1-1-1962

Some factors affecting the composition of milk

K Needham

Follow this and additional works at: http://researchlibrary.agric.wa.gov.au/journal_agriculture4

Recommended Citation

Available at: http://researchlibrary.agric.wa.gov.au/journal_agriculture4/vol3/iss1/5

This article is brought to you for free and open access by Research Library. It has been accepted for inclusion in Journal of the Department of Agriculture, Western Australia, Series 4 by an authorized administrator of Research Library. For more information, please contact jennifer.heathcote@agric.wa.gov.au, sandra.papenfus@agric.wa.gov.au.
IMPORTANT DISCLAIMER

This document has been obtained from DAFWA's research library website (researchlibrary.agric.wa.gov.au) which hosts DAFWA's archival research publications. Although reasonable care was taken to make the information in the document accurate at the time it was first published, DAFWA does not make any representations or warranties about its accuracy, reliability, currency, completeness or suitability for any particular purpose. It may be out of date, inaccurate or misleading or conflict with current laws, polices or practices. DAFWA has not reviewed or revised the information before making the document available from its research library website. Before using the information, you should carefully evaluate its accuracy, currency, completeness and relevance for your purposes. We recommend you also search for more recent information on DAFWA's research library website, DAFWA's main website (https://www.agric.wa.gov.au) and other appropriate websites and sources.

Information in, or referred to in, documents on DAFWA's research library website is not tailored to the circumstances of individual farms, people or businesses, and does not constitute legal, business, scientific, agricultural or farm management advice. We recommend before making any significant decisions, you obtain advice from appropriate professionals who have taken into account your individual circumstances and objectives.

The Chief Executive Officer of the Department of Agriculture and Food and the State of Western Australia and their employees and agents (collectively and individually referred to below as DAFWA) accept no liability whatsoever, by reason of negligence or otherwise, arising from any use or release of information in, or referred to in, this document, or any error, inaccuracy or omission in the information.
Some factors affecting

THE COMPOSITION OF MILK

By K. NEEDHAM, B.Sc. (Agric), Dairying Division.

FOR many years it has been known all over the world that the composition of milk varies. This variation in quality is considered as a serious problem wherever the dairy industry is established.

In 1945 a relatively small investigation conducted in Western Australia showed a similar variation here. Interest and concern in this subject has grown over the years, and the variation in the composition of milk is now one of the most important problems facing dairy farmers in this State.

WHY IS THE COMPOSITION OF MILK IMPORTANT?

There are three major reasons why dairy farmers should be interested in this subject:

1. Liquid milk supplied for human consumption must measure up to certain standards. The fat content must not be less than 3.2 per cent, the solids-not-fat not less than 8.5 per cent., and the total solids not less than 11.7 per cent.

2. Increasing interest is being shown in the question of payment for milk on a quality basis. If such a system were adopted variations in the composition of milk could affect the livelihood of milk producers. A knowledge of these variations is obviously important to the farmers who would be affected by this system, as well as to those responsible for its design.

3. With the advent and expansion of artificial breeding of dairy cattle, a sire survey or sire evaluation scheme is needed to allow the best possible sires to be selected for the A.B. centres.

The groundwork, in the form of heifer calf identification, has already begun. Grade and pure bred herd testing units have contributed a great deal of information on performance in terms of butterfat production, and will continue to do so, but because of the increasing importance of the solids-not-fat figures, there must also be an increasing demand for knowledge of the ability of a bull to transmit characteristics necessary for high production of solids-not-fat in milk.

WEST AUSTRALIAN SURVEY

For these reasons a survey is now being held to obtain more detailed information on the variation in composition of West Australian milk.

The original survey conducted in 1945 was restricted to one herd only. In the current survey a number of herds representing both dry land and irrigated farming conditions, and also the four main breeds of cattle, are included to give a better picture of the position.

The 13 herds selected range geographically from Armadale to Waterloo. One of these is the herd at the Bundibup Research Station, Wokalup. To give a comparison under rather extreme conditions of dairying, the Muresk Agricultural College herd is also included.

The work is progressing well, but it is extremely time-consuming, and even after the field work has been completed later this year a great deal of data will have to be sifted and analysed before any conclusions can be reached. These conclusions should eventually help to give
better control over variations in the composition of our milk.

It is not intended that this survey will show means of overcoming the difficulty of variation in the composition of milk. It is intended primarily to establish that the difficulty does exist under a variety of conditions of dairy farming in Western Australia, and to collect some information on associated levels of husbandry.

