Apple and Cherry Juice—Promising New Outlets for Utah’s Fruit Crops

Off-Grade Apples and Sour Cherries Now Without a Market
May Be Used in This Way.

By F. M. COE

Increasing popularity of deciduous fruit juices in the eastern states, especially apple juices and cherry juice made from pie cherries, suggests the possibility of utilizing a substantial proportion of Utah’s Montmorency cherry crop and off grade apples in this manner. Development of a demand for sour cherries and apples unsuited to fresh marketing by juice and beverage processing would aid in the disposal of the Utah crops of these fruits, which have brought low prices in recent years. The possibility of stimulating home demand for home made apple and cherry juice should also not be overlooked.

The average production of cherries in Utah for the period from 1929 to 1938 was 2,922 tons. The total production for Utah in 1940 was forecast at 3,910 tons, of which 1,330 tons were estimated as sour cherries, nearly all of the Montmorency variety. Approximately 100,000 bushels of apples of juice grade are available for processing each year. Disposal of these blemished apples has been a major problem in our apple industry.

The rise of the fruit juice industry has been startlingly rapid. Packs of pineapple juice have risen from 700,000 in 1933 to over 7,500,000 cases in 1937, while grapefruit juice has increased from 205,000 in 1929 to 6,082,744 cases in 1937. According to one authority, more than ten percent of the United States apple crop is sold as juice, mostly seasonally as fresh juice or preserved temporarily with benzoate of soda. With the introduction of flash pasteurization and other methods of preservation which do not injure the flavor, the production of bottled cider has grown to over a million cases annually, and is increasing rapidly, a substantial portion now being canned.

Possibilities of increasing the consumption of farm-made fresh, clarified sweet apple cider without the acrid aftertaste of the benzoate preserved product are shown by the rapid increase in demand for the sweet apple cider made experimentally by the College, which last year utilized over 1,000 bushels of off-grade apples. Cherry cider preserved by quick freezing and zero storage met with wide approval.

Method of Preparation

Both cherry and apple juices were pressed with a rack and cloth type press

(Continued on page 10)
ILLEGITIMACY IN RURAL UTAH STUDIED BY RURAL SOCIOLOGY DEPARTMENT

Offenders Found to be Mostly Non-Farmers

By JOSEPH N. SYMONS

The sex problem, although as old as the history of man, has not yet been solved. A gradual trend upward in the number of rape cases since 1930 is indicated in the Uniform Crime Reports. Illegitimacy is also increasing as can be seen from the table.

Cases of illegitimate live births in the United States and Utah, 1933-37*

<table>
<thead>
<tr>
<th>Year</th>
<th>United States</th>
<th>Utah</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>number</td>
<td>rate per 1,000</td>
</tr>
<tr>
<td>1937</td>
<td>74,938</td>
<td>40.2</td>
</tr>
<tr>
<td>1936</td>
<td>72,338</td>
<td>39.8</td>
</tr>
<tr>
<td>1935</td>
<td>78,874</td>
<td>39.2</td>
</tr>
<tr>
<td>1934</td>
<td>76,798</td>
<td>38.9</td>
</tr>
<tr>
<td>1933</td>
<td>77,167</td>
<td>39.7</td>
</tr>
</tbody>
</table>

*Taken from Vital Statistics—Special Reports 7: (22) 73. 1939.
†Exclusive of California and Massachusetts for each year, and New York for 1936 and 1937.

In a current study by the Rural Sociology Department of crime and delinquency in six representative Utah counties, preliminary data on illegitimacy (all native white) for the four rural counties for the six years (1932-37) studied was 52. Naturally this total involved at least 104 individuals, but in 18 of the 52 cases paternity was listed as “unknown”, leaving 34 males and 52 females for consideration. Vital social information concerning this group is of interest.

Age of Offenders

The male offenders were found to be the more mature of the two sexes, registering an average age of 26 years, while the females averaged 20 years. Extreme ages of the males were 66 and 17 years, while female extremes were 41 and 14.

The youthfulness of the females in question was striking and pathetic. In spite of the average age of 20 years, records showed 34 of the 52 cases below 20 years of age, 28 were 18 years or less, and 8 cases 16 years or younger.

The emotional and intellectual immaturity implied in these findings can well be kept in mind as residence, vocation and other social elements involved are considered.

Residence Type

Urbanization has been found to be conducive to criminality. Though almost one-half (48.6 percent) of the total population of the United States is rural, this population contributes with respect to place of crime only a little over one-fifth (22.2 percent). In the larger Utah study being made of which this study is but one small part, the aim is not only to compare the urban with the rural, but also to consider crime rates in terms of steps outward from the city into the country. For this purpose the population of the counties studied has been classified in terms of non-farmers, edge-of-town farmers (those whose farms and homes are located on the edges of communities), village farmers (farmers who live in town and cultivate land on the outside of the community) and farm dwellers (those who live on their farms in the country). Those involved in the illegitimate have also been classified on this basis and the following comparisons found to exist:

<table>
<thead>
<tr>
<th>Residence type</th>
<th>Percent of each in total population of the 4 counties</th>
<th>Percent of each in illegitimacy cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-farmer</td>
<td>48.7%</td>
<td>68.6%</td>
</tr>
<tr>
<td>Edge-of-town farmer</td>
<td>3.4%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Village farmers</td>
<td>22.1%</td>
<td>10.4%</td>
</tr>
<tr>
<td>Farm dwellers</td>
<td>25.7%</td>
<td>11.6%</td>
</tr>
<tr>
<td>Unknown</td>
<td>...</td>
<td>5.8%</td>
</tr>
</tbody>
</table>

From this it is evident that over two-thirds of the offenses were committed by non-farmers who do not make up half of the population.

