INVESTIGATION OF FEED FLAVOUR IN CREAM AND BUTTER.

PART I.-FEED FLAVOUR IN. CREAM.

TRIALS CONDUCTED AT MASSEY AGRICULTURAL COLLEGE, PALMERSTON NORTH, BY MEMBERS OF THE DAIRY RESEARCH INSTITUTE AND PLANT RESEARCH STATION, SEASON 1935-36.

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THE preliminary field trials on the influence of pasture- species upon cream flavour conducted during the 1934-35 season and reported by Levy(l) have been continued on a more comprehensive scale during the 1935-36 season, and the results are presented in this bulletin.

The work has been conducted along two distinct lines :-

(1) By grazing cows on specially laid down pastures consisting of the following species : (a) pure perennial rye-grass, (b) perennial rye-grass and white clover, (c) pure Italian rye-grass, (d) Italian rye-grass-grass and red clover.

(2) By feeding indoors to stalled animals known quantities of freshly cut feed produced from pure sowings of the following grasses and clovers : perennial rye-grass, Italian rye-grass, white clover, broad red clover, Montgomery red clover, subterranean clover, and suckling clover.

The details and-results secured from these trials are- set -out below.

SECTION 1.—PADDOCK GRAZING TRIALS.

The sowings for these trials were made in the autumn of 1935. Each sowing was later subdivided into six small paddocks of ½ acre each so as to enable a system of rotational grazing to be adopted. The composition of the pastures in each paddock prior to grazing was determined regularly throughout the trial by plucking a composite sample to the approximate

(1) LEVY : M.Z. Journ. of Agric., 50, March, 1935.

'height that the cows were grazing. The plucked sample was then dissected and the weight of each species determined. Determinations of the dry matter and of the chemical composition of the feeds were made by the Plant Research Chemist, Mr. B. W. Doak. Throughout, the trial, which extended from the 7th October to 8th March, pasture-growth conditions were good, and a plentiful and succulent supply of feed was maintained.

Selection of Cows.

Two-year-old heifers were employed in the experiment,. They were selected from the Massey College dairy herd after having been tested for milk-yield, fat percentage, and freedom from individual cream-flavours and udder-infection. A pedigree Ayrshire, a pedigree Jersey, and a grade Jersey were used for each pasture sown.

Shed Technique.

From the commencement of the grazing trials up to the 1st November the heifers were machine-milked in the Massey College milking-shed, and subsequent to this date they were hand-milked in a new shed specially erected for research into the quality of milk and cream in relation to feeds fed, and later for animal nutrition investigations. Samples of the creams from each of the four groups of cows were taken at every milking.

Grading of Cream.

The samples were graded for intensity of feediness at the Massey College dairy factory by E. Sawers and J. A: Singleton, cheesemaker and butter-maker respectively, about five hours after the morning milking. The scale of points adopted was on an O-10 basis, but the points allotted within this scale are not considered comparable to those allotted within the same scale in the Waikato. On the Manawatu standards for cream, 3 points in the scale adopted would represent the division point between first-grade and finest-grade cream. (To avoid the occurrence of decimals the grading figures in the tables of results have been multiplied by 10.)

Results of Grazing Trials.

The results of the grazing trials are set out in Tables I to V. In the botanical analyses it will be noted that certain percentages of species other than those sown are recorded. These volunteer species are difficult to eliminate in their entirety from the sward. It will be observed (Table I) that the comparatively pure perennial rye-grass feed has given a cream practically free of any feed flavours, a trace being recorded on four occasions only throughout the duration of the trial.

In the case of the perennial rye-grass and white clover sowing it will be noticed (Table II) that in the early stages the pasture was dominantly rye-grass owing to the normally much slower establishment of white clover. During this early dominant rye-grass phase the feed flavour intensity was low and rose later as the white clover increased in the sward during January and February. By this time, however, the season was well advanced and the feed-flavour intensity remained comparatively low compared with what would have been expected had the white clover been as

dominant in October and November as it was in January and February. No explanation why any one species should be more flavour-producing at one season than at another is offered at this stage in the investigation.

TABLE I.—SHOWING RELATIONSHIP BETWEEN A PASTURE OF COMPARATIVELY PURE PERENNIAL RYE-CRASS ATD FEED FLAVOUR IN THE CREAM FROM Cows GRAZING THEREON.

100 = very strong feed flavour. 0 = no feed flavour.

Period.	Average Percentage Composition of Pasture.			Average Intensity of Feed Flavour.		Maximum Intensity of Feed Flavour recorded.		Number of Times Flavour produced.	
	Perennial Rye-grass.	White Clover.	Other Species	Night.	Morning.	Night.	Morning.	Night.	Morning.
Oct. 7–12 .	94	.	6	0	0	0	0	0	0
Oct. 13–19 ..	97	..	3	0	0	0	0	0	0
Oct. 20-29	97	..	3	0	0	0	0	0	0
Oct. 30–Nov. 9 ::	96	..	4	0	0	0	0	0	0
Nov. 10-19 ..	98	..	2	0	0	0	0	0	0
Nov. 20-29 ..	97	..	3		0	0	0	0	0
Nov. 30–Dec. 8 ..	97	..	3	8	0	0	0	0	0
Dec. 15-22 ..	99	..	1	0		0	0	0	0
Dec. 28–Jan. 6 .	98	Trace	2	0	8	0	0	0	0
Jan. 7-16 ..	98	,,	2	0	0	0	0	0	0
Jan. 17–26	97	,,	3	1	0	5	0	2	0
Jan. 27–Feb. 7 ::	98	1	1	1	0	5	0	2	0
Feb. 8-17 ..	97	1	2	0	0	0	0	0	0
Feb. 18–27 ..	96	2	2		0	0	0	0	0
Feb. 28–Mar. 8 ..	97	1	2	8	0	0	0	0	0

TABLE II.—SHOWING RELATIONSHIP RETWEEN a PASTURE SOWN TO PERENNIAL RYE-CRASS AND WHITE CLOVER AND THE FEED FLAVOUR IN THE CREAM FROM COWS GRAZING THEREON.

100 = very strong feed flavour. 0 = no feed flavour.

Period.	Average Percentage Composition of Pasture.			Average Intensity of Feed Flavour.		Maximum Intensity of Feed Flavour recorded.		Number of Times Flavour produced.	
	Perennial Rye-grass.	White Clover.	Other Species	Night.	Morning.	Night.	Morning.	Night.	Morning.
Oct. .7-12 ..	92	6	2	0	0	0	0	0	0
Oct. 13-19 .	95	3	2	2	0	3	0	2	0
Oct. 20-29 ..	94	3	3	1	0	3	0	2	
Oct. 30-Nov. 9 :.	93	5	2	0	0	3	0	1	8
Nov. IO-19 ..	97	2	1	0	0	0	0	0	0
Nov. 20-29 ..	90	6	4	2	0	10	0	2	0
Nov. 30-Dec. 8 ..	91	5	4	4	0	20	0	2	0
Dec. 9-14 .	94	3	3	2	0	10	0	1	0
Dec. 15-22 ..	87	10	3	3	0	10	0	3	0
Dec. 28–Jan. 6 ..	80	17	3	1	0	10	0	1	0
Jan. 7-16 .	48	49	3	10	0	30	0	8	0
Jan. 17-26 ..	77	20	3	5	0	20	0	7	0
Jan. 27–Feb. 7 ..	53	41	6	13	0	30	0	8	0
Feb. 8–17 ..	52	44	4	10	0	20	0	9	0
Feb. 18-27 ..	48	49	3	3	0	10	0	3	0
Feb. 28–Mar. 8 ..	46	48	6	4	0	20	0	4	0

TABLE III.—SHOWING RELATIONSHIP BETWEEN A PASTURE SOWN TO PURE ITALIAN "RYE-GRASS" AND THE FEED FLAVOUR IN THE CREAM FROM COWS GRAZING THEREON.