When this has been done further more specific work will need to be undertaken, especially on feeding practices.

Meanwhile, many dairy farmers are still producing milk which does not measure up to the legal minimum in composition, and sometimes suffering embarrassing consequences.

The great majority of these farmers are anxious to overcome this difficulty, and until the final results of the survey are available this article aims to help them by outlining some of the main factors which influence the composition of milk, and setting out some of the practical methods of dairy husbandry which are considered to give some control over it.

By adopting these, the dairy farmer who is having trouble keeping his milk up to standard may be able to get some improvement in the situation, even if he is not able to overcome it completely.

FACTORS AFFECTING COMPOSITION OF MILK IN W.A.

A great many reasons have been advanced for variations in the composition of milk. These include breed and the family within the breed, feeding, disease (mastitis), age of the cow, stage of lactation, length of lactation, weather, and a variety of differences put down to "individuality" of the cow.

To give a full list of these reasons for variation would only complicate the picture, but on the other hand oversimplification of the problem would only be misleading, and would not take into account the many practical difficulties met by every dairy farmer trying to improve the quality of the milk from his herd.

There is no single rapid and easy method of overcoming this problem; at present it seems that the best solution lies in the continual practice of good husbandry methods.

Some of the many things which come under the heading of "good husbandry" and which can help control the composition of milk are outlined in this article.

Composition of Milk:

Broadly speaking, milk may be divided into two major parts—the liquid (water) which normally ranges from about 87 to 88.3 per cent., and the solids, which range from 11.7 to 13 per cent. The minimum legal limit is 11.7 per cent.

The solids are normally referred to as the total solids, and for the purposes of convenience these are further subdivided into fats and solids-not-fat. The solids-not-fat consist mainly of protein, lactose, sugar and minerals.

NORMAL TRENDS

Stage of Lactation

In a normal lactation, quite regardless of season or time of calving, it has been observed that milk yield rises gradually until about 45 to 60 days after calving, then gradually declines until the end of the lactation period.

The fat and solids-not-fat tests fall quite rapidly between the 45th and 60th days, then rise gradually towards the end of the lactation. There is a tendency for the solids to improve more rapidly than the fat.

These trends may be expected in a normal lactation, where rations have been controlled to provide the full feeding requirements for the full term of the lactation. This obviously does not always take place on the commercial dairy farm, particularly when the herd is relying largely on grazing.
Fig. 1.—Trends in the yield of milk and the percentage butterfat and solids-not-fat in a normal lactation where feed requirements are fully met.

It is here where individual variations from the established trend occur, and make it unwise to rely entirely on the assumption that if the fat level is satisfactory, the S.N.F. will follow. Because of this reliance on paddock grazing for the nutrition of dairy cows in Western Australia there is a marked seasonal trend in the composition of milk.

Seasonal Variations

Because of this reliance on paddock grazing for the nutrition of dairy cows in Western Australia there is a marked seasonal trend in the composition of milk.

Fig. 2.—Seasonal trends in the composition of milk under typical West Australian dairying conditions.
there's still no better drench than "PHENOVIS"

- EFFICIENT: Maximum efficiency against ALL major worms—Black Scour, Small Brown Stomach, Large Mouth Bowel and Barber’s Pole Worms.
- COMPLETELY SAFE: The safest of ALL modern drenches—completely safe for the sheep and the user, too!
- PROVEN: Used and relied upon by Australian sheep-owners for over 20 years, 'Phenovis' has undergone continual research to produce many outstanding improvements.

Another Dependable ICI Product
IMPERIAL CHEMICAL INDUSTRIES OF AUSTRALIA & NEW ZEALAND LTD.
Fats: Commencing in the spring, there is a gradual rise in the fat level, which continues until late summer. With the onset of autumn the fats plunge steeply, to start rising again in late winter.

Solids-not-fat: With the onset of summer the S.N.F. level falls precipitously, remaining low until early winter, when, with the availability of green feed, there is a steady rise until the beginning of summer.

This briefly and simply outlines the seasonal trends in fat and S.N.F. Clearly these trends depend on the quality of the grazing available.

In addition to this trend in the fat and solids-not-fat there are variations in the quantity of protein and lactose. The protein tends to follow the solids-not-fat, and lactose opposes it. Such variations are reported from all parts of the world, and have been observed in this State. As this constitutes a break from the so-called normal lactation, it would be as well at this stage to try to relate these variations to the natural feed supply of grazed pasture.