Vocation

Vocations engaged in by the offenders were rather widely distributed:

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aids father</td>
<td>Aids mother</td>
</tr>
<tr>
<td>Cafe owner</td>
<td>Bookkeeper</td>
</tr>
<tr>
<td>Carpenter</td>
<td>Housekeeper</td>
</tr>
<tr>
<td>Chauffeur</td>
<td>Housewife</td>
</tr>
<tr>
<td>CCC enrollee</td>
<td>Hotel worker</td>
</tr>
<tr>
<td>Farmer</td>
<td>Maid</td>
</tr>
<tr>
<td>Janitor</td>
<td>No vocation</td>
</tr>
<tr>
<td>Kin worker</td>
<td>Odd jobs</td>
</tr>
<tr>
<td>Laborer</td>
<td>Seamstress</td>
</tr>
<tr>
<td>Mechanic</td>
<td>Store clerk</td>
</tr>
<tr>
<td>Miner</td>
<td>Student</td>
</tr>
<tr>
<td>Sheep herder</td>
<td></td>
</tr>
<tr>
<td>Soldier</td>
<td></td>
</tr>
<tr>
<td>Student</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td></td>
</tr>
</tbody>
</table>

One of the most characteristic features of the male vocations, however, was the abundance of representatives of migratory jobs. Among the females, the lack of vocation, the number who gave housekeeping as a vocation, the student total, and the representatives of morally dangerous employment, such as maid and hotel worker, were noticeable.

Marital Status

Males and females involved differed decidedly in the matter of marital status: 29.4 percent of the males were listed as married compared with but

(Continued on page 4)

ELECTRICAL EQUIPMENT FOR USE ON FARMS BEING TESTED AT STATION

A cooperative experiment on electrical devices for use in agriculture is now in progress under the sponsorship of the Utah Power and Light Company and the Experiment Station. Electrical equipment has been installed in the Departments of Animal Husbandry, Poultry, Horticulture, and at the Dairy Experiment Farm. The fund for this work, which was established by the Utah committee on the Relation of Electricity to Agriculture, a subdivision of the national committee of the same name, was made available through the Utah Power and Light Company to purchase and install the equipment.

Equipment which has been installed under the direction of K. W. Browning and W. E. Dunbar, representatives of the Utah Power and Light Company, includes the following: on the Dairy Experiment Farm: milker, separator, feed grinder, stoker, utility motor with three horse power for a fanning mill, water heater, sterilizer and general lighting; in the Poultry Department: four electric brooders, incubator, feed mixer, lighting in the laying houses, scailer, feed grinder and four poultry water warmers; in the hog barn: four pig brooders; in the Horticulture Department: soil sterilizers and a soil heating cable for use in the hotbeds.

Observations are being made to determine the suitability of such electrical devices for use under ordinary farm conditions. Helpful information will be obtained to aid in the determination of the practicability of such equipment for farm use.
Three New Weeds Introduced Into Utah

Bermuda-Grass, Nut-Grass, and Leafy-Spurge Should be Eradicated Before They Become Serious Pests

By BASSETT MAGUIRE

Bermuda-grass, seed spike below

Three weeds, recently introduced into Utah, give indication of becoming serious pests, adding to the already burdensome problem of weed control in the state. All of these plants, long established in other states, have become noxious weeds in those areas. It is obvious that the time and conditions under which weeds can be most easily and effectively eradicated are as they appear, and before they become widely and abundantly established. The following descriptions, illustrations, and suggestions for control are offered with the desire to aid in the recognition and eradication of these weed pests.

BERMUDA-GRASS (Cynodon dactylon Poir.)

Description: A perennial grass with prostrate, creeping wiry branches which root at the joints; producing tough branching underground rhiizomes (root-like stems). The leaves are flat, short, and rather harsh in texture. Seeds are born on one sided spikes 2 to 3 inches long, 3 to 5 in a cluster, and radiating from the end of the stem.

Occurrence and control: Bermuda-grass is a weed of lawns, fields, and waste places, likely to occur along ditch banks. Reproducing by both seed and root stock, it is difficult to eradicate. When newly appearing in lawns, it is best to hand dig the plants, being sure to get all the underground parts.

When occurring in larger stands in open fields or waste places the following control measures are recommended:

Shallow plowing in late autumn so as to expose the root stocks to the air over winter; or where this procedure is not successful, good results have been obtained by sowing a winter smother crop such as rye, barley, or oats. After this crop is harvested, the field should be thoroughly plowed and cultivated, then immediately sown to another smother crop.

NUT-GRASS (Cyperus esculentus L.)

Description: A grass-like perennial herb, with erect triangular stems about 12 to 18 inches high; from small tuber-bearing rootstocks. Leaves in 3 verticle ranks, as long as the stem, with closed basal sheaths. Seed produced in two-ranked spikelets, forming terminal umbels, subtended by several leaf-like bracts. Seed 3-angled.

Occurrence and control: Occurring in moist soil, along ditch banks and in irrigated fields. The weed may be controlled by drying out the soil, followed by clean cultivation. Since the tubers may remain dormant for several seasons, it may be necessary to repeat cultivation.

LEAFY-SPURGE (Euphorbia esula L.)

Description: A perennial herb, reproducing by seed and rootstocks, with erect, smooth stems about 18 to 36 inches high. Leaves narrow, entire, about 2 to 3 inches long. Flowers small, greenish-yellow, in a cluster subtended by leaf-like bracts. The broken stem or leaf will yield a milky sap.

Occurrence and control: Plants of ditch banks, meadows and fields. Small infestations may be eradicated by applying sodium chloride. It is recommended that large areas be plowed, summer fallowed, and followed by a suitable smother crop.