100 = very strong feed flsvour. 0 = no feed flsvour.

Period.	Average Percentage Composition of Pasture.			Average Intensity of Feed Flavour.		Maximum Intensity of Feed Flavour recorded.		Number of Times Flavour produced.	
	Italian Rye-grass.	Suckling Clover	0 ther pecies*	Night.	Morning.	Night	Morning.	Night.	Morning.
Oct. 7–12 .	96	1	3	0	0	0	0	0	0
Oct. 13-19 ..	95	2	3	2	0	10	0	2	0
Oct. 20-29	97	2	1	1	0	15	0	3	0
Oct. 30–Nov. 9 .	95	3	2	1	0	16	0	1	0
Nov. 10-19 ..	95	3	2	2	0	10	0	3	0
Nov. 20–29 .	89	9	3	0	0	0	0	0	0
Nov. 30-Dec. 8	93	6	1	3	0	10	0	3	0
Dec. 14-22 ..	95	4	1	0	0	0	0	0	0
Dec. 28–Jan. 6 .	88	1	11	0	0	0	0	0	0
Jan. 7-16 .	86	0	14	0	0	0	0	0	0
Jan. 17-26 .	83	0	17	2	0	10	0	2	0
Jan. 27–Feb. 7	72	0	28	3	0	10	0	4	0
Feb. 8–17 .	56	0	44	1	0	5	0	1	0
Feb. 18-27 .	49	0	51	1	0	5	0	1	0

* Mainly volunteer white clover and docks.

TABLE IV.—SHOWING RELATIONSHIP BETWEEN A PASTURE SOWN WITH ITALIAN RYE-GRASS AND BROAD RED CLOVER AND THE FEED FLAVOUR IN THE CREAM FROM COWS GRAZING THEREON.

100 = very strong feed flavour. 0 = no feed flavour.

Period.	Average Percentage Composition of Pasture.			Average Intensity of Feed Flavour.		Maximum Intensity of Feed Flavour recorded.		Number of Times Flavour produced.	
	Italian Rye-grass.	Red Clover.	Other Species	Night.	Morning.	Night.	Morning.	Night.	Morning.
qct. 7–12 .	76	21	3	2	0	16	0	1	0
Oct. 13-19 .	68	25	7	11	0	25	0	5	0
Oct. 20-29	63	27	10	1	0	16	0	1	0
Oct. HO-NOV. 9	59	34	7	1	0	16	0	1	0
Nor. IO-19 .	61	33	6	3	0	10	0	4	0
Nov. 20–29 ..	53	41	4	9	0	20	0	8	0
Nov. 30-Dec. 8 ..	46	48	6	6	1	20	5	4	1
Dec. 9–14 ..	56	40	4	2	0	10	0	1	0
Dec. 15-22 ..	50	47	3	5	0	10	0	5	0
Dec. 28–Jan. 6 ..	33	63	4	6	0	20	0	6	0
Jan. 7-16 .	13	83	4	15	0	30	0	8	0
Jan. 17-26 ..	12	84	4	5	0	20	0	5	0
Jan. 27–Feb. 7 ..	13	84	3	15	0	30	0	9	0
Feb. 8-17 ..	6	86	8	7	0	20	0	6	0
Feb. 18–27 ..	6	85	9	2	0	5	0	4	0
Feb. 28–Mar. 8 ..	6	88	7	3	0	10	0	4	0

Comparing the cream produced from the pure Italian rye-grass sowing (Table III) as against the Italian rye-grass and red clover (Table IV), the same general argument holds as in the case of pure perennial rye-grass and perennial rye-grass and white clover. There is a greater intensity of

feed flavour in the Italian rye-grass red-clover combination than in the Italian> rye-grass alone. The trace of flavour detected at: times in the Italian sowing is undoubtedly due to volunteer suckling clover and white clover that appeared in this crop. In January and February the percentage of volunteer white clover increased to-approximately 50 per cent. of the feed. While the Italian rye-grass remained dominant up to approximately the middle of November,' in the Italian - red-clover block a trace only of feed flavour was detected during this period, and the small amount of flavour detected was considered to be of a " cowy " nature rather than typical feed flavour. From the period when the red clover dominated the Italian— from the end of December to the 9th March-feed flavour increased, although under ordinary farming conditions this period is generally one of low feed-flavour intensity.

Throughout the trials certain anomalies existed. Variations in the weather conditions, stage and state of growth of the herbage, time of consumption of feed prior to milking, the presence or absence of small percentages of extraneous plants, the peculiar individuality of the animal and digestive upsets which may be associated with changes in the animal's diet-all these tend to create fluctuations from the normal relationship which appears to exist between feed taint and the bulk of clovery feed eaten. In connection with sudden changes of diet during the trial the following data would appear significant. Three cows that had been grazing on a diet of 94 per cent. Italian rye-grass were changed on to a feed consisting of 55 per cent. Italian rye-grass and 43 per cent. of red clover. On the first day on this feed 4 points of feed flavour were recorded, and on the second day on the same paddock 1· point only of feed flavour was recorded. On the following day the cows were changed to another paddock consisting of 60 per cent. Italian rye-grass and 36 per cent. red clover. Again 4 points of feed flavour were recorded, with a fall on the second day to 1 point, and on the third day to 0 points. On the fifteenth day they were again changed on to 95 per cent. Italian rye-grass diet and 0 points for feed flavour were recorded. During this same period the three heifers that had been continually on a diet of 55 per cent. Italian rye-grass and 43 per cent. red clover gave an average of 0·5 points. When they were changed to another paddock of approximately the same botanical composition for three days they gave 0·3 points of feed flavour, nor did they alter when frequent changes from one paddock to another were made—*i.e.*, accustoming the cow to a particular feed would appear to cause a steadying-up in feed-flavour intensity, and, conversely, putting cows on to feeds that vary greatly in the proportion of clover tends to produce abnormally high-feed flavour on the first day that the cows go on to the clovery paddocks,

The grazing trials reviewed above, despite anomalies that undoubtedly exist, serve to show that neither perennial rye-grass nor Italian rye-grass dominant pastures cause feed flavours, whereas the presence of white clover and red clover in the pasture as a dominant or co-dominant results in a feedy flavour being imparted to the cream. In the above trials it will be observed that, owing to the pastures being newly sown in the autumn preceding the trial, clover dominance did not take place until after December, when feed flavours normally fall in intensity. It is to be expected in the coming season's trial, when the now well-established clover comes away with the grass in the early spring, that greater feed-flavour intensities will be recorded, during October and November.

SECTION 2.—STALL-FEEDING TRIALS.

The stall-feeding trials extended over three main periods : (a,) A period when all six cows were fed on identical rations for twelve days to permit a study of cow individual&y and to allow time for the animals to adjust themselves to stall-feeding conditions ; (b) the feeding to individual cows of pure feeds of various individual species, one cow remaining on the standard grass ration adopted in the early adjustment phase in period (a). The trial for period (b) extended over twenty days, and it is held that this time on any one feed is sufficiently long to give a very reliable index of the feed-flavour intensity any one food is likely to produce. After the special feeds had been fed for twenty days all cows were given a uniform ration in order to check again the influence of individuality of the animals on the incidence of taint, (period (c)).

During period (a) the cows were fed to capacity on a ration of Italian rye-grass, or a mixture of perennial rye-grass and Italian rye-grass. During this period no feed flavour of any description could be detected in the cream of any one of the six cows.

