

SOME FEATURES OF THE ROLE OF SUPPLEMENTARYCROPS IN DISTRICTS OF GOOD RAINFALL.

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For the purposes of this paper districts of good rainfall may be defined as ones in which there is a fairly well to well distributed annual rainfall of from about thirty-five inches upwards. In general in districts of lower rainfall the valuable role of supplementary crops on arable land is well recognised.

But relative to the districts of good rainfall, during recent years, opinions about the role of supplementary crops have not been stable. A few years ago the farmer who could say he had not a single acre under the plough was looked upon with a certain amount of envy by many others, as having attained a high degree of efficiency in grass farming, but against this, it seems significant that more recently, a gathering composed wholly of farmers discussed the considerations for and against supplementary cropping and declared that more supplementary cropping is advisable under their conditions. This happened among dairy farmers in Taranaki where conditions are more favourable than normally for the complete elimination of the plough in grass-farming, and where such a course might have been approved by the majority a few years ago.

The lack of general agreement and stable views as to the role of supplementary crops in districts of good rainfall is advanced as justification for this paper.

Pasture being rightly the main source of food in the districts under consideration it becomes necessary as a first step to ascertain how the supply of food directly available from pastures conforms, especially in respect to its quality and season of supply, with the requirements of a programme of efficient feeding. Let us first consider dairying, largely because in it, results of feeding can be measured more accurately and correlated with their causes more readily.

A basic question is "What constitutes evidence of efficient feeding in dairying?" Examination of farm-production results obtained from herd-testing and other records shows that as a rule, abnormally high annual production of herds or of individual animals is associated with a much more even production from month to month throughout the period of lactation than occurs in the case of average or poor production. The general position is exemplified in the following table in which the monthly fluctuations in production are shown as percentages of the December production. The figures on the left hand side indicate the fluctuations in the production of a herd of 76 cows, the average butterfat yield of which was 391.09 lb. The figures on the right hand side indicate fluctuations in the production of approximately 60,000 cows in a typical season in the Manawatu District. Corresponding figures for other principal dairying districts are to a large degree parallel:

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MONTHLY FLUCTUATIONS IN BUTTERFAT PRODUCTION EXPRESSED
AS PERCENTAGES OF THE DECEMBER PRODUCTION.

	Production of a good Herd of 78 cows.	Typical Production in Manawatu District.
August	89.9	31.9
September	92.1	60.7
October	108.3	90
November	106.7	103.4
December	100	100
January	90.1	83.2
February	86.7	72.7
March	79	65.3
April	69.1	55
May	58.2	32.8
	<u>880.1</u>	<u>695.0</u>

It is instructive to compare these data with the following given by Professor Eckles in the 7th edition of the Dairy Cattle and Milk Production relative to a well fed herd milked twice daily and calving within twelve months.

2nd month	100 (best month)
3rd month	92
4th month	86
5th month	82
6th month	75
7th month	71
8th month	69
9th month	64
10th month	52

In essential points there is much correspondence between these and the New Zealand data.

Table I. indicates that in the case of the herd of- high production to every 100 lb. of butterfat produced in December 397 lb. of butterfat were produced prior to December whereas in the case of average herds for every 100 lb. of fat produced in December 286 lb. were produced prior to December - a substantial discrepancy of 111 lb. of fat per cow for only four months,

Another significant common fact is exemplified in the actual monthly butterfat production of the herd of 78 cows. The Monthly production in pounds of butterfat of that herd was:-

TABLE II.

August	39.9
September	41.2
October	48.07
November	47.4
December	44.4
January	40.02
February	38.5
March	35.05
April	30.7
May	25.85
Total	<u>391.09.</u>

The important practical fact is that the highest monthly production, 48 lb. is but slightly over $\frac{1}{2}$ lb. of butterfat daily. This is an instance of a

common characteristic of the production of many animals yielding greatly above the average, i.e., the highest daily production ranges from $1\frac{1}{4}$ to $1\frac{1}{2}$ lb. of butterfat.