Nut grass, flowering spike and underground tubers shown in inset

Leafy-spurge, flower cluster below
Director R. H. Walker

Dr. Walker came to the Station and dean of the School of Agriculture since 1938, resigned effective July 1, to become director of the United States Regional Salinity Laboratory at Riverside, California. Although Dr. Walker was only connected with the Station a little over two years, he did much in coordinating the work of the various departments and beginning a reorganization of the project work. During his administration the Animal Husbandry Department was reorganized and two new staff members added, one staff member was added to the Agronomy Department, and a new Department of Landscape Architecture was organized.

Dr. Walker was especially interested in the soil survey work as a basis for land use planning studies, taxation schedules, equitable and proper distribution of water and reservoir construction, and soil management programs, and used his efforts to foster cooperative agreements with various federal and state agencies to further the progress of this work in Utah.

Dr. Walker came to the Station from the Range and Forest Experiment Station at Ogden where he worked on range reseeding. Before being connected with the Forest Service, he was associate professor of soils, Iowa State College. He was born in Idaho, received his bachelor's degree from the Brigham Young University, and his doctor's degree from Iowa State College.

No one has yet been selected to take Dr. Walker's place.

Illegitimacy

(Continued from page 2)

3.8 percent of the females. The status of 21 percent of the males and 10 percent of the females was unknown. Two and nine-tenths percent of the males were divorced and 3.8 percent of the females were widows.

Mobility

A relationship has been found to exist between mobility, or the moving from place to place, and crime. In this study it was found that only 32.4 percent of the males were born in the community in which the offense was committed and 54.7 percent of the females. The birthplace of 8.8 percent of the males was unknown.

Without attempting to speak with certainty as to the causes of illegitimacy it is felt that the following items found in this survey should be considered in their relationship to the problem: (1) The youthfulness of the females implies immaturity, innocence, recklessness, unjust treatment from older and more experienced males. (2) The excess of non-farmer offenders, raises the question of the connection of unemployment and temporary employment to crime. (3) Migration from one section to another and vocational placement of a migratory nature have an influence on the increase of crime. (4) In the cases cited in this article only 6 individuals, 3 males and 3 females were known to have had any previous criminal record.

Dr. D. E. Madsen, research professor of animal pathology and George T. Blanch, associate research professor of agricultural economics have been granted leaves of absence for the coming school year.

They will both study toward advanced degrees at Cornell University, Ithaca, New York.

Dr. Walter U. Fuhriman, associate research professor of Agricultural Economics has resigned to accept a position with the U. S. Bureau of Agricultural Economics.

E. M. Dieffenbach, who has worked on machinery for weed control for the U. S. Bureau of Agricultural Engineering with headquarters in Logan, has been transferred to the Bureau of Entomology and Plant Quarantine, and is now stationed in Mississippi.

Dr. Wayne Binns, a former student of the Utah State Agricultural College, and a graduate in veterinary science from Iowa State College, has been appointed to the staff in Animal Pathology.
LINING IRRIGATION CANALS TO SAVE WATER

One of Few Remaining Means of Increasing Amounts of Irrigation Water

By O. W. ISRAELSEN

Lining of irrigation canals in the West constitutes one of the few remaining means of increasing the amounts of water available for application to the land. There is, of course, in many of Utah’s irrigated regions, considerable need for construction of small reservoirs, but even when more reservoirs are built, the need for prevention of excessive seepage losses will still be urgent on many canals.

The object of this article is to present an analysis of the conditions that make lining of irrigation canals financially attractive when all the costs of the lining, construction and maintenance must be paid by the irrigation company, and justified on the basis of the value of the water saved by the lining.

Justifiable Cost of Lining an Irrigation Canal

Considering the welfare of all the people in an irrigated valley or state, the lining of irrigation canals is valuable in three ways, namely: (1) saving of water for use in irrigation, (2) reduction of the cost of drainage of irrigated land, and (3) conservation of soil productivity.

On the other hand, considering only the welfare of the stockholders of a mutual irrigation company, the lining is valuable only to the extent that it saves water for the use of the stockholder irrigators. The drainage systems are usually not under the management or control of the irrigation company and therefore the reduction of drainage costs does not directly influence the canal company officials. Likewise, the lands that need protection against water logging and alkali concentration are frequently far removed from the canals that sustain seepage losses. Therefore, it follows that until the time comes when public agencies, the county, the state and the federal government, which are especially interested in the conservation of soils, become willing to invest funds in the lining of irrigation canals, the cost of lining must be justified largely, if not entirely, on the basis of the value of the water saved, because these costs must be paid by the stockholders of each irrigation company concerned. We may then write the following statement as a basis for justifying lining: The annual cost of lining must not exceed the value of water saved each year.

The significance to the irrigation company of the foregoing statement of the justifiable cost of lining a canal is shown more clearly by the following mathematical analysis:

Let: C = first cost of lining canal; dollars per square foot.
S = seepage loss percent of inflow per mile.
Q = flow in canal; cubic feet per second.
C = cost of lining canal; dollar per foot.
P = perimeter of canal or ditch to be lined; feet.
i = rate of interest; percent per year.
V = value in dollars of 1 acre-foot of water.
d = number of 24-hour days during which canal is operated.
p = perimeter of canal or ditch to be lined; feet.
i = rate of interest; percent per year.
m = maintenance, depreciation and replacement cost; percent of first cost per year.

Then it follows that:
1. The cost in dollars for lining one foot of a canal is equal to product p x C.
2. The annual cost per foot of canal is equal to the product px C x (1 + m).
3. The annual cost per mile of canal is $280 p x C x (1 + m).
4. The seepage loss in second feet in one mile of canal is equal to the product S x Q second feet.
5. The seepage loss in acre feet per season is equal to the product 2 x S x Q x d (Because 1 second foot flow)

(Continued on page 11)

NEW PROJECTS

Some effects of acid-forming materials on Utah soils

This investigation is undertaken under the direction of Dr. D. W. Thorne to determine the value of acid forming materials in improving the chemical and physical properties of alkali and normal calcareous Utah soils and in improving the yield and quality of crops.

