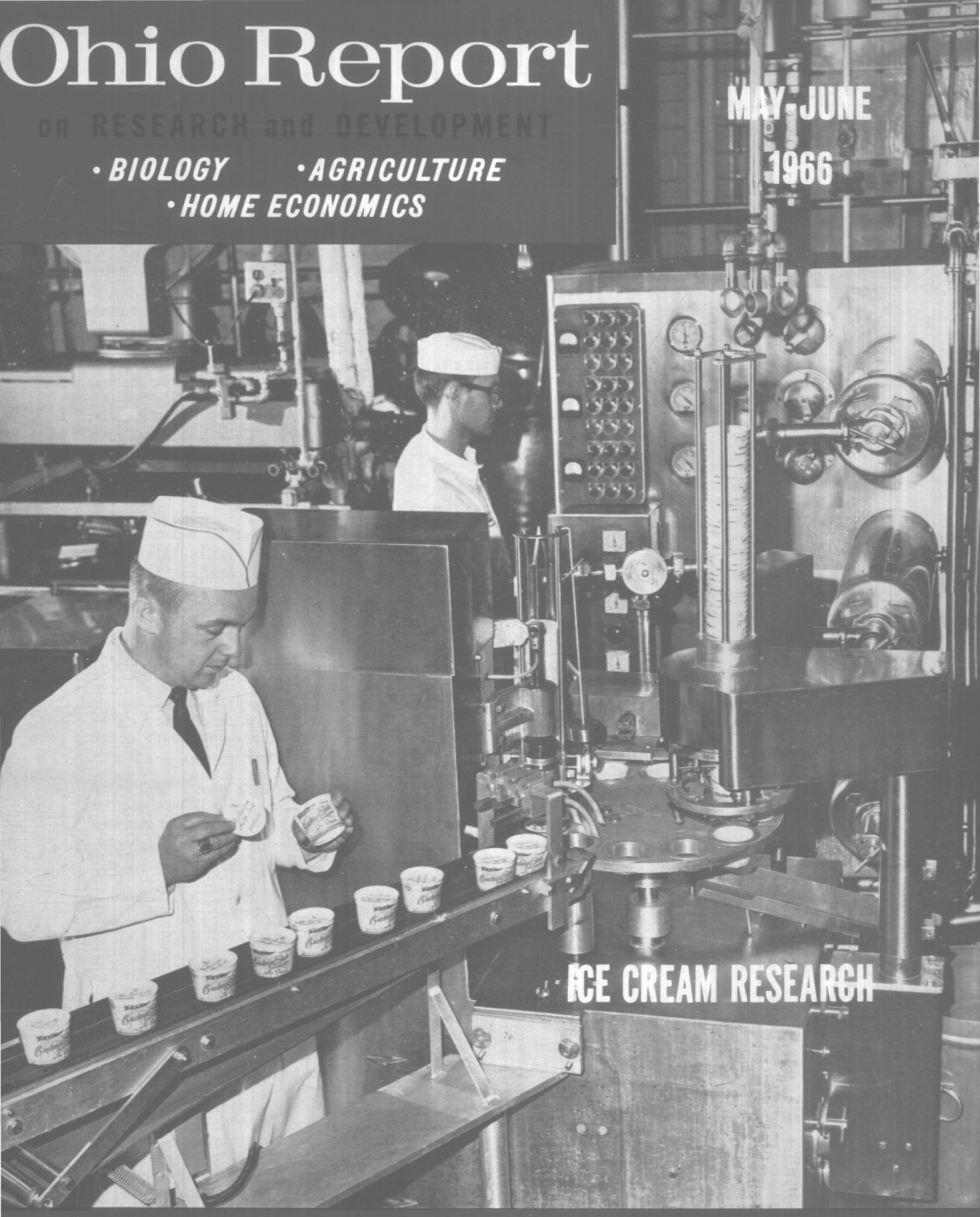
Ohio Report

on RESEARCH and DEVELOPMENT

• BIOLOGY • AGRICULTURE
• HOME ECONOMICS

MAY-JUNE
1966



ICE CREAM RESEARCH

OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER - WOOSTER

Ohio Report

ON RESEARCH AND DEVELOPMENT IN BIOLOGY, AGRICULTURE, AND HOME ECONOMICS

Vol. 51, No. 3 MAY-JUNE 1966

Center Calendar

1966 FIELD AND SPECIAL DAYS

AT WOOSTER

Lawn and Ornamentals Days Sept. 13-14

AT BRANCHES

Tomato Day----------Sept. 12
Northwestern Branch, Hoytville

Agricultural Leaders Day--------Oct. 5
Eastern Ohio Resource
Development Center, Caldwell

AT COLUMBUS

Farm Science Review-------Sept. 21-23

THERE'S MORE TO SEE AT FARM SCIENCE REVIEW

The 1966 Farm Science Review, Sept. 21-23, will be bigger and better than ever. There will be 288 corn hybrids on display by 28 commercial firms, plus commercial varieties of alfalfa, grain and forage sorghums, forage mixtures, sudan-sorghum crosses, and soybeans.

Farm equipment manufacturers will demonstrate the latest equipment, research in agriculture and home economics will be reported by Ohio State University and Research Center specialists, and Extension specialists will demonstrate cultural practices on Ohio crops.

Read About...

Published bi-monthly by the Ohio Agricultural Research and Development Center, Wooster, Ohio 44691.

On the Cover

Ice cream manufacturing and packaging operation in the Department of Dairy Technology at The Ohio State University. This modern facility for research, teaching, and service is particularly suited to industrial type experimentation on processes, products, and equipment.

Translating Laboratory Research into Industrial Application

I. A. GOULD

Research programs of the Department of Dairy Technology are designed to serve the processing and manufacturing segments of the vast dairy industry. These efforts are directed to developing or improving laboratory, processing, and manufacturing methods; establishing knowledge by which new or modified products may be developed by industry; and studying defects in milk and milk products which limit consumer acceptability. Research is conducted in such diverse areas as chemistry, microbiology, engineering, and management.

In a broad sense, no research conducted in the Department is completely unrelated to industrial needs. Even the most profound "fundamental" rsesearch has a related practical purpose—and it may be termed "fundamental" only because the research findings being sought are removed by some indefinite period of time from their industrial interpretation and use. In contrast, the industrial application of "practical" research is clearly evident and the results may be utilized immediately to satisfy an industrial need.

Ice cream is an excellent example of a product where fundamental research can supply the necessary information for industrial processes. The ice cream system is tremendously complex with its mixture of milk products, sweetening agents, stabilizers, emulsifiers, and flavoring materials.

One phase of Department research relates to the characteristics of stabilizers and their role in ice cream. The interaction of the stabilizer with the milk components must be controlled if a product of maximum quality is to be produced. The adoption of new, continuous pasteurization methods has made it necessary to know more about the various types of stabilizers and how they perform under different conditions.

Research has demonstrated that different stabilizers interact with the milk components in various ways and, under some conditions, this interaction may interfere with the effectiveness of the stabilizer. Information obtained will enable the ice cream manufacturer to select a particular stabilizer for a given task and thus to achieve maximum effectiveness at minimum cost.