Pasture Quality and Milk Composition

From our own observations, and from experiments conducted elsewhere, it appears that the fat content of the milk is most seriously affected by the amount of roughage or fibre consumed by the animal. The solids-not-fat are to some extent affected by the protein intake, but more importantly by the total amount of energy consumed. Carbohydrates in various forms, but particularly in the form of cereal grains, play an important part in the provision of readily available energy.

These findings can be applied to the normal pasture season, to explain seasonal variations in composition.

During the summer, when green feed is at a minimum, the fibre content is high—hence the explanation, in part, for an increase in fat percentage at this time of the year.

Conversely, in the late winter and early spring, the fibre content of the pastures is relatively low and the protein and carbohydrate is high—resulting in an increase in the solids-not-fat figure.

It has been shown that the balance between acetic acid and propionic acid determines the test of the fat and the solids-not-fat in the milk. This has been demonstrated experimentally, and in practice the relationship has been shown by varying the proportions of hay (fibre), protein, and total starch equivalent (energy) in rations. This demonstration fits in quite well with the normal seasonal variation under natural grazing conditions.
Fig. 4.—Seasonal trend in pasture fibre related to the composition of milk. The fat level tends to rise as the pasture becomes more fibrous in early summer

ATTEMPTS TO CONTROL THE COMPOSITION OF MILK

Given an understanding of these normal seasonal trends in the composition of milk it is possible to select what appear to be the most important factors affecting composition from the dairy farmer’s point of view. Each of these can be influenced to a large degree on the farm, by the practice of good stock husbandry.

These four factors are:
- Breeding, and particularly the family within the breed.
- Disease, particularly mastitis.
- The age of the cows in the herd.
- Feeding a balanced ration.

Breeding—The Breed and the Family within the Breed

The four main breeds of dairy cows in Western Australia are the Guernsey, Jersey, Friesian and the A.I.S. The differences in fat percentage and S.N.F. between these breeds have long been recognised, and it is generally held that the Channel Island breeds, the Jersey and Guernsey, will give a higher test than the Friesian or the A.I.S.

It is widely believed that if the butterfat content is adequate, the solids-not-fat will follow. This may not always be true. Myers (1) has pointed out that the inheritance of the various constituents of milk is approximately the same, which means that it is possible to breed and select for solids-not-fat. Nevertheless the difference between the best and worst cows in the herd for solids-not-fat is considerably less than the difference between corresponding fat figures, so progress in breeding for solids-not-fat is likely to be much slower than for fat. After examining the work of Waite, Myers concludes that the relationship between fat and solids-not-fat in individual cows is not sufficiently close to rely upon fat percentage as a basis of culling for solids-not-fat.

Furthermore (2), it appears that only 25 per cent. of the production difference between cows within a herd is genetic; the other 75 per cent. is environmental, which for our purpose means feeding and management. When similar comparisons are made between herds the genetic influence is only about 10 per cent. the remaining 90 per cent. being environmental.

Obviously then, feeding is extremely important and offers a much quicker means of early relief than breeding. This in no way removes the need for sound breeding practice, but breeding must be regarded as a long term policy.
Disease (Mastitis)

As far as disease is concerned, it is reasonable to believe that any upset in the metabolism or the physiology of the animal is likely to be reflected in variations in the constituents within any of the body fluids—of which milk is one.

We do know that mastitis is responsible for reducing the solids-not-fat proportion of the milk, but not to what extent. In this respect it has been observed by veterinarians and animal workers that probably the most insidious form of mastitis is the sub-clinical form, in which the farmer is seldom aware of the presence of the disease.

It is therefore possible for the solids-not-fat to be continually lowered without the farmer realising the need to treat the affected animals.

It pays to ensure that the herd is as free from mastitis as possible by regular use of the strip cup and careful observation of the cows. Preventative hygiene must be beyond reproach.

In approaching any individual problem concerned with composition of milk it is always important to first inquire into the general health of the herd and particularly the incidence of mastitis.

Age

Experimental data so far indicate that with increasing age both the yield of the cow and the test of the various components decreases.

Some geneticists claim that the first two or three tests within the first lactation of a heifer are sufficient to indicate her potential production for the rest of her life time. The moral to be drawn from this observation is that it should be well worth while to maintain a fairly high percentage of younger cows in the herd.