Celery improvement studies

This project, under the direction of Dr. L. H. Pollard, Dr. F. B. Wann, and Dr. B. L. Richards, has as its objective the determination or development of varieties of celery most suited to Utah conditions, the improvement of cultural practices, and the determination and control of celery diseases.

Basic studies of factors governing soil erosion by irrigation water

Because of the serious soil erosion conditions caused by irrigation water, Dr. Willard Gardner, in cooperation with the Soil Conservation Service, will study the basic physical relations between the slope of land, size of stream and soil characteristics.

Soil erosion as influenced by irrigation methods and practices

Another phase of the study on soil erosion by irrigation water will be conducted by Dr. O. W. Israel sen and Professor G. D. Clyde in cooperation with the Soil Conservation Service. They will attempt to find the most practical and economical methods of reducing erosion caused by irrigation.

Excessive seepage from this Utah canal saturates the soil and causes ruinous accumulation of alkali on surface of land.
The success of sheep producers in 1939 in the Cedar City area was closely related to the lamb crop, weight of lambs, wool crop, death losses, and economies in operation costs. A study of 56 sheep outfits, for the year 1939, including 100,000 head of sheep, was conducted in Iron, Washington, and Beaver Counties by the Department of Agricultural Economics of the Station. The analysis of these ranches showed that the profit per breeding ewe varied from 2.77 dollars for the most profitable ranches to 0.22 dollars for the least profitable with an average profit of 1.34 dollars per ewe and an average labor earnings of 1,902 dollars per ranch. This profit per ewe was calculated by deducting from the total receipts of the sheep enterprise, all cash expenses of operation, as well as the value of home produced feeds consumed by sheep, the value of unpaid labor, and interest on all capital invested in sheep or land and equipment needed for their operation. Labor earnings are the returns to the operator for his year’s labor and management plus the value at the farm of farm products used by the operator’s family and the rental value of the house.

Not all of the ranchers were able to pay cash costs of operation, interest on borrowed and owned capital, pay themselves and members of their family at the same rate as hired labor, and have left a profit for management. Some operators lacked $2.00 per ewe of meeting these items of expense, while others received $3.00 per ewe above these expenses. Part of this difference was a result of conditions beyond the control of the operators, but much was the result of factors of management within their control.

Individual operators cannot readily change their physical environment but they can adjust their operations to the resources available. Range conditions in an area as small as that covered by this study, do not vary to any great extent. While a few of the sheep producers may have acquired better areas of land, which would reflect itself in better earnings, the majority are subject to somewhat comparable range conditions. Therefore the important factors that determine the profits are more or less within the control of the individual operator. These factors are lamb crop, death losses, marketing efficiency, operating expenses, and efficiency in the use of capital and labor.

A comparison of the ranches with the highest profit per ewe with those ranches with the least profit, shows a difference of $2.55 per ewe. An examination of the data in the table shows that this is not a result of the number of sheep in the outfit, for there is a difference of only about two percent between the two groups. This variation in profit per ewe is a result of greater efficiency of the organization and operation of the ranches.

The most profitable ranches had 20 more lambs per 100 ewes at time of marketing in the fall than did the less profitable group. The lamb crop at time of marketing was 84 percent for the most profitable ranches and only 64 percent for the least profitable ranches. This is one of the most important factors affecting profits from sheep production and emphasis should be given to the necessity of increasing the lamb crop by careful breeding practices and by efficient care of the sheep to increase profits on many ranches in the state as well as in this area.

The weight of lambs marketed was 12 pounds per lamb higher on the more profitable ranches. This difference in weight is partially a result of time of lambing and range conditions during the year.

Other factors related to higher profits were death losses, wool production, and price paid for wool. The most profitable operators lost 5 head less per 100 head of stock sheep operated and nearly 8 head less per 100 lambs. They sheared 9/10 of a pound more wool per
STUDIES INDICATE THAT TRUCKING SHEEP FROM WINTER TO SUMMER RANGE HAS MANY ADVANTAGES OVER TRAILING

Weight Losses of Trailed Sheep Compared to Those Trucked

By ARTHUR D. SMITH

Not only does trailing of sheep from winter to lambing ranges result in considerable loss in weight, and frequent death losses through starvation, accident and poisoning, but trailing along roads is a great inconvenience to motor traffic as well. Furthermore, the damage to scenery is considerable, and frequently erosion results from the excessive trampling along these trails. As long as trailing could be carried on over range areas, where feed could be obtained, this was no problem, for the sheep would likely gain weight on the trail. But with the concentration of many bands onto narrow trails which are frequently highways, the problem has been altered entirely. To avoid these disadvantages, many owners truck or ship their stock.

During the spring of 1939, investigations were conducted by the Range Management Department in which a number of sheep of different bands were weighed and tagged as they left the winter range. These same sheep were again weighed when they reached the lambing ranges. The figures obtained indicate that there is considerable loss in flesh as a result of trailing. A band trailed from the west desert to the Weber Canyon area lost an average fleece and sold the wool for 2.4 cents more per pound.

The analysis of these ranges shows that there is opportunity and need for many sheep producers in the state to increase their rate of production and decrease death losses of sheep by more careful operation practices. This can be done without materially increasing the per unit cost of production, and will result in more returns and a better living to the operator and his family.

Of nearly 8 pounds per head, individual sheep losing as much as 15 pounds. A band from the same area which was shipped the greater part of the way lost but 5 pounds per head. This last band had, however, spent two days on the trail after having been shipped into Ogden, and as a result, lost more weight than they would have if they had been shipped the entire distance to the spring ranges. Further, sheep of this band were on poorer range and had less opportunity to fill up than had the trailed band. Similarly, 25 lamb of a band were weighed before and after trailing to summer range. These lambs lost over four pounds each during a trail period of 6 days. These figures gave no opportunity for comparison, however, only establishing the fact that losses might be expected. It was then determined to learn if significant advantages could be shown by trucking rather than trailing over these routes.