Another ice cream research project deals with selection and use of corn sweeteners. These products, which may replace cane or beet sugar, have unique and beneficial properties but may produce a "corn syrup" type of flavor. Research is underway to determine the maximum quantities of

(Continued on Page 42)

Product clinics acquaint the industry and consumers with advances in research.

Holding Poults After Hatching Reduces Early Growth Rate

KARL E. NESTOR and KEITH I. BROWN*

Recent research at the Center indicated that holding poults for 24 and 48 hours after hatching before placing on feed resulted in a significant increase in poult mortality to 2 weeks of age and a significant reduction in body weight at 2 weeks of age. (Ohio Report on Research and Development 51 (1):12). Further studies were conducted to determine the effect of holding poults after hatching on growth rate after 2 weeks of age.

Two trials were conducted. In both trials, poults were divided into three groups at hatching. One group was placed on feed immediately and the other group was held in chick boxes for 24 and 48 hours before being fed. The poults were weighed at bi-weekly intervals from 4 weeks through 16 weeks of age. At 4 and 6 weeks of age, the birds were weighed in grams. They were weighed in pounds at the other ages.

The results are presented in Table 1. The values in this table represent the averages of two trials. A difference in growth rate between sexes was evident as early as the 4th week of age. So the mean weights of the two sexes are presented separately. Each average value was based on the weights of 55 to 85 birds.

Holding poults for 24 and 48 hours reduced body weight in males at 4 and 6 weeks of age in comparison with the controls (0 hour group.) These differences were highly significant statistically ($P<.01$), which means that there was less than one chance in 100 that the differences observed were due to chance.

Body weight was also reduced in the 24-hour group at all of the older ages. The differences were statistically significant ($P<.05$), indicating that there was less than one chance in 20 that the differences were due to chance.

From the results obtained with the 24-hour group, the 48-hour group should also show reduced growth rate at the older ages. Mortality prior to 4 weeks of age was much greater in the 48-hour group than in the other two groups. It is possible that the weaker poults, which would have grown more slowly, died prior to 4 weeks of age and as a result the average body weights at the older ages were greater than expected.

The results obtained with females were a little different. The 24- and 48-hour groups had lower body weights than the controls at 4 and 6 weeks of age. The differences at these ages were highly significant. The treated groups also had lower body weights at 8, 10, and 12 weeks of age but the differences were small and non-significant. All three groups had essentially the same body weight at 16 weeks of age.

Mortality occurring in the three groups was not significantly different from 4 through 16 weeks of age. Since the groups differed greatly in mortality prior to 2 weeks of age, most of the early mortality was probably due to starvation.

Since the body weights were generally reduced in the treated groups prior to 8 weeks of age, these groups probably would have lowered resistance to a disease outbreak. Such a disease outbreak did not occur during the experiment.

Based on the results of this experiment, it is recommended that poults should be placed on feed as soon as possible after hatching in order to avoid losses due to starveouts and to avoid the reduced weight gains which might reduce resistance to disease.

TABLE 1.—Effect of Holding Poults after Hatching on Early Growth Rate.

Hours Held After Hatching	Age (wks.) 4	6	8	10	12	14	16
				Males			
0	473	910	3.54	5.62	8.01	10.4	12.3
24	430	833	3.34	5.41	7.64	9.9	11.6
48	423	884	3.50	5.63	7.97	10.4	12.3
				Females			
0	411	758	2.86	4.34	6.00	7.60	8.70
24	383	723	2.80	4.30	5.96	7.62	8.80
48	355	717	2.76	4.22	5.89	7.50	8.67

*The authors express sincere appreciation to Philip A. Renner for his technical assistance in conducting this experiment.

NEW CHEESE VARIETIES

for the American Market

T. KRISTOFFERSEN

Cheese consumption in the United States has increased steadily in recent years and is now at an all-time high. Not only is more cheese being consumed but more varieties of cheese are being introduced in the market and are being accepted by consumers. The increased interest in new cheese varieties is a result of the growing quest for new ventures in foods by the American consumer. The world of cheeses, like no other food, offers the consumer an opportunity to satisfy his desire for new tastes.

Two new and distinctly different cheese varieties—White cheese and Katchkaval from Yugoslavia—have been studied in the Department of Dairy Technology to adapt them to American conditions. Mrs. Natalija P. Kapac, staff member at the University of Skopje, Yugoslavia, and a visiting Fellow in the Department during the past year, has been conducting these studies.

In Yugoslavia, White cheese and Katchkaval are manufactured in the mountain regions from sheep's milk, which is brought to factories and converted directly to cheese. The adaptation of these cheeses to American conditions involves primarily the problem of obtaining a full-flavored cheese from pasteurized cows' milk.

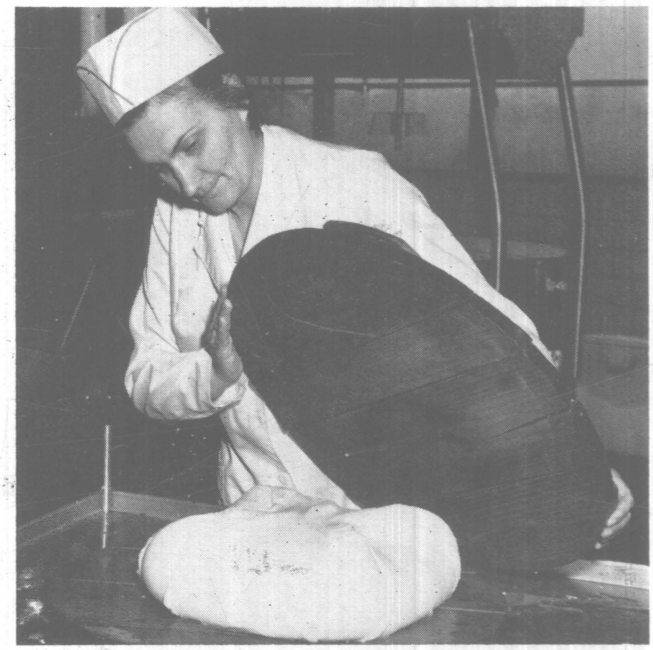
White cheese is a high moisture cheese with a consistency similar to cottage cheese curd. Its flavor seems to be a cross between brick cheese and Nu World white mold cheese.

The adapted manufacturing procedure, using pasteurized cows' milk, consists of the following steps:

Coagulating the milk with selected culture bacteria and rennet extract, transferring the soft curd into a cloth-lined hoop for drainage, pressing the curd for 14-16 hours to aid moisture removal, cutting the curd in 4 x 5 inch strips and placing these in brine for 24 hours, curing in a brine solution at 60° F. for at least 1

(Continued on Page 47)

Soft White cheese curd is collected in cloth-lined hoop by Mrs. Natalija Kapac, University of Skopje, Yugoslavia. For the manufacture of White cheese, the rennet coagulated curd is placed directly in a cloth-lined hoop without prior cutting and cooking.



After hooping, the frame is removed and pressure is applied directly to the White cheese curd. Cover is placed on the curd and weights are placed on top of the cover.