Period (b) was commenced by giving each individual cow a pure ration of ,a single clover species, one check cow still being retained on the mixture of perennial rye-grass and Italian rye-grass as in period (*a*). It was not possible to produce absolutely pure stands of certain of the clovers, and during the early days of the trial rather many weed impurities were present owing to the slow establishment of some species. The botanical analyses of these "pure " feeds are shown in Tables V to X. Digestive troubles and upsets to the animals through " blowing " rendered modification of the ration necessary for certain of the clover species throughout the trial. In all cases, however, the species under trial was kept dominant in the ration, and where mixtures were necessary care was taken to ensure that the added feed was in itself non-taint-producing.

FEEDING PRACTICE.

The following species of grasses and clovers were sown out, as pure sowings : Perennial rye-grass, Italian rye-grass, white clover, broad red clover, Montgomery red clover, subterranean' clover, and suckling clover. Certain of them, owing to their slowness in establishment and low competitive nature as a pure sowing, became contaminated with volunteer species of which *Poa* annua and toad rush (*Juncus* bufonius) were the chief. These feeds were cut with the scythe, packed in waterproof bags, and transported from the area to the stable in a small handcart. The feed was cut as required, care being taken that it was fed in as fresh and natural a condition as possible. The cows at first were fed five times, and, later, four times a day, the quantity fed and the residue remaining being weighed. The hours of feeding were approximately 8 a.m., 10 a.m., 12 noon, 3 p.m., and 6 p.m.; latterly one feed at 11 a.m. replaced the 10 a.m. and'noon feeds.

SELECTION AND GENERAL MANAGEMENT OF TEE COWS.

Six four-year-old Jersey cows were employed in the trial.

For the period of the experiment the six cows were stall-fed in a stable constructed adjacent to the milking-shed. A feed-bin was provided for each stall and was so built as to allow of controlled feeding of the cows. The cows were bedded with shavings and straw, care being taken that none of the straw was available as feed. They were groomed twice daily and were exercised in the stable yard. When clover was being fed some trouble was experienced with scouring and " blowing," and a constant watch had to be kept to avoid serious consequences.

MILKIWG-SHED TECHNIQUE AFD GRADING.

The six cows were hand-milked in the special Dairy Research Institute dairy shed. The sampling practice and the. treatment and grading of the samples were identical with those already described in Section 1. The milk of the cows was separated and the cream was graded individually.

DETERMINATION OF SPECIES COMPOSITION OF RATIONS.

The green-weight-analysis method was employed, samples being taken from the actual feed-bins of the cows. The work entailed rendered it -impossible to analyse every feed in this manner, but as many samples as pdssible were examined, and these give a reliable average of the composition if applied over a period of time. The correctness of applying such an average figure to the ration of each individual day is obviously dependent upon the variability of the composition of the food fed. Actually, however, there was little' variation in the herbage as cut. The slight possible variations from the actual composition as given by the average percentage figure, 'moreover; are in all probability too small to be a factor giving rise to misleading conclusions. Accordingly, the average figures have been employed in the analysis of daily data when necessary.

In 'addition, dry-matter determinations and chemical analyses of the daily rations have been carried out as in the grazing trials.

RESULTS OBTAINED FROM THE STALL-FEEDING TRIALS..

It will be noted in reference to Table V that cow No. 13 feed on Italian and/or perennial rye-grass produced a cream practically free of feed-flavour, and what flavour *was* produced can be attributed to the small percentage of suckling clover and white clover present in the feed fed.

TABLE V.—FEED CONSUMED AND FLAVOUR PRODUCED BY Cow No. 13 BETWEEN 12TH NOVEMBER AND 1ST DECEMBER. COW FED ITALIAN AND/OR PERENNIAL RYE-GRASS.

100 = very strong feed flavour. 0 = no feed flavour.

Date.	Composition of Feed.				Flavour produced		Notes on Feed consumed.
	Perennial Rye-grass.	Italian Rye-grass.	Other Species.	Percentage of other Species in Total Feed.	Night.	Morning.	
	lb.	lb.	lb.				
Nov. 12 . .	62	61	1	0·8	0	0	Trace suckling clover and weeds.
,, 13 . .	64	58	6	4.7	0	0	Ditto.
,, 14 . .	84	76	8	4·7	0	0	,,
,, 15	94	85	Trace	. .	0	0	
,, 16 ::	84	42	,,		0	0	
,, 17 ..	68	68	,,	.	0	0	
,, 18 . .	60	72	,,	. .	0	0	
,, 19 . .	44	59	,,	.	0	0	
,, 20 ..	113	20	,,	. .	0	0	
,, 21 ...	79	35	,,	..	0	0	
,, 22 .	.	97	,,	. .	0	0	
,, 23 . .	.	113	,,	.	0	0	
,, 24 . .	. .	94	9	9	10	0	7 per cent. suckling clover, also trace of white.
,, 25 . .	. .	103	10	9	10	0	Ditto.
,, 26 . .	. .	96	9	9	0	0	,,
,, 27 . .	. .	96	9	9	10	0	,,
,, 28	. .	87	9	9	10	0	,,
,, 29 ::	. .	107	11	9	10	0	,,
,, 30	. .	116	11	9	10	0	,,
Dec. 1-2 ::	. .	93	9	9	0	..	,,
Averages . .	. .	..		3.8	3.2	0	

Table VI sets out the position in the case of cow No. 14. fed, over the given period with a ration* dominantly suckling clover (*Trifolium* dubium). It will. be noted that this feed was not particularly pure owing to the great difficulty of hand-weeding large enough blocks to furnish sufficient feed of a low-producing species of the nature of suckling clover. The feed was for the greater part 64 per cent. suckling clover, and this proportion is rarely ever exceeded in the field under grazed pasture conditions. It will be obvious at a glance that. suckling clover produces an intense feed flavour in cream when fed during the day without any considerable period elapsing between time food is, consumed and. milking-time. It is obvious, also, that where a sufficiently long period is given prior to milking, as in the case of the morning dream, the animal itself is able to eliminate all feediness from the milk produced.

TABLE VI.—FEED CONSUMED AND FLAVOUR PRODUCED BY Cow No. 14 IN THE PERIOD 12TH NOVEMBER TO 1ST DECEMBER. COW FED SUCKLING CLOVER.

100 = very strong feed flavour. 0 = no feed flavour.

Date.	Composition of Feed.					Flavour produced.		Remarks on Feed consumed.
	Perennial Rye-grass.	Italian Rye-grass.	Suckling Clover.	Other Species.	Percentage of Suckling Clover in Total Feed.	Night.	Morning.	
	lb.	lb.	lb.	lb.				
Nov. 12 ..	44	43	38	22	26	40	0	Other species include *Juncus bufonius* and *Poa annua* dominantly, with traces of white clover, brown top, Italian rye-grass, sweet vernal, mouse-eared chickweed, shepherd's purse.
,, 13 ..	30	27	78	47	43	60	0	
,, 14 ..	..	.	131	73	64	50	0	
,, 15 ..	..	..	129	73	64	40	0	
,, 16 ..	..	..	83	47	64	30	0	
,, 17 ..	..	..	134	76	64	50	0	
,, 18 ..	..	..	134	75	64	40	0	
,, 19 ..	..	..	111	65	64	0	0	
,, 20 ..	.	..	102	57	64	40	0	
,, 21 ..	..	.	118	67	64	40	0	
,, 22 ..	..	.	111	62	64	30	0	
,, 23 ..	..	..	108	61	64	40	10	
, 24 ..	..	..	121	69	64	30	0	
,, 25 ..	..	..	118	67	64	40	0	
,, 26 ..	..	..	140	79	64	30	0	
,, 27 ..	..	..	128	72	64	40	0	
,, 28 ..	..	.	113	64	64	50	0	
,, 29 ..	.	.	111	63	64	50	0	
,, 30 ..	..	..	117	66	64	30	0	
Dec. 1 ..	..	..	85	48	64	20	..	
Averages. .	..	..	..	.	..	37·5	0·5	