This was accomplished the past spring and summer by weighing two lots of sheep from each of two bands; one of these lots being subsequently hauled by truck to their destination, the others being allowed to trail with the band. Analysis of the 1940 results shows that the ewes which were trailed were an average of 2.95 pounds lighter at the end of the trail period than they were when they began the journey. The ewes which had been trucked had similarly lost weight, the average being 1.95 pounds per animal. The lambs gave much more interesting figures. The sheep were trailed from their spring range near Portage, Utah, to the Cache National Forest east of Logan. The band was on the trail for 6 days. When weighed at the end of the 6 day journey, the trailed lot had lost an average of 2 pounds while those which had been trucked had gained an average of one-half pound each. Twelve days later the lambs were again weighed. During the eighteen day period which had elapsed since the first weighing, the trailed lambs had gained an average of 6 pounds per head while those trucked had gained 9.5 pounds per head. This is an advantage of 3.5 pounds for the lambs trucked over those which had been required to trail. This seems to indicate that the trail losses may be permanent.

It is planned to weigh the lambs again when they are marketed to determine if their are similar differences in the weight of lambs at marketable age. If this be true, these data though preliminary, would indicate that there may be a considerable advantage in returns to the owner by handling lambs by train or trucking rather than requiring them to trail over the difficult routes now available.

The Rambouillet flocks of the Animal Husbandry Department and Branch Agricultural College will be divided into five breeding lines or groups, beginning with the breeding season this fall. The breeding program in two of these lines will be so planned that a fairly high degree of in-breeding will be developed. The three remaining lines will be maintained in heterozygous condition and a promising young ram will be tested on each line each season. Rams which prove to be outstanding in these progeny tests will later be used as sires in the inbred lines. By this means it is hoped that highly uniform (homozygous) inbred lines can be developed, which will transmit their characteristics to their offspring with a greater degree of uniformity than do non-inbred (heterozygous) individuals. Approximately thirty inbred lines are being developed at the Western Sheep Breeding Laboratory, at Dubois, Idaho. Lines being developed by the Utah Agricultural Experiment Station, and by other stations that are cooperating with the Laboratory, will supplement the breeding program at Dubois—Ralph W. Phillips.
CONTAMINATION OF MILK FROM INTERNAL AND EXTERNAL SOURCES

Contamination Can Practically Be Eliminated by Keeping the Cow Clean, Using a Narrow Topped Pail, Sterilizing Equipment, and Adequate Cooling.

By L. W. JONES

STATE and city regulation of the milk supply to assure quality milk for the public has raised many questions with respect to conditions of production. The sources of bacterial contamination entering milk and the relative significance of each are of fundamental importance to the dairyman. These sources of contamination may conveniently be divided into contamination from the interior of the udder and that from external sources.

Udder Infection

In the production of market milk from healthy cows, internal contamination from the udder requires little if any consideration, but to the producer of certified milk this problem may be one of major importance. Frequently, milk coming from infected udders contains large numbers of bacteria, but excessive numbers can come from udders that are apparently normal. In some cases these counts have exceeded 100,000 bacteria per cubic centimeter. Such cows usually can be detected only by making counts on individual animals of the herd. Usually however the number of bacteria range between 50 and 5,000 per cubic centimeter.

Work was done at this Station with cows that had consistently passed negative tests for contagious abortion, tuberculosis, and infectious mastitis with the aim of determining the number of bacteria really unavoidable under aseptic methods of production. Ten cows were used in the experiment which extended over a period of 4 months and involved 160 samples of milk. The average number of bacteria per cubic centimeter obtained was 239. Thus we see that with the careful selection of animals the number of bacteria coming from the udder can be made negligible.

Bacterial counts obtained from cows suffering from udder infection indicated however, that this source could be a factor of real importance in the production of market milk if udder infections became widespread in a herd. A great deal of variation was found between the number of bacteria produced by different cows but the fact was plainly evident that some animals consistently gave milk with a comparatively high number of bacteria while the milk of others consistently gave a low count. In producing grade A milk individual animals should be tested and the cows that are consistent producers of milk with a high bacterial count should be segregated or eliminated.

In this investigation considerable differences between the numbers of bacteria in any two quarters of the same udder were found. The same thing was noted with respect to the kinds of bacteria in the different quarters of the udder. The greater numbers were found in the fore milk and the smallest number in the middle milking, however, the elimination of the fore milk would have a negligible effect on the content of the entire milking. The procedure may be of value, however, when milk with a very low count or with an exceptionally fine flavor is desired, as the flavor of fore milk is frequently objectionable.

External Contamination Easily Eliminated

While the internal contamination may be of interest mainly to those producing a special grade of milk, the contamination from external sources is of great importance to every dairyman attempting to produce a quality product. These external sources are numerous but only two, utensils and the coat of the cow, are of major importance. When proper care is exercised in cleaning the coat of the cow before milking, using small topped pails, and sterilizing utensils, the production of milk low in bacterial numbers is regularly obtained. These principles when combined with cooling to low temperatures insure the delivery of milk which will be low in bacteria and will consequently keep satisfactorily. Results obtained by the application of the above factors strikingly illustrate their importance.

Milkers experienced in the proper methods competed on six different farms against the usual milkers. The average bacterial counts on milk obtained by the experienced workers were 13,060 bacteria per cubic centimeter while the average obtained by the usual milkers were 2,058,000 per cubic centimeter. Other data collected from five cities involving 309 dairymen showed an average bacterial count of 2,400,000 per cubic centimeter before sanitary methods were introduced as compared with 28,000 per cubic centimeter after. These results and others obtained under widely varying conditions indicate that anyone who will use reasonable care can produce milk with a fairly low bacterial count. Elaborate equipment is not needed, while an understanding of the methods of preventing contamination from important sources is necessary.