MOLDY CORN

as a Feeding Problem

L. E. WILLIAMS and H. S. TEAGUE

Moldy corn has recently caused feeding problems with swine and to a lesser extent with other livestock and poultry. These problems, which have been encountered in relatively wide areas of Ohio, Indiana, Michigan, and Ontario are with corn from the 1965 crop.

The prime symptom is a lack of palatability, ranging from lower intake to complete refusal of corn or feed containing corn. In addition, several cases of moldy corn toxicity which may have caused abortion and rectal prolapse have been reported by swine producers in the affected areas.

Moldy feed has been associated with similar problems in the past. Many molds (fungi) common to feed grains are potential or actual producers of toxins. However, conditions often are not favorable for growth and reproduction of the molds or the production of toxins.

In 1965, environmental conditions were favorable for mold invasion and growth on corn in the field. Almost all field problems reported have been with corn from the 1965 crop and began to appear soon after harvest. Thus, the implication of "storage type" molds is minimized. Molds which grew on the corn in the field appear related to the symptoms observed.

Technical names of common "field type" molds are *Diplodia, Gibberella, Fusarium, Cladosporium, Nigrospora,* and *Cephalosporium*. The storage molds are primarily *Aspergillus* and *Penicillium*. The six field molds listed have been identified in samples of corn from the affected areas in variable degrees of infestation.

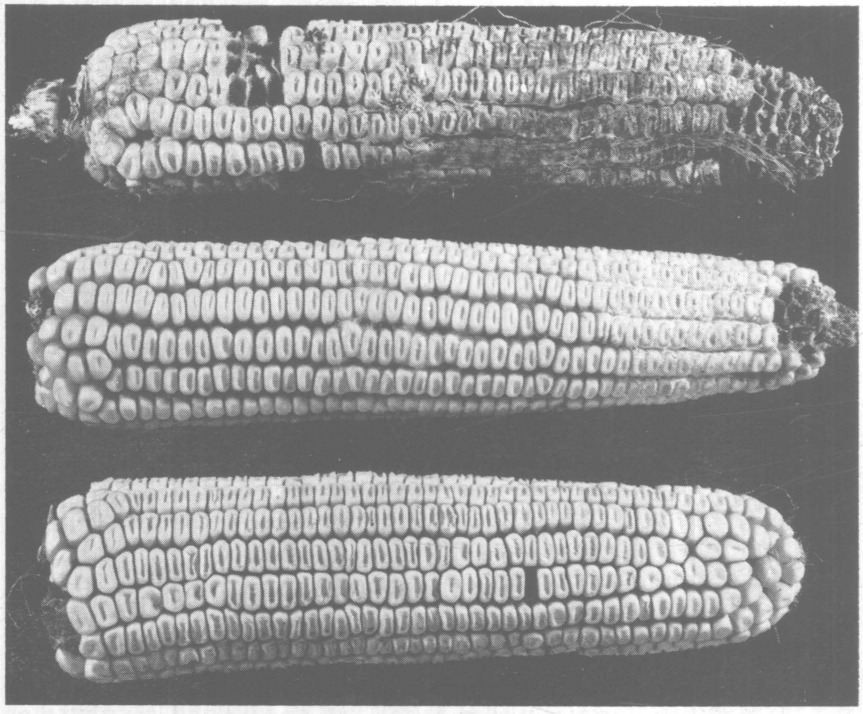


Fig. 1.—Corn ears with molds. Top, molded in storage; center, molded in the field; bottom, healthy.

Many factors may affect the prevalence of molds on corn in the field. The hybrid type, date of planting and harvest, population of plants per acre, temperature and humidity (particularly during August, September, and October), and the occurrence of early frosts are all factors. In storage, moisture content of the grain and storage temperature are critical factors.

There has been some concern that the feeding problem may be related to another malady of corn, the red streaking of kernels. This condition was first noted in adjacent areas of Ohio, Indiana, and Michigan in 1963 and since then has spread to several other states and Canada. The cause of red-streaked corn kernels has not been definitely established. However, the Ohio Agricultural Research and Development Center has isolated a virus (temporarily called 3A) in 44 Ohio counties which may be related to the problem.

Because red-streaking and molds both appear most commonly on kernels at exposed ear tips, farmers who previously have experienced ear rots with corn may attempt to associate the feeding problems with the comparatively new occurrence of red-streaked grain. However, since red-streaked corn has appeared previously without any apparent reduction in feeding value, it is believed that

red streaking alone is not the cause of the current feeding problems.

The area involved coincides in general with the area in which the red-streaked condition was prevalent. Thus, the relationship of red streaking of corn to susceptibility to molds warrants further investigation. The effect of red streaking, if any, on palatability is currently being studied. It has been shown that corn plants infected with certain viruses are more susceptible to molds which cause root and stalk rots.

Where moldy corn is a problem and swine refuse to eat or will eat only a small quantity of feed, other undesirable effects have been noted. In young pigs, a swelling of the vulva in females or anal region in males may occur. Straining by such animals sometimes will cause the uterus or rectum to evert and protude. This is similar to hormonal stimulation caused by estrogen-like materials and apparently is an effect of toxins produced by certain molds. Some mold toxins are also capable of causing swelling of the teat area and may result in abortion in bred animals. Symptoms vary from one lot of corn to another and with age of the animal.

Certain management practices should be followed until the causes of these feeding problems are determined. In most cases, the feeding value of the corn can be realized by some scheme of feeding to different classes of livestock.

When using a new supply of corn, it is desirable to gradually replace the old supply rather than make an abrupt change. This applies particularly where molds have been observed prior to or after harvest and when using corn of unknown origin.

It is recommended that the feeding value of questionable corn be determined first on a small group of animals before mixing large quantities of feed. Corn known to be unpalatable to younger stock in some cases is satisfactory for older growing-finishing stock.

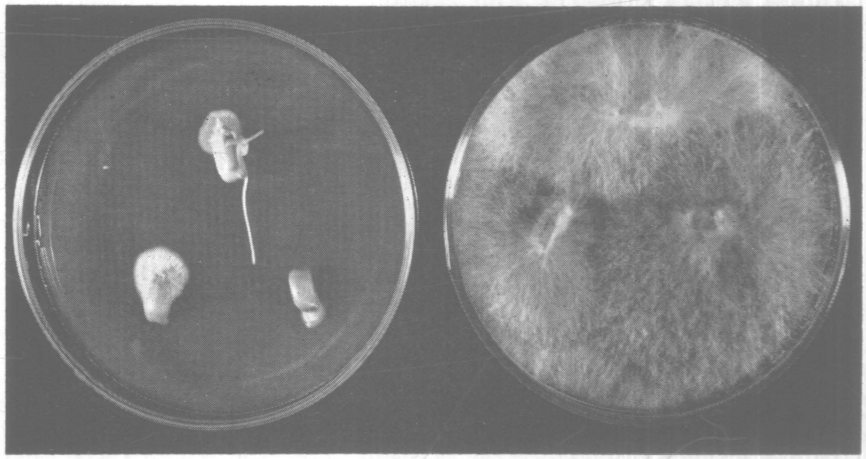


Fig. 2.—Molds growing from corn kernels placed on a sterilized agar medium in petri plates. Left, Gibberella roseum **(which has been established as a producer of toxins in previous feeding problems) growing from a sample of a "problem" lot of corn. Right,** Cephalosporium **mold growing from a sample of "healthy" corn.**

If symptoms of estrogen stimulation occur, the corn should not be fed to pigs of any age. Such stimulation may not be evident for a week or more after a change in feed. If the corn causes a problem and no other feed source is readily available, the level used should be reduced until the symptoms disappear. A general recommendation is that moldy corn should not be used as more than 25 percent of the total feed.