Table VII sets out the position in the case of COW No. 15 fed on a diet consisting largely of Montgomery red clover. Owing to the fact that this clover comes away late in the spring there was a high percentage of impurities in the early period of the feeding trial. It was necessary to add a certain amount of rye-grass to the-ration to prevent "blowing" and to improve palatability owing to the presence of toad rush. Towards the end of the trial the Montgomery red clover was relatively pure. It will be noted that a fairly consistent feed flavour was produced, but that it was not as intense as that produced by suckling clover. The irregularities which occurred in the trial may be accounted for by the fact that the cows were given a feed at' noon and were exercised between 1.30 p.m. to 3 p.m. in the yard and then given another feed in the stall prior to milking. If this final feed were not readily eaten, then possibly the feed eaten after exercise was not capable of influencing the milk at that night's milking.

TABLE VII. — FEED CONSUMED AND FLAVOUR PRODUCED BY COW No. 15 IN THE PERIOD 12TH NOVEMBER TO 1ST DECEMBER. COW FED MONTGOMERY RED CLOVER.

100 = very strong feed flavour. 0 = no feed flavour..

Date.	Composition of Feed.					Flavour produced.		Remarks on Feed consumed.
	Perennial Rye grass.	Italian Rye-grass.	Red Clover	Other Species.	Percentage of Red Clover in Total Feed.	Night.	Morning.	
	lb.	lb.	lb.	lb.				
Nov. 12 ..	50	49	31	31	19	50	0	Other species, mainly annual grass (*Poa annua*) and toad rush (*Juncus bufonius*). Traces of white and suckling clover and Italian rye-grass.
,, 13 . .	32	29	63	63	34	40	0	
,, 14 . .	..	..	105	100	51	40	5	
,, 15 . .	..	..	84	81	51	20	0	
,, 16 . .	10	10	58	56	43	10	5	
,, 17 . .	10	20	67	65	41	30	0	
,, 18 . .	12	.	81	77	48	40	5	
,, 19 . .	..	..	71	69	51	20	0	
,, 20 . .	61	..	47	45	31	20	0	
,, 21 . .	30	..	63	60	41	30	0	
,, 22 . .	..	..	59	56	51	10	5	
,, 23 ..	..	32	50	49	39	30	0	
,, 24 ..	..	14	95	82	63	20	0	
,, 25 ..	..	..	96	41	70	50	0	
,, 26 .	..	..	96	41	70	50	10	
,, 27 . .	..	..	83	35	70	30	0	
,, 28 . .	..	..	71	30	70	0	0	Bin full when taken out to milk.
,, 29 . .	..	..	77	33	70	40	0	
,, 30 . .	..	...	85	37	70	20	0	
Dec. 1 . .	..	..	62	27	70	0	..	
Averages. .		..	..	..	51	27·	1·5	

Table VIII sets out the results for cow No. 16, fed on a ration of white clover (dominant). Here again it was necessary to add rye-grass to the diet to ward off serious "blowing." The daily consumption of white clover was high, and it was obvious that on certain days the cow appeared to sicken of the diet. On these days also it is to be noted that the feed-flavour intensity in the cream declined, although there were some anomalies in this respect. On the whole it will be fairly obvious that 'white clover is a milk-taint-producing feed, but not to so great an extent as suckling clover.

TABLE VIII.-FEED. CONSUMED AND FLAVOUR PRODUCED BY COW NO. 16 OVER THE PERIOD 12TH NOVEMBER TO 1ST DECEMBER. COW FED WHITE CLOVER.

100 = very strong feed flavour. 0 = no feed flavour.

Date.	Composition of Feed.					Flavour produced.		Remarks on Feed consumed.
	Perennial Rye-grass.	Italian Rye-grass.	White Clover.	Other Species.	Percentage of White Clover in Total Feed.	Night.	Morning.	
	lb.	lb.	lb.	lb.				
Nov. 12	55	54	76	1	41	60	0	Other species consist mainly of annual meadow-grass, toad rush, and suckling clover.
,, 13	37	34	143	3	66	40	0	
,, 14			227	Trace	100	30	0	
,, 15	48	44	115	4	53	5	0	
,, 16	17	17	161	Trace	83	30	0	
,, 17	19		210	,,	92	40	0	
,, 18	11		231	,,	95	50	5	
,, 19	95	i i	69	,,	37	20	0	
,, 20	93		118	,,	56	20	0	
,, 21	41	38	112	,,	59	30	0	
,, 22	..	82	164	,,	67	20	0	
,, 23	..	73	132	,,	64	20	0	
,, 24	..	49	126	5	70	20	0	
,, 25	..	46	184	4	79	40	0	
,, 26	..	61	186	6	74	40	0	
,, 27	.	52	107	5	65	30	10	
,, 28	.	70	117	5	60	30	0	
,, 29	..	61	112	6	62	50	0	
,, 30	..	70	140	7	65	10	0	
Dec. 1	..	56	105	6	63	0	0	
Averages..	..	..	..	..	68.4	29·2	1	

Table IX sets out the results for cow No. 17, fed on a diet consisting mainly of subterranean. clover. The high palatability of this clover is demonstrated by the enormous bulk of green feed consumed daily and from the fact that it was not so necessary to include rye-grass in this diet to induce eating. Towards the latter end of the trial the diet was more, mixed owing to the pure stand of subterranean running out, and recourse had to bc made to a farm pasture in order to continue on the test of this. species. It will be noticed that subterranean clover is a high feed-flavour producer. and stands next to suckling clover in this respect.

TABLE IX.—FEED CONSUMED AND FLAVOUR PRODUCED BY Cow No.17 OVER THE PERIOD 12TH NOVEMBER TO 1ST DECEMBER. Cow FED SUBTERRANEAN CLOVER.

100 = very strong feed flavour. 0 = no feed flavour.

Date,	Composition of Feed.					Flavour produced.		Remarks On Feed consumed.
	Perennial Rye-grass.	Italian Rye-grass.	Subterranean Clover.	Other Species.	Percentage of Subterranean Clover in Total Feed.	Night.	Morning.	
	lb.	lb.	lb.	lb.				
Nov. 12 ..	53	52	71	6	39	20	0	Suckling clover the main impurity. After 25th the impurities were : Suckling, 13 per cent. ; white clover, 5 per cent.; other grasses, 21 per cent. -mainly rye-grass, crested dogstail, cocksfoot, and brown-top; also traces of *Poa annua.*
,, 13 . .	35	32	115	12	59	0	0	
,, 14 . .	..	.	187	14	93	20	0	
,, 15 . .	..		203	15	93	50	0	
,, 16 .	..	..	239	18	93	50	5	
,, 17 . .	..	.	230	17	93	30	0	
,, 18 .	..	..	220	17	93	40	0	
,, 19	..	..	223	17	93	25	0	
,, 20 . .		..	247	18	93	40	0	
,, 21 . .	ii	..	169	13	83	30	0	
,, 22	.	94	175	13	62	40	0	
,, 23 ::	..	95	164	12	56	40	0	
,, 24 . .	..	36	174	13	77	30	0	
,, 25	..	30	180	14	79	30	0	
,, 26 . .	..	17	137	87	56	50	0	
,, 27 ..	.	.	129	92	61	50	10	
,, 28 ..	..	.	106	68	61	30	0	
,, "9 . .	..	.	81	41	61	40	0	
,, 30 . .	..	..	89	57	61	40	0	
Dec. 1 . .	..	..	73	47	61	0	.	
Averages. .	..	..	..	..	74·69	32	0·75	

Table X shows the position in regard to cow No. 18, fed on a ration containing broad red clover. The clover was fed at a slightly more stemmy stage of growth than Montgomery red clover, and for approximately a week it served as a pure ration. After this period, however, it was necessary to include some rye-grass in the diet, owing to increasing stemminess of the clover. The variations in results from day to day are explained possibly by the fact that little or no feed was consumed in the final feed after exercise prior to milking, or else sufficient time had not elapsed for the flavour-producing principles to reach the blood-stream.