The control of contamination from the body of the cow requires, of course, that the cow be kept clean. This can be accomplished by brushing which should be done sometime before milking in order that the dust may settle. Just before milking it is imperative that flanks and udder be wiped with a damp cloth. Occasionally the udder and flanks should be washed. Properly bedding animals will aid materially in keeping them clean.

Large reductions in bacterial content have resulted from the use of small topped pails which reduce the area through which dirt and dust can fall into milk. It is claimed that more than half of the contamination of milk during milking could be prevented by the use of these pails.

Of all the factors which account for high bacterial count in milk listed, by far the most important is unsterilized equipment. The total numbers of organisms gaining access from air and dust is almost negligible compared with those derived from the surfaces of unsterilized pails, coolers, cans, strainers, clarifiers, and bottle fillers. It has been estimated that as high as 80 percent of bacteria entering milk come from this source. Scalding or otherwise sterilizing equipment reduces contamination from this source.

Cooling of Milk Essential

The factors previously discussed...
MODERN ASPECTS OF SOFT CURD MILK

No Substitutes Found for Natural Soft Curd Milk in Infant Feeding

By R. L. HILL

Perhaps it is best to explain at the beginning the meaning of the term "soft curd milk." When milk is coagulated in the laboratory or in the stomach by the use of rennet enzyme or by pepsin, it forms a curd. Whether or not this curd will be hard and rubbery in consistency or soft and pliable depends largely on the composition of the milk before coagulation. Some cows give milk that on coagulation forms a soft pliable curd, while others only secrete milk having a hard rubbery curd. The former type of milk is called soft curd milk.

The test now in use to determine the softness of the curd of milk as well as the pioneering work on the distribution of the soft curd character in dairy cows are developments originating at this Station. The superior digestibility of soft curd milk was also first discovered here. In recent years numerous experiments at many different research stations have demonstrated the superior digestibility of soft curd milk. Since the curd test has been shown to be an index to the digestibility of the milk, it is now possible by testing the milk from each cow in a dairy herd to select the cows in that herd that secrete milk that is more easily digested than the rest of the milk from the herd.

Natural Soft Curd Milk

A large number of dairies both in this country and abroad have segregated these cows and are now putting on the market a natural soft curd milk. Some of these dairies are careful in their testing and produce a fine grade of soft curd milk, but because of improper supervision and testing other dairies have put out a product labeled soft curd milk that is not soft curded. In some sections, and more particularly New York City, the milk commission has established definite standards and is controlling the distribution of soft curd milk. Certified soft curd milk has received the official approval of the American Medical Association.

Modified Milk

Most physicians, when using cows' milk in the feeding of infants, modify the milk. Practically all of the formulas used contain some ingredient to soften the curd of the milk. By the use of the proper formula market milk can be converted into a satisfactory food for most infants. Soft curd milk has the advantage that it furnishes a natural unmodified, unsweetened, safe infant food that can be used in its native state.

Processed Soft Curd Milk

Because of the relatively small number of cows that secrete soft curd milk and the expense of segregating them in sufficient numbers to produce a quantity of soft curd milk, methods are being employed to artificially soften the curd of market milk. A number of different treatments to accomplish this result are in use.

Homogenization. When market milk is homogenized the fat globules are so finely dispersed in the milk that they interfere with curd formation during coagulation resulting in a softer curd. While this method causes considerable softening of the curd it does not, according to research conducted elsewhere, render the milk as digestible as the natural soft curd milk.

Base exchange treatment. In order for milk to coagulate there must be a definite amount of soluble calcium salts present. By filtering the milk through a zeolite filter most of the soluble calcium is removed, resulting in a milk that has a soft curd when coagulated by rennin without the addition of calcium salts. This milk is being marketed in a number of cities under the name of "Sof-Kurd" milk. According to digestion experiments conducted at another station, however, this milk is not as digestible as the natural soft curd milk.

Evaporated Milk

The treatment given milk while converting it into evaporated milk both homogenizes and sterilizes the product. Each of these processes softens the curd. The resultant product, evaporated milk, has a soft curd and is a very digestible product. The curd of the sweetened condensed milk which is not sterilized is harder than the regular evaporated milk.

Boiled Milk

Prolonged boiling of milk softens the curd and renders the milk more digestible. While many are opposed to the use of boiled milk because of the destruction of vitamins in the boiling process, yet there can be no question as to its superior digestibility over the unboiled product. Pasturization of milk has little effect on the softness of the curd and its resultant digestibility.

Some other methods of modifying milk for infants have been suggested but have not yet proved their value. F. J. Doan of the Pennsylvania Agricultural Experiment Station has carried on rather extensive digestion experiments on the different modified milks and this is his conclusion. "It should be emphasized that, at present, none of the suggested methods of preparing a fresh fluid milk for pediatric purposes appears to be sufficiently satisfactory."

Relation of Soft Curd Milk to Udder Infection

When a cow has a common udder infection known as subclinical mastitis the curd from the infected quarters is usually softer than the milk from noninfected quarters. This has given rise to the conclusion that udder infections are the cause of soft curd milk and that only cows having udder infections produce soft curd milk. This view is fallacious. A large number of cows having no udder infection have been shown to secrete soft curd milk. Unless the cow secreting the soft curd milk has been tested for udder infections, she may be secreting an abnormal milk as the result of the infection and not normal soft curd milk. For this reason care should be taken in selecting cows for the production of soft curd milk to make sure that they are free from udder infections.
APPLE AND CHERRY JUICES

(Continued from page 1)

after washing and grating. Cherries should be soaked several hours in cold water before pressing, while sprayed apples should have the spray removed by washing in 1 to 1 1/2 percent hydrochloric acid.