A companion fact of equal practical importance is that the highest daily production of a great many animals of relatively unsatisfactory animal production also ranges from $1\frac{1}{4}$ to $1\frac{1}{2}$ lb.

From these facts it may be contended that the inherent butterfat-producing capacities of the animals of really good and of unsatisfactory annual production often are essentially equal and that the difference in annual yield are due primarily to differences in the degree of efficiency in feeding. The circumstantial evidence provided by "good" years when the universal supply of feed naturally available is particularly good, strongly supports this contention. During periods of natural abundance of feed the production of herds customarily of low yield often approximates that of reputedly superior herds.

TENTATIVE STANDARDS FOR ASSESSING EFFICIENCY OF FEEDING.

Adopting this view, and assuming that herds of normally good dairy type are being handled, one is able to advance the following:

If the total production for the 10 months of greatest yield is less than 6 times that of the December production then feeding efficiency is poor.

If the production for the 10 months of greatest yield is 6 to 7 times that of the December production then average efficiency in feeding is attained.

If the production for the 10 months of greatest yield is 7 to 8 times that of December production then efficiency in feeding is above the average.

If the production for the 10 months of greatest yield is more than 8 times the December production then the efficiency in feeding is good and if more than 9 times, very good.

These standards are definitely tentative and changes in practice such as the adoption of earlier calving are probably bringing changes in our production which would call for revision of these tentative standards. The standards are applicable only to herds in which the greatest production takes place during August to May inclusive.

The practical bearing of the standards is that they teach that a cow with an inherent maximum producing capacity of $1\frac{1}{4}$ lb. of fat daily, i.e., 37.5 lb. of fat in the month of highest production, may range in annual production from under 225 to over 337 lb. of fat according to the efficiency in feeding.

Principally because of variation in the inherent producing-capacity of cows it will be easy to cite exceptions to the standards which are submitted merely as generalisations which give guidance as to seasonal requirements of feed under fully efficient dairy husbandry.

SEASONAL FEED REQUIREMENTS.

The variations in the feed requirements from month to month of the herd of 78 cows already mentioned have been calculated as being typical of the position when

good feeding -of cows of reasonably good type is practised. The variations are shown in Table III. The feed requirements have been assessed on the feeding standards given in the 1932 Edition of Physiology of Farm Animals by Marshall and Halnan:-

TABLE III,

MONTHLY FLUCTUATIONS IN FEED REQUIREMENTS OF HERD OF 78

COWS CONSIDERED IN TABLE II: ,

August	93
September	103
October	106
November	105
December	100
January	94
February	91
March	85
April	79
May	71
June	48
July	48

A ration 50% above maintenance has been allowed during June and July to provide for recuperation - a "steaming up" during the period of no production of butterfat, .

SEASONAL PRODUCTION OF FEED BY GRASSLAND IN DISTRICTS OF

GOOD RAINFALL.

The climatic conditions at Marton result in growth of grassland similar in essential features to that which takes place in the main districts relative to which the role of supplementary crops is being considered. Work done at Marton and recorded by Hudson, Doak and McPherson in Bulletin 31 of the New Zealand Department of Scientific and Industrial Research provides data which enable the seasonal fluctuations in feed-production under Marton conditions to be ascertained accurately, Table IV which indicates the average position for a period of three years is based on data from Appendix A of Bulletin 31, and relates to the yield of leafy green grass from an unmanured somewhat poor pasture of which ryegrass, white clover, sweet vernal., catsear, and Poa annua were the main constituents .

TABLE IV.

MONTHLY YIELDS OF LEAFY GREEN GRASS EXPRESSED AS PERCENT.

AGES OF THE DECEMBER PRODUCTION.