TABLE X.—FEED CONSUMED AND FLAVOUR PRODUCED BY COW No. 18 OVER THE PERIOD 12TH NOVEMBER TO 1ST DECEMBER. COW FED BROAD RED CLOVER.,

100 = very strong feed flavour. 0 = no feed flavour.

Date.	Composition of Feed.					Flavour Produced.		Remarks on Feed consumed.
	Perennial Rye-grass.	Italian Rye-grass.	Red Clover.	Other Species.	Percentage of Red in Total Feed.	Night.	Morning.	
	lb.	lb.	lb.	lb.				
Nov. 12	48	47	62	1	39	10	0	Trace only = suckling clover, *Poa annua*, mouse-eared chickweed, and shepherd's purse. From 20th on, other species include mainly suckling clover, trace of white clover, sorrel, and odd flat weeds.
,, 13	30	27	118	3	66	20	0	
,, 14	..	..	193	Trace	100	6	0	
,, 15	..	..	217	,,	100	10	0	
,, 16	..	..	155	,,	100	0	0	
,, 17	..	..	224	,,	100	40	0	
,, 18	..	..	212	,,	100	10	0	
,, 19	..	..	235	,,	100	30	5	
,, 20	..	105	90	15	43	40	0	
,, 21	25	83	71	12	37	40	0	
,, 22	..	77	66	11	43	10	0	
,, 23	..	74	63	10	43	20	0	
,, 24	..	84	72	12	43	40	0	
,, 25	..	89	76	12	43	0	0	
,, 26	..	95	82	13	43	20	0	
,, 27	..	92	80	13	43	20	0	
,, 28	..	90	77	13	43	10	0	
,, 29	..	87	74	12	43	10	0	
,, 30	..	97	83	14	43	0	0	
Dec. 1	..	81	69	11	43	0	0	
Averages..	..	..	..	..	62·7	17	0·25	

While in the above the average figure may not represent, the true position in regard to the feed-flavour intensity: induced by broad red clover, yet there can be no question that this species is capable of producing a feedy flavour in the cream, although the indications there, as in the grazing trials set out in Section 1, are that red clover does not produce as intense a feed flavour as white clover, subterranean clover, or suckling clover.

Summing up the position and taking the average feed flavour produced over the same twenty-day period, we have the relative position as shown in Table XI.

TABLE XI.-SHOWING SUMMARY OF RESULTS OBTAINED FROM PERIOD (b) IN WHICH COWS WERE FED ON DIFFERENT SPECIES OF CLOVERS. ALL FIGURES AVERAGED OVER A TWENTY-DAY PERIOD.

100 = very strong feed flavour: 0 = no feed flavour.

Cow No.	Dominant species Fed.	Average Percentage of Clover in Daily Ration.	Average Flavour Intensity.		Maximum Flavour Intensity.	
			Night.	Morning.	Night.	Morning.
13	Italian and perennial rye ..	3·8	3·5	0	10	0
14	Suckling clover	64·0	37·5	0·5	60	10
15	Montgomery red clover ..	51·0	27·5	11·5	50	10
16	White clover	68·5	29·2	1·0	60	10
17	Subterranean clover.. ..	74·7	32·20	0·7	50	10
18	Broadredclover	62·7	17·0	0·2	40	5

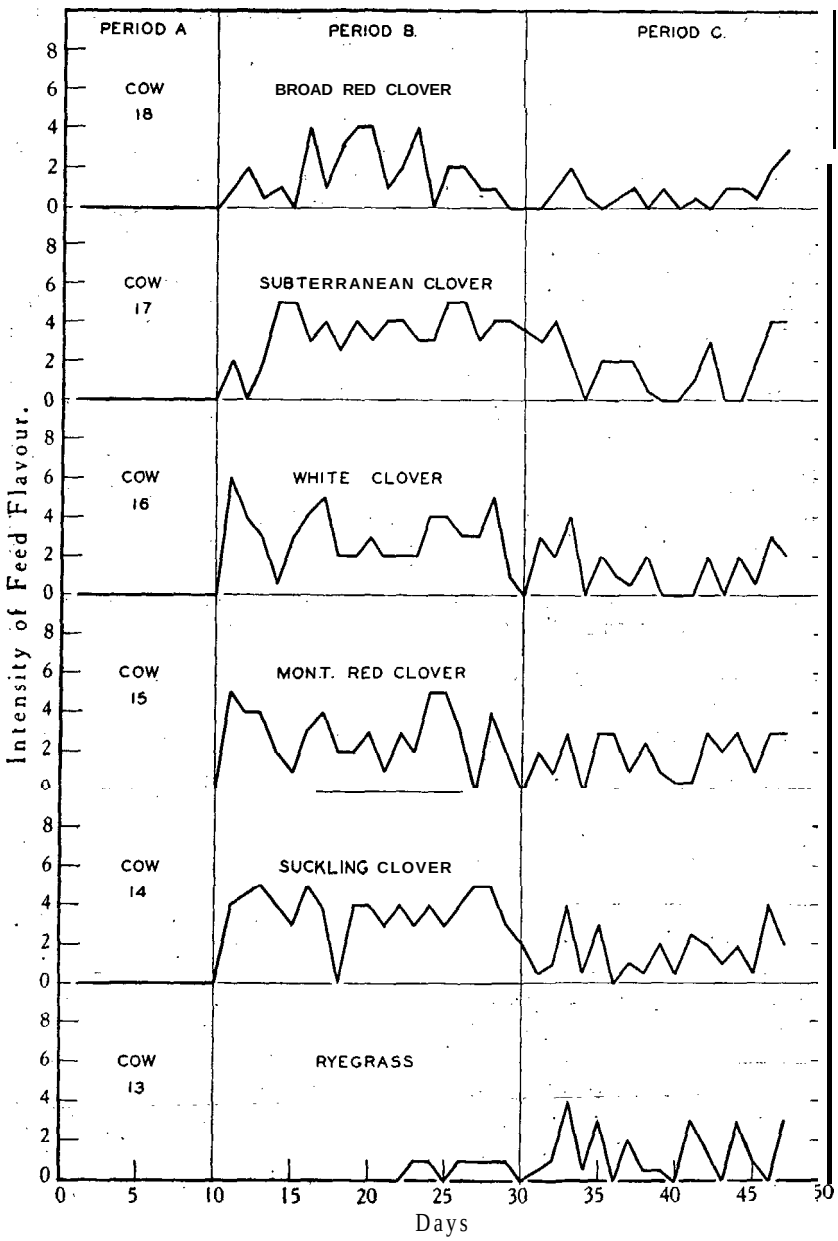
Period (c) : This period was designed to test cow individuality in regard to propensity to produce feed flavour. Four classes of feed were fed over various periods extending from two to ten days, according to amount of feed available. Considerable variation in feed flavours was noted from day to day in cream from any one cow on the same feed, but, on the whole, the average results from the individual cows support the findings in the trial under period (b), excepting that the average flavour intensity was lower, probably on account of the lateness of the season. The average figures for each cow over the same period and on the same feeds are shown in Table XII. The results for all three periods for the six cows are shown graphically on p. 14.