It is not suggested that the herd should be predominantly first calvers, but the old adage "when you are on a good thing stick to it", does not apply to dairy cows. It does not pay to retain cows of 10 to 12 years of age in the herd.

Of the three points examined so far, breeding and the composition of the herd on an age basis are obviously long term considerations. The opportunities for better breeding are continually being enhanced by the provision of artificial breeding services, and through them, greater access to high producing dairy sires and the availability of the Pure Bred and Grade Herd Recording and Testing Schemes. These also are long term projects and cannot be expected to provide a quick remedy to the difficulty in an emergency.

Control of Mastitis falls more appropriately into the short term type of remedy provided the disease can be observed and proper veterinary attention given to the animals.

Feeding a Balanced Ration

Proper attention to the feeding of a balanced ration is the quickest method of raising the solids-not-fat level. This assumes, of course, that the cows have the genetic potential for high production, that they are free from disease, and that the composition of the herd is satisfactory.

What exactly is meant by a balanced ration? Here is a brief explanation:

A cow requires food for two major purposes—maintenance and production. Maintenance is the food required to maintain the normal bodily functions of the animal such as reproduction, breathing, walking and all other normal functions of life. Production, in the case of a dairy cow, means the production of milk. In a beef animal it would be the provision of meat.

When we speak of a ration for a cow we may have in mind either the food obtained from grazing, that obtained from a combination of grazing and supplementation with hay, silage, or concentrates, or we may even mean a ration consisting purely and simply of purchased materials fed in the bail.

In any case, the ration will contain the main essential food elements—fats, carbohydrates, and proteins. Each of these, individually and in combination helps serve the dual purpose of maintaining the animal and providing for its production requirements.

It has already been explained that by varying the proportion of these components of the ration it is possible to vary the composition of milk. We know also that if a ration is varied in quantity or quality, we can influence production of butterfat S.N.F. or the total number of gallons of...
milk—hence the ideal situation is that we should provide a ration for the animal which contains these components in just the correct proportions to allow her to produce milk of as normal a quality and composition as is possible and at the same time provide the maximum economic volume.

This simply means then that the ration should not contain too much of any particular food component. If it does, it is unbalanced and is harmful and wasteful. If it contains the components in the correct proportions (which have been determined from feeding experiments) that ration is then balanced, and highly profitable.

It is known that an actively growing well managed pasture in the flush of the season is in itself almost a complete and properly balanced ration for a cow producing up to three gallons a day. Inferior grazing will not provide for this level.

However, it is well known that under West Australian conditions, the pasture is in this form for only a relatively short period of the year, under dry land conditions. Depending on the district this time ranges from September to December.

At other times of the year, whether as dry or green feed, the pasture tends to be inadequate. This means that there is a need to add some components to it by means of supplementary feeding, in order that the final total food consumed by the animal for a day will constitute as nearly as possible a balanced ration.

It has been the standard recommendation of the Department of Agriculture to encourage dairy farmers to conserve hay and silage and to grow summer green feed for just this purpose.

However, this may not be enough. The amount of the balanced ration needed by the cow, and the total of its energy intake, vary according to the quantity of milk produced. The higher the production the higher the requirement.

Even actively growing well managed pasture of the subterranean clover-Wimmera ryegrass type or our conventional irrigation pasture are unlikely to provide for more than maintenance and three gallons of milk a day. Beyond this figure, the ration will need to be supplemented with concentrates.

Once the pasture has dried off, its ability to provide for continued production falls steeply. From this time until the break of the new season it seems likely that by the proper use of silage and hay it would be possible to supplement the ration enough for production of about two gallons a head a day.

As the cows can take in only a limited amount of dry matter each day, it is likely that the limit of this form of supplementation will be reached when silage is fed at the level of say 60 to 80 lb. per day, depending on the size of the animal, or in a combination of say 50 lb. of silage and 10 to 15 lb. of good quality meadow hay.

A cow which is capable of producing above two gallons at the time of the year mentioned is most unlikely to be able to give higher production figures if supplemented only by silage or hay. In fact, even if the cow were willing, she would probably not be capable of taking in any more dry matter in this form.

At this stage we must resort to feeding concentrates in the form of cereals, meatmeal, linseedmeal, rapeseedmeal or other protein and energy concentrates.