August	24
September	68
October	102
November	101
December	100
January	94
February	35
March	15
April	14
May	11
June	10
July	11

The table shows that for every 100 lb. of green grass produced in December, 585 lb. were produced throughout the whole year and that of this, only 188 lb. were produced outside of the period October to January inclusive. In brief, 68% of the whole year's supply of feed was produced in 4 months and only 32% of the annual feed supply in the remaining eight months. It should be kept in mind that this was the result when the utilisation of the grassland was designed, as far as was deemed practicable, to level out the production of the pasture from season to season.

Some may think that a more even supply of feed would be obtained from a better type of pasture judiciously topdressed; Marton results give information on this point. These results which are summarised on page 58 of Bulletin 31 relate to a pasture in which perennial ryegrass and white clover were the dominant species. In 1929-30 when this pasture was treated with 4 cwt. of superphosphate annually, 77.5% of the yield occurred in the October to January period and 22.5% in the remainder of the year. In the following year, though the periods do not correspond exactly with those already cited, there seems to have been some improvement in the seasonal distribution of feed but the feed still remained not so evenly distributed as was that of the poorer manures pasture. These results which refer to instances in which the superphosphate was applied in the spring are supplemented by others in which it was applied in the autumn or the summer and that without satisfactorily amending the position. Actually topdressing of relatively good pasture substantially broadens the absolute gap between winter production, on the one hand and late spring or early summer production on the other hand. A typical instance is:

YIELD OF GREEN HERBAGE IN LB. PER ACRE DAILY.

	3 cwt. of super.		
	No manure.	Summer Application.	Autumn Application.
(a) 12th May to 28th August.	9.2	20.9	24.6
(b) 7th October to 17th October..	120.2	185.6	194.5
Gap between winter and spring Production.	111	164.7	169.9

The immediately preceding data illustrate a point of fundamental importance which seems not always to be clearly understood, It is that, omitting special swards subsequently mentioned, as a rule, the better the pasture and the greater its vigour the larger is the difference between the supplies of feed produced directly in the season of high production and in the season of low production.

COMPARISON BETWEEN SEASONAL FEED SUPPLY FROM PASTURES AND SEASONAL FEED REQUIREMENTS.

From the foregoing data one obtains the following facts which, taken together, are of considerable moment in practice.

1. Under utilisation of pastures designed to spread the supply of feed as evenly as possible, from 68 to 77.5% of the year's production of feed took place in October - to January 2nd from 22.5 to 32% in the remainder of the year,

2. An efficiently fed herd of good production required 39.52% of the whole year's feed supply in the period October to January and 60.5 per cent during the remainder of the year.

In short, the seasonal supply of feed is broadly the reverse of the seasonal requirements of feed.

REMEDYING THE POSITION.

There are two main schools of thought relative to the method of remedying this position.

One advocates dependence mainly on ensilage and hay making and frequently suggests also the exploitation of such auxiliary practices as nitrogenous topdressing and the use of special pastures to give feed when pastures normally fail, e.g., special paspalum or cocksfoot and red clover paddocks for summer and special subterranean clover paddocks for winter and early spring. Though definite knowledge about the general utility and economic standing of these auxiliaries seems to be scant it may be granted that they could be employed at times with advantage and this more frequently than they have been employed in the past.

Relative to the role of ensilage the following statements are submitted as a summary of the position:-

1. In districts of good rainfall on the majority of the dairy farms devoted dominantly to pasture ensilage should be practised and it could also be introduced advantageously into the work of a much greater number of sheep farms than now practise it.

2. The mid-January to mid-March period widely and often is a critical one for which silage of the sort commonly made is far from ideal as a supplement to pastures in the rations of dairy cows.

Further, it is extremely doubtful whether there is any justification for an attempt to induce farmers generally to produce a different type of silage - one made from much more leafy and immature herbage would be needed to meet the late summer feed-requirements in dairying.

That supplies of silage of the type available have distinct limitations as a summer feed for dairy cows was rather freely illustrated during the 1935 summer, when, because of the dry season, greater use than usual was made of it.