TABLE XII.—SHOWING AVERAGE FEED FLAVOUR FOR DIFFERENT COWS WHEN SIMILARLY FED OVER VARIOUS PERIODS.

100 = very strong feed flavour. 0 = no feed flavour.

Period.	Percentage Composition of Feed.				Points of Feed Flavour : Averages for Periods.												Average for Group.	
	Rye-grass.	White Clover.	Red Clover.	Other Species.	Cow 13.		Cow 14.		Cow 15.		Cow 16.		Cow 17.		Cow 18.			
					N.	M.	N.	M.	N.	M.	N.	M.	N.	M.	N.	M.	N.	M.
Dec. 2-4 . .	50	20	20	10	18	0	18	0	20	0	30	0	23	0	10	0	20	0
,, 7-9 . .	66	29	.	5	12	0	12	0	20	0	10	0	13	0	3	0	12	0
,, 16-17 . .		..	100*	..	13	0	8	0	18	0	13	0	13	0	5	0	11	0
,, 18-24 . .		..	98†	2	12	0	15	0	16	0	6	0	9	0	6	0	11	0

* Broad red clover. † Montgomery red clover.



Graph showing the relationship between intensity of feed flavour in the cream and the different. feeds received by the six cows during the three experimental' periods.

Throughout these stall-feeding trials it was noted that a fairly wide range of variation existed in feed-flavour intensity between one day and another, even when cows were fed on the same ration over a- giyen-period. This may have been associated with the state of the feed itself or it may have been purely a matter of variation in the amount, of feed consumed immediately prior to milking.

As previously explained, the cows were exercised after their noon feed from 1.30 p.m. to 3 p.m., and were then given a further feed prior to milking, and it would appear that on certain days less of this feed was actually consumed prior to milking. than on another day.

Work in America by C. J. Babcock and others has shown that-feed flavour in cream is to a large extent governed by the time elapsing between the taking of the feed and the time the cows are milked. This is clearly shown in the Palmerston North experiment in comparing night cream with morning cream. The last feed given in the evening to the stall-fed 'cows was at 5.30 p.m., and, assuming that this feed was all eaten by midnight, there would be a clear six hours between the last feed and milking-time. This period, even-in the case of the diet producing most feed flavour, is sufficiently long for practically all feed flavour to become eliminated from the system of the animal.

To confirm this result in daytime feeding a trial was conducted with the six stall-fed cows. The trial extended over a ten-day period, the cows being divided into two groups of three. Por five days three cows were fed right' up to milking-time, and in the case of the remaining three these had their last- feed four hours -prior to milking. A-ration of broad-red clover and Italian rye-grass was fed in each case. For the second period of five days the cows were reversed-Le., the three cows fed right up to milking-&me in the first period received no feed prior to milking, and the other three were fed right up to milking-time. The total daily milk-yield and feed-consumption were carefully measured, dry-weight determinations of the latter and butterfat-fat determinations of the former being made. The summary of this trial is contained in Table XIII.

TABLE XIII.—SHOWING EFFECT OF WITHHOLDING FEED FOR FOUR HOURS PRIOR TO MILKING ON FEED FLAVOUR, TOTAL CONSUMPTION, AND TOTAL PRODUCTION OF BUTTERFAT OVER A PERIOD OF TEN DAYS.

Particulars of Group.	Total Feed-flavour Points recorded.	Total Consumption. (Pounds of dry Matter).	Total Production. (Pounds of Butterfat).
Fed up till four hours before milking	12½	836·1	35·232
Fed up till milking	34½	836·8	34·885

It will be noted that rationing of clovery feed prior to milking led to a considerable reduction in feed-flavour intensity, and this commends itself as a means of partial control of..feediness in cream particularly in cases of high feed-flavour intensities where the grade of the cream is deleteriously affected.

It might be argued that rationing the herd would result in a reduced butterfat-yield, but it would appear that, provided the animal is on good feed, her total consumption of feed will not be affected nor will butterfat-production decline by rationing. This point is clearly indicated also in Table XIII, where it will be seen that the total consumption of feed and the

total butterfat produced was almost identical in the two cases. Where the supply of available feed is limited, rationing would probably tend to cause a reduction in feed consumed and in butterfat-production, but, generally speaking, the period of high feed-flavour intensities corresponds with the flush growth of pastures and there should be no shortage of feed over this flush period.

PART. II.—FEED FLAVOUR IN BUTTER.

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The investigation of feed flavours in butter was commenced at 'the beginning of the 1934-35 season, and the findings for that season were published in the ***Journal of Agriculture*** for March last(l). During the present season (1935-36) the investigation has been continued at Morrinsville, and additional farms have been studied in the Te Awamutu and Frankton districts, the co-operating factories at each centre being, the Morrinsville Co-operative Dairy Factory, the Te Awamutu Co-operative Dairy Factory, and the New Zealand Co-operative Dairy Factory. The technique of the investigation was, along the lines of the previous year, but greater attention. was paid at the Morrinsville centre to detail in the botanical composition of pastures and the seasonal changes in these, together with a careful study of butterfat-production in relation to pasture type and its correlation with feed-flavour intensity.

The most promising feature of the work during the, 1934–35 season was in the indication that feed flavours diminished in intensity as the quality of the pasture sward improved and as the per-acre production tended to rise. The present season's investigation has confirmed that indication, and it has opened up a most encouraging vista to the dairying industry in the Waikato and elsewhere where feed flavours are likely to be intense.

The present season has confirmed in no indefinite terms the fact that clover-dominant pastures give rise to intense feed flavours, and that the lower-producing annual clovers, those which represent the early phases of pasture-building in the Waikato more particularly, arc worse in this respect than the higher-producing types of clovers that figure in the ultimate, highly improved sward. Similarly, in the grasses, sweet vernal figures in the early developmental phases of the Waikato pastures, and this grass is suspected of causing a peculiar flavour to which the name "Coumarin" has been tentatively given. As the pastures improve as a result of manuring and stocking, non-flavouring grasses, such as perennial. rye-grass, cocksfoot, and, paspalum, tend to dominate the sward, and these in a dominant position associated with white clover would appear to be the ultimate aim in the Waikato. The evidence to date goes to show that when this state of affairs has been attained the feed flavour will be reduced to a- point. where the ordinary processing methods in the factory can fully deal with the problem.

It is not presumed that these changes in pasture composition can be induced overnight, as it were, but, given reasonable financial and advisory facilities, the average dairy-farmer in the Waikato should be able to effect a marked improvement in the position within six years. Experiments to determine the most effective manurial, seeding, and -stocking programme were commenced in the 1934-35 season, and these arc being continued in the 1936-37 season.

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(1) LEVY, E. BRUCE : "**Investigation of Feed Flavour in Butter.**" *Journal of Agriculture*, **March, 1936, Vol. 50, p. 135.**

TECHNIQUE OF THE INVESTIGATION.

The more intensive study was undertaken at Morrinsville, where forty farms were chosen fully representative of the pasture and soil types of the district. Each farm was mapped, and numbers were allotted to each field. A copy of the farm map was placed in the milking-shed alongside a shed sheet, upon which was entered daily the number of cows milked, the number of the field from which the cows came prior to each milking, and reference was made to any supplementary feeds fed, such as hay, silage, or roots. These shed sheets were collected at the end of each month, and fresh sheets supplied for the ensuing month. Periodical visits to the sheds were made to check up on records.