Corn which may cause a problem in swine feeding may not have lower feeding value when used as only a portion of the feed or diverted to use by other livestock or poultry. In most instances, ruminant animals have been able to consume such corn without ill effects.

Research projects have been initiated in animal and plant science departments at the Ohio Agricultural Research and Development Center and The Ohio State University to: 1) determine the relationship of molds and red-streaking to palatability or toxicity of corn, 2) determine whether or not viruses (particularly the 3A virus) are associated with a greater incidence of field ear mold, 3) determine the type and level of toxicity or lack of palatability in problem lots of corn when fed to livestock or poultry, and 4) determine corn cultural practices which affect the incidence and severity of molds in the field.

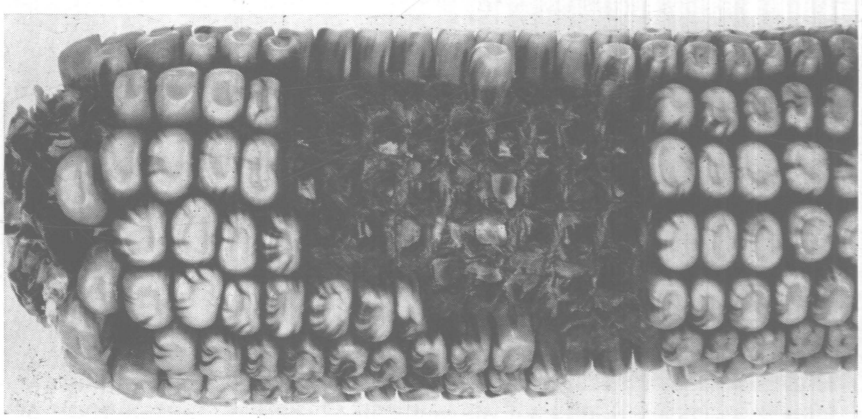


Fig. 3.—Red-streaked kernels on an ear of yellow dent field corn.

NUTRIENT ELEMENT PROBLEMS
with Vegetable Crops

FREEMAN S. HOWLETT

The nutrient element problem presents a dilemma for the progressive vegetable grower. On one hand he is concerned with maintaining an adequate supply of nutrient elements for optimum growth and yield. On the other hand, with certain elements it is important that an excessive amount be avoided.

Frequently statements are made that a particular "balance" must be maintained. Whether this involves the soil or the plant often is not made clear and the real meaning of this relationship between nutrient elements likewise is not explained. Since it is not known exactly what is in the soil on the one hand and what is in the plant on the other, the contention that some precise balance must be established and maintained with the soil or the plant has little scientific validity.

It is not denied that elements have a relationship to each other in some instances both within the soil medium and in other instances within the plant. It is well known that an excess nitrogen supply applied to the soil magnifies the need for additional potassium applications. This has been supported by experimental evidence. The fact that potassium within the soil has a pronounced effect in reducing the rate of entrance of magnesium is likewise well established. However, the contention that the amount of potassium added should have some precise relationship to nitrogen has little scientific evidence to support it.

Plant analysis or leaf analysis has proved to be a major means of ascertaining a plant's nutritional status. Analysis of the leaves in vegetable crops has shown the range in composition of each element from the most deficient stage to the extreme or greatest value which can be obtained. For example, the range of potassium in tomato leaves is from 0.6% to 15.0%.

Fig. 1.—Ohio growers take tomato leaf samples for analysis of nutrient element content.

Effects of Potassium

The minimum potassium requirements for most vegetable crops has been somewhat arbitrarily set at 2.5%, although visual symptoms of a deficiency will not usually be evident until the percentage becomes less than 1.5%. Because of the effect of potassium in reducing leaf magnesium content, potassium as high as 10-11% in leaf lettuce and tomato is usually associated with a deficiency of magnesium. Excess amounts of nitrogen, manganese, and boron are likewise not desired but for other physiological reasons.

The outstanding contribution of leaf analysis in presenting evidence on the precise composition of vegetable leaves cannot be contested. Some differences of opinion may exist as to the precise level below which growth and yield may be detrimentally affected but this is not a serious concern.

Prior to the establishment of the leaf analysis program with vegetable crops on July 1, 1964, a large amount of data had been obtained to show the ranges in con-

tent of each nutrient element in various vegetable crops. Furthermore, the evidence indicating the minimum requirement of each element has been of outstanding value in interpreting analyses of leaves submitted by growers during this 2-year period.

During this time, much evidence has been obtained to support the conclusion that visual symptoms are of little value in determining the particular element responsible for the appearance of the leaves. The reliability of visual symptoms has also been complicated by the fact that new or uncommon pesticides applied to the soil or plants may occasionally result in chlorotic effects. Even carbon dioxide additions occasionally result in visual effects on the leaves.

Marginal chlorosis of the leaves may result from a deficiency of potassium, water, or even nitrogen. Chlorotic spots within tomato leaves also may be associated with a low nitrogen supply, particularly when such leaves are located on the lower portions of the stems of these plants. In fact, it can be definitely concluded that the leaf analysis program has added further support to the conclusion that visual symptoms are unreliable in distinguishing the cause of an abnormal condition.

Summary of Analyses

This report presents some major conclusions obtained from chemical analyses of the leaves of the various vegetable crops included in the program. *In no respect is this report intended to be indicative of the condition of vegetable plants throughout the state.* Conclusions can be drawn only for the particular samples submitted by growers. Only a few samples of certain vegetables have been submitted.

Figures 2 and 3 present results from two tomato samples, one tak-

(Continued on Page 43)

PLANT ANALYSIS LABORATORY*
OHIO COOPERATIVE EXTENSION SERVICE, THE OHIO STATE UNIVERSITY
AND OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER, COOPERATING

NAME John Doe ADDRESS Route 1 (Street or Rural Route) Northwest (City) Ohio (County) (State) DATE 8-27-65

CROP Tomato - Field DATE SAMPLED 8-18-65 PLANT PART Leaves APPEARANCE Pale green Some were yellow.

SAMPLE NUMBER	N(1) %	P %	K %	Na %	Ca %	Mg %	Mn ppm	Fe ppm	B ppm	Cu ppm	Mo ppm	Zn ppm	Al ppm
574	1.48	.14	1.34	.08	5.82	1.25	256	308	36	15	9.0	30	388
RANGE													
DEFICIENT													
LOW	↑ X	↑ X	↑ X										
SUFFICIENT				X	X	X	X	X	X	X		X	
HIGH											X		X
EXCESS													

(1) Total Nitrogen reported for horticultural samples only.

ADDITIONAL COMMENTS:
Variety Heinz 1350 Nitrogen, phosphorus and potassium low to deficient. Molybdenum high, all other essential nutrient elements satisfactory.