3. The most inexpensive way of harvesting the pasture crop is that which dispenses with special labour and equipment, e.g., grazing.

4. The least wasteful way of harvesting the grass crop is grazing - account has to be taken of the wastage due to decay, fermentation, leaching, etc., in both ensilage and hay-making.

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5. Grazing ordinarily is more compatible with the continued welfare and possible improvement of the swards on an economic basis.

6. Even if silage were entirely suitable as a supplementary feed, it would not be at all easy to build up reserves of it adequate to give a full measure of safety in the event of successive unfavourable seasons.

The second school of thought allots to special crops such as mangels, lucerne, chou moeller, an important place on many farms in districts of good rainfall, in the task of suitably levelling out the supply of feed from season to season. At the same time normally an important place in the task is also given to ensilage and hay.

Properly planned special cropping provides a supply of feed both adequate in quantity and suitable in quality throughout the year. There is no conclusive evidence that generally this result can be obtained satisfactorily in any other way over a series of years.

Judicious special cropping provides an opportunity for the replacement of inferior pastures. Often the fact that special cropping necessitates the breaking up of pastures is advanced as an objection to, such cropping and this even in relation to farms, on which more breaking up of pastures than is taking place is definitely advisable if the most economic production, irrespective of the influence of cropping, is to be obtained from the pastures. This position has been intensified, by recent advances in strains of pasture plants. Even in districts in which grass-farming is at the highest pitch of efficiency farms on which no pastures could be resown with advantage are extremely rare. Hence any setting of the cost of replacing pastures as an item against special cropping is largely the creating of a bogey. In this connection it stems highly significant that in one of the best grassland districts in the Dominion the farms which have the greatest amount of really good pastures stand out in respect to the amount of arable cropping carried out on them.

When a search is made for the explanation of good pastures, with cropping the line of thought necessarily travels in a circle: the better the pastures the more the need for special cropping or some alternative to balance the seasonal supply of feed; the more special cropping, the more opportunity of basic improvement of pastures.

Suitable supplementary cropping, is the necessary basis of the most effective and profitable development of the increasingly important side-line, pig-flesh production. This position will be intensified with any change over from the production of porkers to that of baconers. Often simple extension of the area required for dairy cattle in respect to such crops as mangels, chou moellier, swedes, carrots and lucerne would assist the pig-feed position greatly. The growing for pigs of additional crops such as barley and peas is often well justified.

Special cropping also reacts favourably in the important task of breeding replacement stock.

It is advanced against cropping that it involves additional 'outlay in equipment and horses' and 'the keep of working horses.. Probably this is of less moment than is sometimes thought. In the 550 North Island dairy farms reviewed in the report of the Dairy Industry Commission there were 2.61 working horses per farm. Incidentally there were more horses per farm and fewer acres of farm per horse in the districts in which least arable cropping was done. In the different subdivisions of the Auckland Land District there was 1 horse to each 38 to 43 acres; in Taranaki there was 1 horse to each 50 acres; over all the farms there was 1 horse to each 47½ acres. Against this position is to be set the fact that in the Auckland Land District 1 acre of arable crop was grown to every 11 dairy cows, whereas in Taranaki there was 1 acre of arable crop to every 9 cows.

The average capital value of the implements per farm is enlightening. It did not differ materially from district to district. It amounted to £157 per farm. This value seems sufficient to meet the needs of the relatively modest arable cropping programme desirable for herds of 50 to 70 cows.

It would seem then, that in respect to horses, and implements, arable cropping generally presents no substantial difficulties.

The foregoing considerations either singly or together do not form a complete case either for or against the advisability of supplementary cropping. In fact some of the decisive considerations have not been mentioned.