Detailed botanical analyses of all fields on the forty farms were made by a check method of eye estimation, substantiated in many cases by point analyses of the swards. The pastures of the more important farm types were botanically analysed monthly so as to check up on seasonal botanical modifications of pasture mixtures. State and stage of growth were also noted, together with individual methods of pasture utilization and the question as to whether the herd as a whole was considered to be adequately or inadequately fed.

Special nitrogen-manurial trials were instituted in an effort to bring about pasture changes, some 200 acres being experimentally treated and distributed over ten farms on different soil and pasture types. The basic aim in this manurial work was to gain information on the possibility of translating clover-dominant swards into grass-dominant swards by the direct application of nitrogenous manures. Half of each field was treated with sulphate of ammonia plus lime, and the other half with nitrate of soda plus lime, 1½ cwt. of each ingredient being used in each case.

There is no question that, in the Waikato at least, nitrogen is essential to grass-growth, and the fundamental principle behind the pasture-improvement work of the Waikato, whereby grass-dominance replaces clover-dominance, lies, one way or another, in getting more nitrogen on to the country to become effective in September, October, and November, when the feed-flavour intensity is most pronounced. The two obvious methods are: (1) To increase the phosphate and lime applications so that more clover feed may be produced and more stock may be carried, to the end that more stock nitrogen is manufactured and deposited on the farm in the form of dung and urine. There is no doubt that top-dressing with phosphates to increase the per-acre stock concentration has been effective over the present grass-dominant farms of the Waikato, where liberal and correct manuring, together with pasture renovation by surface harrowing and reseeding to rye-grass, or by ploughing and resowing down well to good strains of rye-grass, have been carried out. (2) The second method is to make certain fields, at least, grass-dominant by the direct application of nitrogenous fertilizers. In the 1936-37 season comparative trials under these two headings are being carried out, the fundamental question being the most effective and most economical way to introduce more nitrogen into the swards of the Waikato.

One of the limiting factors to wholesale trials along these lines is the cost of the work and the limited funds available. Because of the fact that stock itself is a master factor in the translation of clover-dominance to grass-dominance, whichever way the transition is effected, the separately fenced field must be regarded as the experimental unit, and these fields, when the

trials are run co-operatively with farmers, must be sufficiently large to carry the entire herd for at least two to three days, for no farmer can be expected to graze and milk the cows and separate the cream from two individual sections of his herd. Further, more than one field on each farm should be treated.

The question of management also is important in the transition from clover-dominance to grass-dominance. Close grazing, irrespective of manuring, favours clovers, whereas rather lax grazing encourages grasses rather than clover-particularly discouraging those clovers that figure in the old permanent pasture. This again serves to emphasize the need of the field as the unit of the trial in order to efficiently control the stock-grazing factor, and even when this is attained farm co-operative experimenting may yield no data under adverse climatic conditions. This was borne out during the season just past where owing to a late spring the nitrogen-treated fields were in many cases so closely grazed as to offer no chance whatever for the sward to develop its grassiness before the normal clover-growth came on and before the effectiveness of the applied nitrogen had worn off. It would appear that no form of nitrogen will last effectively longer than eight to ten weeks, and unless the growth produced during this period of effectiveness is allowed to develop somewhat, then little change in the composition of the pasture is to be expected, unless, of course, sufficient nitrogen in a toxic form is put on to injure the clover of the sward. Such applications arc not recommended, however, actually an application of nitrogen, provided the growth following is allowed a fair chance to make some headway, has an effective range for longer than eight. to ten weeks in so far as the growth produced is fed *in situ* by the grazing animal, which in turn returns to the land the majority of the food it has consumed in a form that is almost immediately available again as plant food, and thus the effective range of the original nitrogen dressings is extended. This principle, of course, applies to all forms of manuring : there is a primary effect from the manure as such and a secondary effect from stock residues that are deposited as a result of the initial growth from the manures, and in the case of phosphate applications the grass-growth following some years of such manuring is a secondary effect and not a primary effect-the primary effect being confined mainly to the clovers of the sward. At a rough estimate it would appear that a carrying-capacity of approximately one adequately fed cow per acre or its equivalent will return to the land sufficient nitrogen to maintain the rye-grass in a vigorous and healthy condition, and as far as the Waikato is concerned there lies the key to the position in regard to pasture-making, and, as will be seen in the results of the feed-flavour investigation, here lies also the most practical means on the farm of reducing the intensity of feed flavours in cream.

The technique of experimentson- the-scale carried- out during the last two seasons investigating the feed flavour in butter cannot of necessity be very refined, and it is to be expected that certain incongruities will appear in the tabulated results. None of the factors is consistent day by day. Even on the best of farms the pastures vary not only from field to field, but also from part to part in any one field according largely to stock concentration, those areas further from the gateways generally being less grassy than those approximate to gateways and highways for stock. The utilization factor varies from farm to farm and from season to season ; the weather conditions -temperature, humidity, sunshine, and rainfall-vary from day to day ; the human factor varies from farm to farm, and even on the same farm, as does also the animal itself.

Nevertheless, these are the practical conditions under which any form of modified firm-management that might be suggested as an outcome of the investigation must be applied, and it is claimed that no differences will be significant in the daily routine of the farm unless these appear under the normal farm conditions as they exist in practice.

It would appear that the results secured to date are significant and. that these, when applied in the daily routine, will eventually lead to an, improved article as far as feed flavours are concerned and that there, will be an accompanying fillip in the production as well:

The technique in the factories concerned is as follows : Samples of cream are drawn from the cream-supply of co-operating farmers, the night cream and the morning cream being kept separate. These samples are kept until the last supplier's cream is received and are then graded by sense of smell and taste. A scale of, O-10 has been adopted ; '0 = no feed flavour and 10 = a very strong degree of feed 5avour.

Differentiation is made between feed flavour and flavours which arise as 'a r&stilt of bacterial contamination, the litter being classified as " off " and are eliminated in assessing the average feed-flavour intensity. Daily results are' recorded, and these are summarized every ten days. In the investigation " off " flavours have been further investigated by direct microscopic counts, and bacterial contamination thus verified and, wherever possible, rectified at the source of contamination. The bacterial contamination of the cream-supply interfered in. no 'small measure with the course of the investigation, and in summarizing results, particularly in the warmer months, whole periods on some farms had to be omitted from the calculation owing to bacterial contamination overshadowing the true characteristic feed flavour.

Consideration of Results.

In the 1934-35 -season it was found possible'to classify the farms of the Morrinsville district roughly into four types. During the present season these types have been largely retained with certain minor subdivisions result&g in the following eight classified- types :-

Farm Type 1.—Perennial rye-grass is dominant, white clover subdominant, and with upwards of 10 per cent. cocksfoot, Yorkshire fog, &c. Some paddocks may be not quite so grassy as the type.

Farm Type l-Z.--Co-dominant perennial rye-grass and white clover with cocksfoot often subdominant. Fields slightly lower in soil fertility than type 1.

Farm Type 2.-Dominaht white-clover. farms with perennial rye-grass subdominant or co-dominant on the better and more' highly stocked fields. The poorer fields may contain some suckling clover and sweet vernal:

Farm Type 2-3.—White clover, suckling clover, and/or subterranean clover may be co-dominant. Sweet vernal, Yorkshire fog, cocksfoot, and perennial rye-grass may be subdominant.

Farm Type 3.-Suckling clover or subterraneanolover dominant. Sweet *vernal, Danthonia* pilosa subdominant or co-dominant. Some perennial rye-grass, cocksfoot, -and white clover. Farms in the early stages of making.