*MAILING ADDRESS: OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER, WOOSTER, OHIO 44691

Fig. 2.—Results of analysis of field tomato leaf sample taken in August 1965.

PLANT ANALYSIS LABORATORY*
OHIO COOPERATIVE EXTENSION SERVICE, THE OHIO STATE UNIVERSITY
AND OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER, COOPERATING

NAME John Doe ADDRESS - (Street or Rural Route) (City) Cuyahoga (County) Ohio (State) DATE 3-21-66

CROP Tomato - Greenhouse DATE SAMPLED 3-14-66 PLANT PART Leaves APPEARANCE Good

SAMPLE NUMBER	N(1) %	P %	K %	Na %	Ca %	Mg %	Mn ppm	Fe ppm	B ppm	Cu ppm	Mo ppm	Zn ppm	Al ppm
183	3.76	.64	5.50	.29	4.25	.62	419	103	68	36	3.4	181	140
RANGE													
DEFICIENT													
LOW													
SUFFICIENT	↑ X	X	X	X	X	X	X	X	X	X	X		X
HIGH												X	
EXCESS													

(1) Total Nitrogen reported for horticultural samples only.

ADDITIONAL COMMENTS:
Variety W.R. - 25 Leaves of first cluster sampled - Soil test 1-6-66. Phosphorus 370 lbs. Potassium 266 lbs. Magnesium 320 lbs.

*MAILING ADDRESS: OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER, WOOSTER, OHIO 44691

Fig. 3.—Results of analysis of greenhouse tomato leaf sample taken in March 1966.

Applying Research

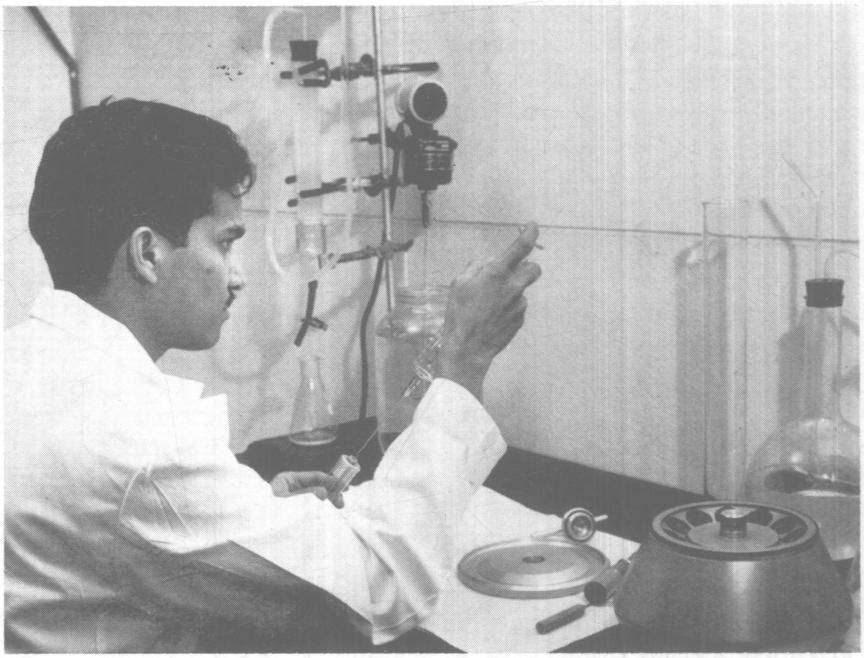
(Continued from Page 35)

the products which may be used safely and the factors which cause the "corn syrup" flavor.

For many years, an industry objective has been to develop either a sterile milk or a sterile concentrated milk which would have the flavor quality of freshly-pasteurized milk and almost indefinite keeping properties without need of refrigeration. Milk proteins have been a major barrier to the successful development of these sterile products. The application of temperatures necessary to sterilize milk cause the degradation of the proteins, resulting in a "cooked" flavor. Furthermore, the proteins in the sterile, fresh-flavored product tend to undergo physical changes during storage which cause the product to "gel".

The cooked flavor of sterile milk is due to sulfur compounds produced by the heat treatment. Using radioactive sulfur, Department scientists have demonstrated that a wide variety of volatile sulfur-containing chemical products are produced which have different flavor characteristics and effects. By knowing what these changes are and how they are produced, the research worker can suggest modifications of the products and processes to place these changes under maximum control.

Intensive fundamental studies on the chemical and physical nature of milk proteins have been in process to establish the cause for "gelling" of the sterile concentrated milk during storage. Findings by Dr. P. M. T. Hansen and his co-workers revealed that certain milk proteins tend to produce a "complex" as a result of the application of heat, that the different proteins in milk undergo various kinds of physical and chemical changes at elevated temperatures, and that certain changes tend to "shift" after the milk has been heated. The dynamic state of the proteins following heat treatment constitutes a major cause for the "gelling" defect in sterile, fresh-flavor concentrated products.



The ultracentrifuge is used to study changes in milk proteins caused by heat treatment.

Another need for the production of a sterile, fresh-flavored product is the elimination of the spore-forming microorganisms—bacteria able to survive extremely high temperatures. Research has demonstrated the feasibility of using selected amino acids to stimulate the rapid germination of the spore-forming bacteria so they may be destroyed by moderate heat treatments. The practical application of this principle has great potential.

Some years ago, a new fluid milk product was introduced on the market in which the vitamin and mineral content was increased by additives. One additive was an iron compound. Immediately, inquiries were received from commercial firms about obnoxious flavor in the fluid milk after it had been placed in distribution channels. Examinations revealed this to be "rancid" flavor resulting from the decomposition of the milk fat by the enzyme lipase—a constituent of raw milk.

Normally, lipase is easily inactivated at pasteurization temperatures. Department scientists observed that certain types of iron compounds being used in the modified products tended to protect the lipase enzyme from heat destruction. Consequently, the enzyme remained active following pasteurization and produced changes in the milk which caused the undesirable flavor.

Immediate attention of research workers to this problem resulted in recommendations to the commercial companies to change their choice of the iron compound and to alter their processing methods. These changes permitted immediate control of the flavor problem.

The quick response by research workers was possible because several years of research had been

conducted on aspects of the lipase enzyme. A background of knowledge had been developed which could be put to immediate practical use.

In recent years, the introduction of non-dairy whitening agents for coffee brought into focus the need for a lower-priced cream product which could compete cost-wise. This resulted in Department staff members developing a special, low-fat "cream" which had excellent flavor and excellent coffee-whitening properties. Several dairy companies in Ohio immediately adopted this new product.