It is very difficult with these concentrates to obtain a quick rule of thumb method for balancing. In the final analysis, the decision rests with the farmer on a careful observation of the performance of his herd and the individual cows, to decide whether he should feed a little more or a little less of the supplementary ration available.

If success is to be achieved, the individual cow in any herd is the important unit. This means that the farmer must practice the principle of feeding the individual cow according to her production. He can only know this if he regularly records milk production, or preferably, is a member of the Grade or Pure Bred Recording Scheme.

CONCLUSION

These are just some of the known factors associated with variation in the composition of milk. If they are understood a little better and given more attention, with particular reference in the short term to the feeding of balanced milk.
rations throughout the whole of the lactation period of the cow, and by eliminating or reducing mastitis it is possible that the incidence of low solids-not-fat may be reduced.

Some years of association with the problem at a farm level has convinced the author that most cases require individual treatment and that few farmers have the technical "knowhow" to balance a ration. This means that improvement is unlikely to be rapid because of the lack of knowledge by the farmer on the one hand and shortage of trained extension personnel on the other.

A generalised statement on rations does not help very much. Some suggestions on the preparation of balanced rations appear as a separate article. A particular approach to individual circumstances is needed and where the farmer and the extension officer can co-operate much good can result.

REFERENCES


ACKNOWLEDGMENTS

The author desires to record his appreciation of the helpful suggestions made by Messrs. M. Cullity, S. Dilkes and G. Robinson, of the Dairying Division during the preparation of these notes.

F.A.O. CONFERENCE URGES STUDY OF PESTICIDES IN FOOD

The health, commercial, legal and scientific problems caused by the use of insecticides in agriculture are to be considered at a meeting of international experts to be called by F.A.O. next year.

Among the problems mentioned in a draft resolution unanimously adopted by the Conference of the Food and Agriculture Organization of the United Nations during its 11th session in Rome recently were the increasing apprehensions about the side-effects of pesticides on human beings and farm animals, misunderstandings concerning pesticide residues in food, differing government regulations on this matter which might interfere with international trade in agricultural products, the development of resistance to pesticides by insects, and the occupational hazards connected with the production, handling and use of pesticides in agriculture.

Under the terms of the resolution, which was introduced by Canada, F.A.O. is to call an inter-governmental conference in 1962 to study these problems in detail and establish close contacts with the World Health Organization, the International Labor Organization and other international agencies on all aspects concerning public health and occupational hazards. In addition, a committee on pesticides in agriculture, made up of a small number of international experts, would be established immediately.

The delegate of Canada, Dr. W. Hurtig, said it was necessary to ensure that pesticides could be used economically and safely. Stressing the need to facilitate the movement and shipment of food products between countries, he said that "differences in pest control problems, differing requirements for the amount of use of pesticides and differences in eating habits between countries," would make it impossible "to negotiate internationally acceptable numerical values for specific residue tolerances."

"However, if there is adequate exchange and agreement on the scientific and technical principles involved, the existence of numerical tolerances should not be an obstacle to the international movement of food. To achieve this goal, the scientists concerned must reach agreement on the principles, analytical methods and safety procedures that will be involved," Dr. Hurtig said.

[The Director of Agriculture (Dr. T. C. Dunne) was Australian delegate at the F.A.O. Conference].

Journal of Agriculture Vol 3 No 1, 1962
WHY BUY A USED CRAWLER?

Why take a risk on a second-hand machine which may or may not be reliable?

WHEN A BRAND NEW TRACK-MARSHALL COSTS SO LITTLE MORE!

Track-Marshall 50 with Hydraulic angle and tilt blade and Hydraulic ripper, operating in a gravel pit near Perth.

£3,600 TRACTOR COMPLETE (Equipment extra)

HUGE SAVING!

Track Marshall, Australia's top-selling crawler (with the outstanding features at a down-to-earth price) is used and recommended throughout Australia by Government Departments, Contractors, Shire Councils, Timber Getters, Graziers and Farmers.

- 62 h.p. with 14,500 lb. drawbar pull.
- Spare parts always available.

MOORE ROAD MACHINERY (W.A.) PTY. LTD.

Division of Malcolm Moore Industries Ltd.

80 GREAT EASTERN HIGHWAY, SOUTH GUILDFORD. PHONE 65 1231

Please mention the "Journal of Agriculture of W.A." when writing to advertisers

POST COUPON FOR DETAILS


NAME

ADDRESS

Present Unit

If school project, tick ( )

Journal of Agriculture Vol 3 No 1, 1962