With Montmorency cherries, the hat press process in which the grated, crushed cherries are heated to 150 degrees F. or over before pressing gave the best colored juice, and was the most convenient to clarify and handle, since the heating coagulated pectins and other suspended materials which prevent filtering cold pressed juices, as well as inactivating enzymes and killing yeasts, molds, and bacteria that sour the juices. After settling for an hour or so, the juice was easily clarified by a home made cloth bag filter.

Cold pressed juice, while superior in flavor, was inferior in color, and had to either be heated to prepare for filtration or have pectic enzyme added at the rate of 1 pound to 50 gallons and let stand for 5 hours to coagulate the cloudy suspended material before filtering.

With apple juice, cold pressing is the rule, since heating crushed fruit or unfiltered juice imparts a cooked flavor. After straining through cloth to remove bits of apple from the juice, pectin was added as previously described, left 5 hours or overnight, and filtered with a cloth bag filter with the aid of a handful of filter aid called Hyflo Supercel dusted on the inside surfaces of a wet cloth filter bag to build up a filtering layer. Care is taken not to rile the settlings at the bottom of the overhead supply barrel since this material rapidly clogs up the filter bag and should be filtered last. An easily made filtering arrangement is illustrated.

Opinions differ as to the merits of clarified and unclarified cherry and apple juices, but preliminary tests of cherry juice and experience with the sale of apple cider at the College indicates a strong local public preference for the clear juices for beverage purposes, although some unclarified canned juices are being marketed elsewhere.

Preservation of Apple and Cherry Juices

Heating, either by the holding or flash pasteurizing method which involves a short heat treatment and rapid cooling to avoid the cooked flavor found in holding pasteurization, followed by sealing to exclude air, is the most common method of preservation. Where cans are used, the flash pasteurized juice is filled hot at 190 degrees F. into clean, enameled cans, sealed, inverted for one minute to sterilize the lids, and cooled in water. Holding pasteurization in bottles or cans at 170 degrees F. for 10 minutes, then cooling, may be used. Glass containers should have the corks or caps loose until thoroughly heated in order to avoid breakage by expansion in heating and must be cooled first with warm, then cool water. Where freezing storage is available, cherry and apple juices may be kept for long periods frozen at temperatures of 10 degrees F. or lower. Glass containers or wooden kegs may be used providing 10 percent head space is left to prevent breakage by expansion. Sealed enamel cans are also useful as storage containers and have the advantage of smaller family size units.

Varieties for Juice

The Montmorency cherry is the standard juice cherry, although blends of acid and sweet cherry juices make attractive and well flavored drinks without dilution with water. Ordinarily Montmorency juice is diluted with water or sugar syrup to reduce the acidity, from four to eight percent of sugar being added to the diluted juice. Where a sweetened, concentrated juice is wanted which can be diluted without additional sweetening, from 25 to 35 percent of sugar is added. A density of approximately 17 degrees Brix is used for dilute juices prepared commercially.

Two juice samples which ranked high in the preliminary tests made this year were those made from Montmorency juice blended with English Morello type juice, and that made by blending Montmorency, Morello and Black Tartarian juice. The latter juice was darker in color and required less sugar on account of the sweetness of the Tar	arian juice, only 18 percent sugar being required to bring the undiluted juice to 34 degrees Brix desired to give a 17 degree Brix drink when diluted with an equal quantity of water. Since many tons of Black Tartarian cherries go to waste each year because they are too soft for canning, this combination seems particularly promising.

For apple cider of rich body and full flavor, the Jonathan apple is the best Utah apple, and is abundant and cheap. Jonathan cider may be used alone or blended with juice from milder, sweeter apples, such as Grimes Golden, Winter Banana, Rome Beauty, or Delicious which are too flat to use alone. Wine-sap, White Winter Pearsain, and Wealthy apples make good, tart, sweet cider, but Red Astrachan, Yellow Transparent and Duchess are too tart to be used alone. Crab apple juice adds astringency and may be blended with juice of other non-astringent varieties.

For more detailed information on preparation of juices see Treseler, Joslyn and Marsh. Fruit and vegetable juices. New York, A. V. W. Co., 1939.
BEE LOSSES
(Continued from page 1)
were often blamed to sugar-beet webworm spray. Other suspected causes of loss during recent years have included tomato fruitworm, smelter smoke, mosquito control operations, orchard spraying, garden spraying and dusting, loco worm, starvation, or the occurrence of some new and as yet unrecognized disease. All such possibilities are being kept in mind as the investigation progresses.

Repeated experimental tests with various grasshopper bait combinations, spread near a large apiary in Weber County during August and to mid-September of 1939, indicated that the bees seldom were attracted to such fines during the period under investigation. Similar tests conducted in Cache County during June and July of 1940 have attracted few honeybees. Observations in tomato fields indicate that honey bees are not particularly attracted to blossoming tomato plants. Tomato growers have been urged to use care in dusting, to keep the poisonous dust on the tomato plants and not allow it to drift upon nearby nectar plants which might be along bordering ditch banks or in nearby fields, and to keep the tomato fields free from weeds which might be in bloom and attractive to bees at the time of spray treatment.

The size and importance of the bee industry in Utah is much greater than is realized by most people in the state not closely associated with it. In 1936 the value of honey and wax amounted to $207,000 and in 1937, partly as the result of death loss, only $102,054. Utah ranks eighteenth among the states in the commercial production of honey. It is generally believed that the value of bees as pollinators of fruit trees and other plants needing insect pollination much exceeds the value of the honey and bees-wax produced each season. Some horticulturists attribute the low fruit production per tree in some sections of Utah to the scarcity of bees at pollination time.