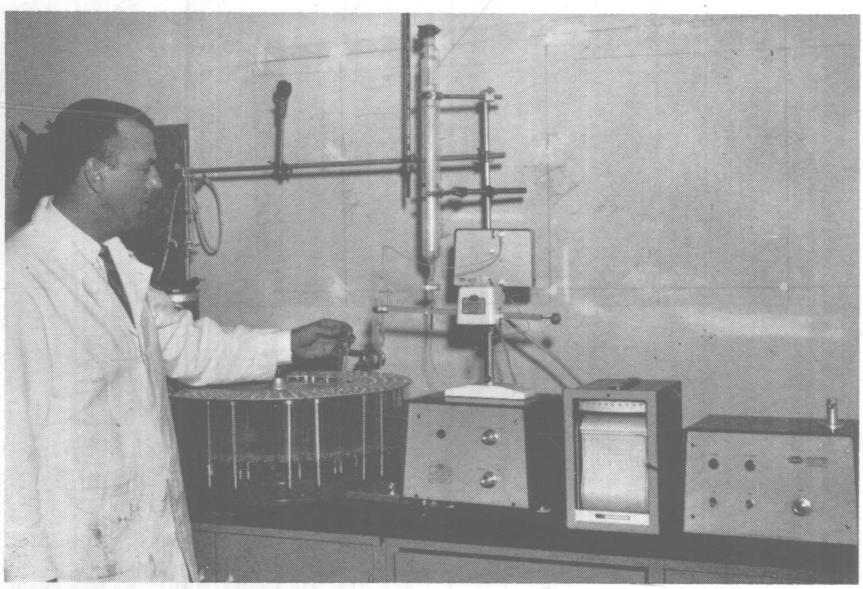
Fluid milk plants frequently experience a need for conserving milk solids during the flush period of milk production so the solids may be utilized later when milk production is low. In recognition of this need, research workers developed a sweetened product containing relatively high concentrations of fat and milk solids-not-fat which retained excellent flavor qualities over an extended period of storage under normal refrigeration conditions. This product can be easily reincorporated into milk products for general distribution when needed.

In the past, many companies desired to freeze and store high-fat content cream so this cream would be available in periods of shortage. A main problem in such storage arises from the development of a "cardboard" or "oxidized" flavor in the frozen cream.

Research revealed the optimum temperature treatment needed for processing cream for frozen storage so maximum keeping properties could be imparted to the frozen product. This development was based on earlier fundamental research dealing with the production of active sulfur (sulfhydryl) compounds from milk and milk products by heat treatment.

A major present need of the fluid milk industry is to extend by three to four times the keeping property of fluid, packaged milk. Current research suggests that higher-temperature processing methods may need to be used if maximum keeping properties of the milk are to be obtained. Although the spoilage bacteria in the milk are killed by normal pasteurization temperatures, it appears that certain products of the bacteria are heat-resistant and may cause chemical deterioration of the pasteurized milk. If confirmed, this finding will have immediate industrial application.

The foregoing are typical examples of Department of Dairy Technology research with industrial application. The ultimate aim of these studies is to make available to the consumer milk and milk products of finest quality, in maximum quantity, and at lowest possible cost.



Automatic fraction collection is a means of separating chemical compounds produced by bacteria responsible for flavor in milk products.

Nutrient Problems

(Continued from Page 41)

en from field tomato in August 1965 and the other from greenhouse tomato in March 1966. In the field tomato sample, nitrogen, phosphorus, and potassium were too low and on the border line of deficiency. As pointed out to the grower when he receives the report of results, the "low" category is below the *minimum requirement* or *critical level.*

Since leaf samples were not taken in June or early July from the field tomato, it is not possible to conclude whether the low values were the result of a heavy crop. In fact, it is possible that the content of these essential elements was below the minimum requirement 2 months earlier. Obviously a deficiency occurring early would be much more severe than one resulting from the development of many fruits. The length of time which a plant has been deficient is an important factor to be considered.

Figure 3 shows the results from a greenhouse tomato sample taken in March 1966. The nitrogen content of these leaves was approaching the "low" range but the amounts of the remaining essential elements were satisfactory. Zinc

(Continued on Page 44)

Nutrient Problems

(Continued from Page 43)

was considerably higher than necessary but was not considered "toxic."

The following results were obtained from analyses of several vegetable crops in the program:

Beans - Snap: Only a few samples have been obtained. Potassium deficiency was undoubtedly responsible for the chlorotic condition found in these samples. The range in potassium content was .97 to 1.55 percent (dry weight basis).

Cauliflower: Magnesium was deficient in the few samples submitted. Boron and molybdenum were in ample supply. These elements are often reported to be deficient in cauliflower and leaf analysis has made it possible to distinguish between these three elements.

Cabbage: In one sample submitted, the leaves were chlorotic and "cupped." Boron and copper were in the low category and magnesium was on the border line.

Carrot: A considerable number of carrot samples from plants growing in muck soils have been submitted. Although in some instances the samples were taken from plants which were "small and stunted," no essential element was in the low or deficient range. Aluminum tended to be high. The toxic level of this non-essential element in leaves of several plant species has not yet been ascertained.

Celery: Problems which have arisen with celery on muck involve low boron and a phosphorus level below what might be considered "optimum." In those cases where iron and aluminum were high in the soil, the amount of phosphorus in the leaves has not been far above the minimum requirement. Magnesium deficiency also has been determined in celery growing in muck soil.

Fig. 4.—Directions for taking muskmelon leaf sample are given to grower (left) by Extension specialist.

Cucumber: A considerable number of greenhouse cucumber samples have been submitted. The plants were making very satisfactory growth and yielding well in practically all instances. In samples with excessive potassium content, magnesium tended to be lower. Minor elements were very satisfactory in all samples.

Lettuce: In some samples of both leaf and Bibb lettuce, high potassium (11 percent dry weight basis) was found with consequently low or deficient magnesium. The content of remaining elements was satisfactory.

Muskmelon: In some samples of muskmelon, low potassium and high magnesium contents have been ascertained. Considerable variation in leaf nitrogen has occurred. Soil sample values were not well correlated with leaf composition.

Onion: Some samples submitted have been found deficient in phosphorus, magnesium, boron, copper, and zinc. As expected, differences occur between plants growing on different farms in muck soils. Phosphorus was undoubtedly low because of fixation by iron and aluminum. Magnesium likewise was affected when potassium was high.

Pepper: Only a few samples have been submitted and the nutrient element situation was very satisfactory in all instances.

Potato: A considerable number of samples have been obtained in which wide ranges in content of nitrogen, potassium, and magnesium were found. Both upland and muck soils have been involved.

As expected, rather high nitrogen has been noted on muck soils. In some instances the amounts of manganese and aluminum (non-essential) have been high to excessive.

On mineral soils, the amounts of nitrogen and potassium have ranged quite widely. Nitrogen has tended to be high in a number of samples. The correlation between soil and leaf composition has not been as satisfactory as desired in plants on upland soils.

Sweet Corn: Rather wide differences in leaf nitrogen without any apparent effect upon yield have been found in samples submitted by growers. Magnesium deficiency has been observed in some samples.

Boron invariably has been very low without any noticeable effect. However, in research conducted at the Center's Vegetable Crops Branch, the boron content has been much higher. The author believes that boron is deficient in sweet corn when only 5 to 10 parts per million (dry weight basis) are present and that this deficiency may result in effects not evident to the grower. A reduced number of kernels to an ear and a less sweet condition might occur without the grower realizing such a situation.