One of these is labour. The Position summed up is: If supplementary cropping can be done by the labour already employed regularly on a farm without bringing about neglect of some other essential farm task, then it will prove profitable to do the supplementary cropping. But as the amount spent directly on hired labour for cropping increases the profit from the cropping tends to decrease until a point may be reached when a greater net profit would be obtained by dispensing with the cropping even though the cropping itself is profitable. As an instance one may cite two similar Manawatu farms of 60 acres. One was wholly in grass. On the other production was driven up 35 to 40 lb. of fat an acre by cropping. The returns from the additional butterfat largely were eaten up in costs of cropping which necessitated the employment of an additional adult farm hand. But such cases are not general. Further, and this is of great practical importance, they can be obviated usually if the additional labour is fully and skillfully utilised. In the case cited, if the pig production potentialities of the place were exploited to the further extent that the additional labour allowed, then the additional pig returns would have recouped much of the additional labour outlay and thereby set the position right.

On the farm wholly in grass one man with a small amount of help from his family handled about 40 cows and cropping would have necessitated an additional adult. While such a farm is of importance as an illustration of the important bearing of labour considerations it seems well to emphasise that it is not illustrative of the general position. This may be gleaned from the fact that the

number of cows generally handled per labour unit is approximately 21 (Report Dairy Industry Commission) With such a labour-herd relation, time for cropping normally is available.

A second factor which determines the advisability of supplementary cropping embraces soil and weather conditions upon which reliable and economic yields depend. One illustration of this is the sandy Wellington-West Coast belt; One cannot but approve of the practice of some farmers of this belt who employ lucerne for summer and subterranean clover for winter as substitutes for arable cropping and this with considerable success. Another important illustration is provided in parts of North Auckland where there is a combination of heavy soils and abundant rainfall which militate against constant success with arable crops.

A third important factor determining the advisability of arable cropping is the weed position, e.g., Californian thistle, may be the deciding factor,

Much of what has been said up to this stage has referred to dairying. Dairying certainly presents the stronger case for special arable cropping - this because dairying is faced not only with, a critical winter-early-spring period as is sheep-farming, but also with a critical late summer period during which the sheep farmer obtains much relief by disposal of say fat lambs.

But the ultimate success of much sheep farming, as of dairying, is founded upon the milk supply and this being so, the feed requirements in sheep-raising parallel in essential features, those of dairying; the control of parasites of sheep enters as an additional factor of considerable moment. Hence in practice a close association between special arable cropping and uniform success in sheep raising is often to be found.

To sum up:

1. Efficient feeding means economical production, e.g., without improving the quality or increasing the size of many herds production could be increased 25 to 50 per cent merely by better feeding.

2. When feeding is efficient the feed directly available from grassland diverges greatly during specific periods from the feed requirements during those periods.

A measure of the gap between feed supply and feed requirements is provided in the following facts:

(i) under good utilisation from 68 to 77.5% of the year's grassland production takes place during October to January inclusive; 22.5 to 32 per cent during the remainder of the year.

(ii) 39.5 per cent of the feed requirements of a good herd efficiently fed arise in the October-January period and 60.5 per cent in the remainder of the year.

3. Normally topdressing, excluding nitrogenous topdressing, tends to make the gap wider instead of narrower.

4. Similarly, improvement of swards tends to enlarge the gap.

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5. Ensilage alone is far from an ideal means of remedying the position.

6. The introduction of special purpose pastures, and of nitrogenous topdressing at times may be advantageous.

7. Suitable special cropping, as a rule, supplemented by ensilage and haymaking serve well to bridge the gap.

A clear understanding of the role of supplementary crops involves realising

- (a) special crops are a way to pasture improvement, and hence their whole cost is not attachable to the crops themselves.
- (b) pasture-improvement intensifies the need for special provision of feed.
- (c) extension of special cropping would facilitate the fuller exploitation of pig-keeping and the successful raising of replacement stock.
- (d) as a rule supplementary cropping would not call for substantial outlay on implements or working horses,
- (e) as a rule the labour regularly employed is sufficient.

The facts as reviewed provide a definite indication of profitable scope for expansion of special arable cropping to supplement grassland in districts of good rainfall.

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