During the 1939 bee loss investigation, A. G. Pledger, president of the Utah State Beekeepers Association, cooperated actively in the bee loss investigations, setting aside a large apiary at Slatterville for detailed experimental studies to help advance the investigations. Aid was also extended by various other beekeepers. During 1940, Mr. Pledger of Ogden and Mr. G. Mey-

LINING IRRIGATION CANALS
(Continued from page 5)
for a period of 24 hours amounts to 2 acre-feet).
6. The value of water saved each season is then equal to the product 2 x S x Q x d x Vw.

It is therefore easy to see that:
5280 x p x C x (i + m) = 2 x S x Q x d x Vw ...................(1)
It is evident from equation (1) that
C = \frac{S x Q x Vw x d}{2640 x p x (i + m)} ...................(2)

Illustrative Examples:
1. Saving of water by lining, percent per mile
2. Inflow to canal section, second-feet.
3. Value of water per acre-foot, dollars.
4. Length of irrigation season in days.
5. Average perimeter of canal, feet.
6. Interest rate, percent per annum.
7. Maintenance and replacement of canal lining; percent of first cost per year.

Example No. 1

Then it follows from example No. 1 that:
\[
C = \frac{0.07 x 75 x 1 x 150}{2640 x 20 x 0.04 + 0.07} = \$0.136
\]
From example No. 2 it is evident that:
\[
C = \frac{0.03 x 100 x 2 x 175}{2640 x 30 x 0.04 + 0.09} = \$0.101
\]

The Cost Value Ratio

It must be noted in the illustrative examples given that the values presented are maximum values—not actual. The actual cost of lining a canal with cement concrete having a thickness of four inches would be about 12 cents per square foot. The cost-value ratio with example No. 1 would then be 136/120, which is equal to 1.13. In other words, the justifiable cost, with assumptions as given would be 13 percent greater than the actual cost, even though percent is allowed for depreciation and maintenance, which is a liberal estimate for concrete lining.

Example No. 2 shows that even if water is worth two dollars per acre-foot the maximum justifiable first cost of lining a canal would be only slightly more than 10 cents per square foot providing only three second-feet (or 3 percent of a 100 second-foot stream) could be saved by one mile of lining and provided the yearly maintenance costs were 9 percent of the first cost. It is also evident from example No. 2 that if the water saved had a value of only one dollar per acre-foot, an irrigation company could justify a first cost for lining of 5 cents per square foot; all other values remaining the same.

By the use of equation 2, canal company officials can make a large number of similar comparisons after estimating the seepage losses, value of water, costs of maintenance and other items given.

Continued cooperative work on this project should lead to knowledge of the causes of bee losses in Utah. Such information would form the basis for improving agricultural programs and aid in reducing adult bee losses in this region.

During the past few years the Station has released new improved varieties of spring wheat, barley, and oats, all developed here. Erect, a new variety of spring wheat was released several years ago. Velvon barley, which has proved popular, is a high-yielding, smooth-awn variety highly resistant to covered smut. The latest release is a new variety of oats named Uton; it is a high-yielding, large white oat, resistant to loose and covered smuts.
USE OF COLD STORAGE LOCKERS RAPIDLY EXPANDING IN UTAH

Over 10,000 Lockers Now in Use in the State

A new business, that of renting cold-storage lockers to individuals for the preservation of fresh meats, poultry, fruits, and vegetables is expanding rapidly in many parts of the United States.

Ten years ago the frozen food locker plant was little known; there was only one plant in Utah. Today it is estimated by one of the trade papers that there are 1,000,000 locker plant customers in the United States. A recent survey conducted by the Department of Agricultural Economics of this Station with the cooperation of the county agents showed 31 plants in operation in Utah with a capacity of over 10,000 lockers. These plants are located in 13 counties, more or less concentrated in the north central part of the state.

The first plant in Utah was established in Salt Lake City in 1929, the next in Provo in 1931. Of the other 29 plants all but two have been established since 1937. Fifteen have started business during 1939 or 1940. The size of the plants as indicated by their locker capacity ranges from plants with 60 lockers to one of 1,250 units. The average number of lockers is 357.

The services rendered by individual locker plants vary from one plant to another, but a typical plant usually consists of: (1) A chill room where meat is chilled to remove all body heat and aged before being cut and frozen. This room is usually maintained at 32 to 36 degrees F. (2) A cutting or processing room where the meat is cut into roasts, steaks, chops, etc., and wrapped and labeled. (3) A sharp freezing room, where the individual cuts are quickly frozen at temperatures from -10 to -25 degrees F. (4) A locker room where temperatures of 0 to 10 degrees F, are maintained. The capacity of each locker is from 200 to 250 pounds. The lockers are rented on a monthly or yearly basis and small charges are made for the various services rendered.

In addition many plants are equipped to render lard, blanch vegetables, cure meat, and to perform other services.

It is difficult to predict just how far the locker plant movement will expand in Utah. However, it seems reasonable to expect further expansion during the next few years. The frozen-food locker has many advantages to offer, especially to the farmer or to the large or average sized town or city family. The farmer may butcher at any time of the year and store his meat fresh. Meat cutting by an experienced meat cutter is likely to result in a better utilization of the carcass than would be the case with most farm cutting. Freezing eliminates the drudgery of home canning and gives a more palatable product. Less spoilage of food results than where freezing weather is depended on for preservation. The town dweller may purchase a whole or half an animal at wholesale prices and have it cut by an expert, wrapped, labeled and stored.

Fruits and vegetables maintain their fresh flavor better when properly frozen than when processed by other methods. Not all vegetables will freeze satisfactorily, however, particularly tomatoes and lettuce.

The freezing and storage of fruits, vegetables, meats, poultry and other products in refrigerated locker plants involve problems not encountered in the older and more familiar processes of food preservation. Several departments of the Utah Agricultural Experiment Station are now actively engaged in investigating certain of these problems. Numerous other state and federal experiment stations are conducting similar investigations, so that much valuable information on processes used and the value of frozen foods will soon be obtainable.

Each dot indicates the location of a cold-storage locker plant in Utah

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