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Organic Acids of Silage and Milk Composition

AVERY D. PRATT and H. R. CONRAD

Dairymen have a keen interest in the treatment of silages to alter the fermentation process in the hope of improving the composition of milk. Klosterman and coworkers at the Ohio Agricultural Research and Development Center treated corn silage with high calcium limestone and obtained increased growth rate of steers and beef heifers. Dairymen began asking if silage treated this way would increase milk production or butterfat percentage of milk.

Workers at the Wisconsin Agricultural Experiment Station compared calcium-carbonate (limestone) treated silage with untreated corn silage. These silages were fed in a simple reversal type experiment. The silages were fed as the only roughage and grain was fed according to the production of 4 percent fat-corrected milk (F.C.M.). The consumption of untreated corn silage was greater.

Analyses of rumen fluids showed a significantly greater concentration of organic acids (acetic, propionic, butyric, and lactic) in the cows fed limestone-treated corn silage. However, there was no significant effect on yield of 4 percent F.C.M. Milk fat percentage was depressed in the cows fed treated silage but not to a level which was statistically significant. The authors state that a decrease in milk fat could become a problem if treated corn silage were fed as the sole roughage.

Byers and others at the Illinois Agricultural Experiment Station compared corn silage with similar corn ensiled with 1 percent limestone. They fed three groups of eight animals each in a continuous trial, allowing free will consumption of silage, 1 lb. of alfalfa hay per 100 lb. body weight, and grain at the rate of 1 lb. to 3 lb. of 4 percent F.C.M.

The three groups were fed differently only in respect to silage intake: a) limestone-treated silage, b) untreated silage, and c) untreated silage with limestone added at feeding time. The treated silage contained 104 percent more acetic and 80 percent more lactic acid than the untreated silage. The higher organic acid content of the treated silage did not have a significant effect on the organic acid content of the rumen fluids, milk yield, butterfat percent, or body weight.

Other research showed that acetic acid or its salts are used in formation of butterfat. When silage fermentation results in an increase in propionic and a decrease in acetic acid, a decrease in butterfat percentage results.

Ohio Research

Treatment of alfalfa-grass mixtures with 5 grams of zinc-bacitracin (an antibiotic) per ton resulted in a silage with lower total volatile fatty acids but with an increased amount of acetic acid. Bacitracin-treated silage also contained more non-volatile lactic acid than untreated silage.

Klosterman had shown that increased lactic acid in corn silage resulted in greater daily gain of beef heifers. The question then arose, how would increased lactic acid content of silage affect the composition of milk?

Ear corn was picked with most husks on when the corn was in the soft dough stage. The ears were run through a picker-grinder operated as a stationary unit at the silo. The cobs were cut by the revolving blades, after which the material passed through a screen and between rollers which crushed it thoroughly. The corn was treated with bacitracin as it passed through the blower. The resulting silage varied in dry matter content from 45 to 60 percent. Some was left untreated and some was treated with 1 percent high-calcium limestone.

Twelve cows were fed this bacitracin-treated silage and alfalfa grass silage from calving in early November (or earlier) to January 19. This was considered as a preliminary or adjustment period for the experiment to be described.

Variously treated ear corn silage was fed for four experimental periods in this order: 1) bacitracin-treated, 2) untreated, 3) limestone-treated, and 4) bacitracin-treated.

Eight cows were fed alfalfa-grass silage of 53.2 percent dry

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Milk Composition

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matter and four were fed the ear corn silages simultaneously at a ratio of 1.5 lb. of grass silage dry matter to 1.0 lb. of ear corn silage dry matter.

The cows were bedded with sawdust to avoid eating of bedding.

The cows were milked twice daily and the milk composited for daily analyses of protein, butterfat, and solids-not-fat.

Haylage is known to contain more lactic acid than high moisture silages. Haylage fed with limestone-treated ear corn silage, since both are high in lactic acid content, might be expected to increase body weight gains rather than butterfat percentage. There were wide fluctuations in the butterfat percentage of individual cows, both in the preliminary and the experimental periods. The average butterfat percentages of the groups also varied from day to day. However, the extreme fluctuations were of about the same magnitude for the groups fed each silage, while major changes occurred on or near the same day.

The treatment of ear corn silage by both bacitracin and limestone increased the butterfat percentage significantly ($F<0.05$) from 4.44 percent for the untreated to 4.73 and 4.90 percent, respectively. If the experiment were repeated, the same result might be expected 95 times out of 100.

Treatment by both bacitracin and limestone reduced the solids-not-fat content of milk significantly ($F<0.05$) from 9.20 percent to 8.86 and 8.98 percent, respectively.

Treatment of the ear corn silage did not have a significant effect on protein content of milk.

The higher dry matter silage resulted in a highly significant ($F<0.01$) increase in milk production. Average daily milk production was 31.18 lb. when cows were fed silage of 35.5 percent dry matter and 33.73 lb. when fed silage of 53.2 percent dry matter.

The increase in production when the cows were fed limestone-treated ear corn silage was not considered to be due to higher lactic acid, which has been shown to cause weight gains, but to an increase of about twice the amount of acetic acid which would be expected in proportion to the increased lactic acid content.

Conclusions

The results of this experiment indicate that the treatment of ear corn silage with either zinc bacitracin or high calcium limestone will increase the butterfat content of milk significantly for short periods when fed with silage as the sole source of grain-concentrate. They will likewise lower the solids-not-fat of milk significantly. The decision of whether to use these treatments is a matter of judgment.

Nutrient Problems

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Further research is needed to ascertain if such a low content of boron has detrimental effects upon plant composition and yield.

Tomato - Field: In some field tomato samples submitted in August, too low amounts of phosphorus and potassium have been found. Whether this effect has resulted from the outstanding development of fruits during June and July cannot be determined since no samples had been submitted early. There was no doubt that in some cases an insufficient quantity of these elements had been applied at the time of planting.

A deficiency or excess of minor elements has been rare. Wide ranges in the aluminum content of the leaves have been obtained. The magnitude of a toxic amount of this non-essential element has not been determined.

Tomato—Greenhouse: Few instances of nitrogen deficiency have been detected in greenhouse tomato samples. In fact, excess nitrogen is found quite commonly. Phosphorus deficiency has practically never been found. Potassium has varied widely, resulting in some instances in low to deficient magnesium. Very few cases of minor element deficiency have been noted.

General Conclusions

As indicated, correlations between soil and leaf composition have not been as satisfactory as desired. Wide ranges of phosphorus and potassium in the leaves have not necessarily been associated with equivalent amounts of these elements as reported in soil tests. This emphasizes the need for leaf sampling to ascertain what is available within the plant for growth and fruiting.

Chlorotic or abnormal effects on leaves have been very unsatisfactory means of diagnosing a nutrient element deficiency or excess. Under present conditions in which new and uncommon pesticides are applied to soil and plants, a further complicating factor has been added.

Few nutrient elements give clear, easily recognizable symptoms of a defiency or excess. Even with nitrogen, some difficulties occur in this respect. For example, with the tomato a number of other environmental factors may result in leaf chlorosis, such as tobacco mosaic virus, low water, excess water, and insect and disease injury. In the past, a deficiency or an excess of an essential nutrient element frequently has been given credit for

chlorosis or abnormal appearance of the plant when some other factor probably was responsible.

The leaf anlaysis program has demonstrated that the most informed and progressive vegetable growers are doing an excellent job of providing an adequate nutrient element supply for their plants. In some instances, excesses of certain elements are evident, with nitrogen probably the most common element in this category. With added information from the research program being conducted in conjunction with the leaf analysis service, more precise control of the nitrogen content of plants may be possible.

The program has shown that generally only 1 or 2 of the 12 essential elements for which analysis is made are deficient or excess in a given planting. Until this program was initiated, it was not possible to predict that this would be the situation with the various vegetable crops. This fact is significant since it simplifies the interpretation of results. It also indicates the trend of future research with such crops and governs recommendations for the production of maximum yields of optimum quality vegetables.

Cheese Varieties

(Continued from Page 37)

month. A longer curing period increases the flavor.

Prior to using, the cheese is soaked in fresh water for 2 hours to reduce the salt content. Soaked cheese may be packaged and stored at 40° F. for 2 to 3 months without significant flavor loss. The composition of White cheese is approximately 47 percent moisture, 21 percent fat, and 5.7 percent salt.

Katchkaval

Katchkaval is a member of the pasta filata cheese family, which includes Provolone and Asiago. The adapted manufacturing procedure is as follows:

Coagulating the milk with special heat-tolerant bacterial cultures and rennet extract, cutting the curd into fine particles, removing the whey, pressing the curd in the vat, cutting the pressed curd into particles about the size of wheat grains, pressing the curd particles in a cloth until the desired acidity (pH 5.3) is reached, dividing the curd mass (called Baskija) in 5 x 1/2 inch strips, working the strips in 0.5 percent salt solution at 170° F. until the curd becomes elastic and pliable, molding and skewering the curd and letting cool for 24 hours, salting the cheese in brine for 3-5 days, drying and waxing the cheese and curing at 60° F. for 3 months, followed by storage at 40° F.

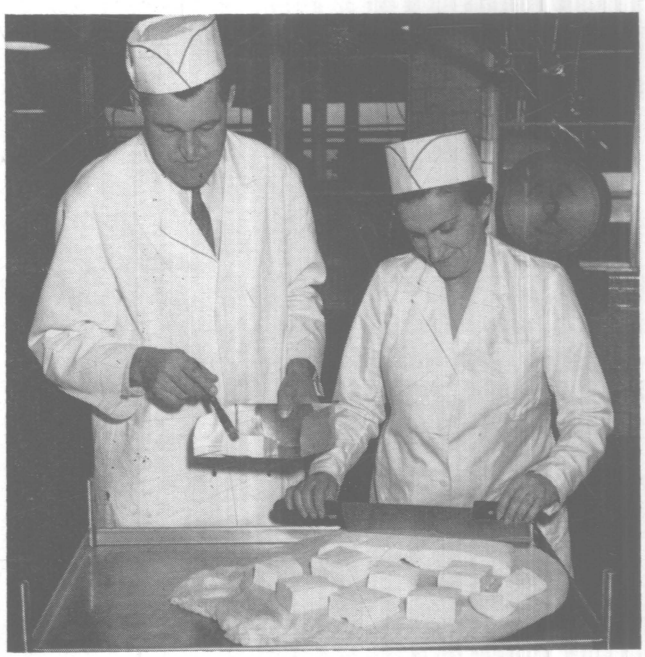
Katchkaval may be cured for 1 year or longer. Its composition is approximately 35 percent moisture, 24 percent fat, and 2.3 percent salt.

Characteristics and Uses

The flavor of White cheese is sharp and becomes somewhat pungent after 3-4 months of curing. The cheese is quite salty by American standards and tastes, which may restrict its acceptance. The flavor of Katchkaval is clean and slightly sharp.

In their homeland, both cheeses are used as table cheeses. In addition, White cheese is used for salads, pastries, and cakes. Katchkaval may be used in cooking and, when grated, as a condiment for soups and other warm dishes.

These studies of Yugoslavian cheeses point up the possibility of the development of new varieties of cheese for American consumers. Although some varieties which are popular in foreign countries may not be immediately suited for American production and use, an opportunity exists to modify these so they become acceptable both to manufacturers and consumers.



Following pressing, the mass of White cheese curd is cut in strips. Mrs. Kapac is cutting curd while Dr. T. Kristoffersen, Department of Dairy Technology, observes texture of the cheese.

PRICE AND INCOME TRENDS

MERVIN G. SMITH

In the next few months, farm prices on the average are expected to weaken slightly while farm costs continue to increase gradually. Even with this squeeze, total farm income this year will be among the highest and per farm income will be the highest in history.

As an example of the trends, in April farm prices received declined 2 percent and prices paid by farmers increased two-thirds of 1 percent. So the parity level declined about 2 percent to an average of 80. However, farm prices were still 9 percent above a year before.

The higher farm prices over a year ago are mainly accounted for by the higher prices for livestock.

Hog prices are expected to decline slowly during the last half of this year as the number coming to market gradually increases. By the end of the year, hog prices will probably be below the previous year. The hog cycle is developing about as it usually does with a 3- to 5-year complete cycle.

Fat beef cattle prices have been somewhat higher than last year but are expected to continue under pressure with larger marketings coming on. Higher prices earlier in the year were partly a result of smaller supplies of pork. Prices of feeder cattle are likely to remain strong and above last year, with strong demand by cattle feeders.

Some relaxation in the acreage limitations is taking place. Wheat acreage for next year has been increased. This means that wheat land formerly in reserve will be put back into production. A total of about 60 million acres of land has been put into reserve.

This total reserve is expected to be reduced somewhat next year. However, even with strong domestic and foreign demand and reduced surplus stocks, U. S. farmers will still not need to put all reserve land back into production. In fact, if this land was brought back into production and a good crop year was registered this year, the larger production would likely reduce prices so much that farmers' incomes would be drastically reduced.

Production of soybeans continues to expand. The prospective demand for soybeans looks very favorable for the next few years. The intentions for planting this year indicated about 5 percent increase in acreage over last year.

Milk prices this spring were about 9 percent higher than in 1965. This could be expected with about 5 percent less production. Consequently, the total cash receipts for milk are probably running about 6 percent above last year. Prices of milk are expected to continue strong. More milk will be in demand for next year but farmers will need strong prices if they are to expand production.

New Publications

Copies of the following publications may be obtained from the Mailing Room, Ohio Agricultural Research and Development Center, Wooster, Ohio 44691.

Research Bulletin 982—Meat Department Labor Requirements: A Tool for Improved Retail Management

Research Bulletin 986—84th Annual Report: Research and Development for Economic Growth

Research Bulletin 987—Insect and Mite Pests of Strawberries in Ohio

Public Information Series 12—Weed Control in Non-Crop Areas (Extension Leaflet 132)

Research Summary 8—Greenhouse Vegetable Research—1966

Research Summary 9—Fruit Crops Research—1966. Part I. Small Fruits. Part II. Tree Fruits

Research Summary 10—Research at the North Central Branch

Research Summary 11—Sheep Research and Development—1966

Research Summary 12—Research at the Mahoning County Farm

Research Summary 13—Swine Research

Research Summary 14—Dairy Science—1966

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