Farm Type &.-Suckling clover, *Danthonia pilosa*, sweet vernal co-dominant ; usually much flat weed ; some perennial. rye-grass, cocksfoot, white clover, but in a stunted condition. Farms virtually in an unimproved condition and of low per-acre productivity.

Farm Type 4.-Drained peat lands ; grass dominant. Yorkshire fog, brown-top often dominant ; cocksfoot, paspalum, subdominant, with some perennial rye-grass and white clover on more consolidated pastures. *Lotus* major often prevalent in summer.

Farm Type &-consolidated peat swamps : Perennial rye-grass, white clover. Yorkshire fog and/or paspalum dominant.

In Tables I and II twenty farms representative of those under trial at Morrinsville have been tabulated and grouped into the eight main pasture types as set out in farm types 1 to 4A above.

The outstanding points to be noted in the results as set out in these tables are : (1) That the months of October and November are the worst periods for feed flavour; (2) that the farms that carry the poorest types of pasture (type 3) are the worst in feed-flavour intensity for the duration of the flush of feed that is produced ; (3) the poorer the pasture the shorter the flush period, but the more intense the feed flavour (3A group); (4) the more grassy the pasture types the milder is the feed flavour (type 1 group) ; (5) the white-clover-dominant-pasture types give a high feed flavour, and for the duration of the present wet season this flavour was prevalent over a long period of the year and there is a fairly marked autumn period of increased feed flavour, which is due almost entirely to white-clover growth ; (6) the true peat swamp (type 4) gave little or no flavour, and what is present in the 4A group is due largely to some paddocks on rolling non-peat country associated with the farm.

The really important fact depicted in Tables I and II is that the better grassed and more improved farms are giving quite mild feed flavours, whereas the unimproved farms, or farms in the early stages of improvement., are giving quite strong feed flavour. Partly developed farms are giving an intermediate intensity of feed flavour.

The Morrinsville Results compared with those at Frankton and Te Awamutu.

The results from the Morrinsville factory are remarkably regular in rise and fall in feed-flavour intensity according to the clover content of the pastures, and, in particular, in reference to the annual clovers—suckling clover and subterranean clover. The relationship of morning cream to night cream (see Tables I and II) is also extremely pronounced and is in accord with pasture composition, the poorer pasture types being comparatively strong in the morning compared with the better-quality pastures. At Morrinsville also the autumn grading coincides well with the botanical

composition of pastures-the white-clover-dominant pastures being responsible for the maintenance of a feed flavour that is common to. pastures of the 1 and 1-2 types, declining as the 2–3, 3, and 3A types are met with, this period being a very low clover period in those pastures where the annual clovers predominate in the spring and early summer.

At the Frankton and Te Awamutu factories (see Tables III, IV, V, and VI) there is less marked gradation in the points allotted for feed flavour, and the morning cream is relatively more strongly flavoured than in the case of the Morrinsville factory. This state of affairs is probably due to the fact that farms included in the survey in the Te Awamutu and Brankton districts were, on the whole, inferior to those in the Morrinsville area. In the Te Awamutu area no typical type 1 farms were recorded and greater difficulty was experienced in classifying the farms into the groups as shown. This latter point was also true of the Frankton area. Undoubtedly, however, those farms classified in the type 1 and 1-2 groups were the best grassed and most highly improved of all the farms surveyed within the Te Awamutu and Frankton areas, and these, be it noted, are the most mild from a feed-flavour point of view. A point to be noted in these farms is the rather narrow ratio of morning cream to night cream, and this may be regarded as verification of the rather poorer pasture swards compared with those at Morrinsville. Table II sets out the position at Morrinsville in regard to morning cream, and here, on the whole, there exists a wide ratio between morning cream and night cream, excepting in the case of type 3 farms, where the ratio may be narrow. Thus the ratio of the morning cream to night cream for the Morrinsville farms for the months of October, November, and December is 1 : 4·85, whereas for farm N in the type 3 group at Morrinsville the ratio for the same period is 1 : 1·55. The ratios of morning cream to night cream at Te Awamutu and Frankton respectively for October, November, and December are 1 : 2·23 and 1 : 2·54. This wide or narrow ratio between morning and night cream may be accounted for by the fact that where the herd can get its fill quickly and easily and is adequately fed in the evening and up until midnight, that herd is content to camp after midnight until milking-time in the morning, whereas where.the animal is hungry at midnight there is the probability of its fossicking for a feed early in the morning prior to milking and hence a high morning-feed flavour would be recorded.

Individually there are large differences in suppliers in both the Te Awamutu and Frankton results, and this may be observed from an examination of Tables III, IV, V, and VI. At Frankton (Tables III and IV) the best-grassed farm is farm A, although even this has some rising country at the back where the turf is much weaker than on the flat, and one hill paddock is subterranean-clover dominant on the north-east and north-west slopes. The poorest pastures in the Frankton series are R, S, and T, and these gave consistently the worst feed-flavours. Farm R may be regarded as a suckling-clover-dominant farm in a rising stage of soil fertility as a result of recent manuring. Farm P is a subterranean and suckling-clover-dominant farm, and Q is a subterranean-clover-dominant farm with some white clover and suckling clover present. These, it will be observed, are all high in feed-flavour intensity.

The average figures for the farm types at Frankton were not as outstanding as at Morrinsville, where very much-more detailed botanical work Was undertaken, but the fact is clear that the better pastures give less feed flavour than the poorer, and while it is very true that the numbers of good

pastures are few yet there appears to the writers to be no reason why the poorest pastures should not he made as good as the best and the best considerably improved.

In the Te Awamutu area (Tables V and VI) no pastures were met with in the survey that one could place in the type 1 group, and in general it must be said that most of the pastures within this area are still very much in the developmental stages. Farms A, and B are dominantly paspalum in the summer and this grass has kept the feed flavour low. Farms Q and R are typical poor suckling-clover-dominant farms, and farm S is an extremely poor farm, where weeds constitute upwards of 50 per cent. of the sward. It will be noted that feed flavour on this farm is comparatively low compared with farms Q and R. The position here was largely a matter of insufficient growth to produce much feed or feed flavour. It is fairly obvious also that the normal weeds of the pasture are not responsible for the characteristic feed flavour met with, otherwise farm S would have given the maximum points for feed flavour, as this is the most weedy farm met with in the survey.

It must be stated that for the year under review conditions were very favourable for the development, firstly, of annual clovers in the pastures of the Waikato during the spring and early summer, and, secondly, of white clover over the summer and autumn periods., There appears to be no doubt that the drought of the prior 193435 season opened up the pastures greatly, largely by the elimination of white clover. In such weakened pastures the conditions were most propitious for the germination, growth, and spread of annual clovers, and this was in evidence on many farms where the soil fertility appeared such as should grow white clover, and no doubt did grow white clover prior to the drought of the preceding summer., This state of affairs would account for the abnormally high feed flavour in general throughout the lighter soils of the Waikato at least, a temporary setback in the pasture-development work being experienced.

Result of Nitrogen Manuring Trials.

The most outstanding result of applied nitrogen was the early response and greater growth from the grasses of the sward, and particularly from perennial rye-grass. The manure was applied during the first week in July, and the maximum effects of the nitrogen dressing were seen during late July, August, and September, after which period the response began to wane. Unfortunately, the spring of 1935 was late, being cold and comparatively dry until the end of October, with the result that the nitrogen-treated fields were hard, rather than leniently, grazed. In the effort to ensure grass-dominance the grazing management is most important and a certain amount of let-away of the sward is necessary before the grasses can assume dominance over the clovers. The cold spring of 1935 precluded lenient management of the treated pastures, and consequently but little statistical information was gleaned regarding the value of nitrogen manuring as a control measure of feed flavour in cream. It must be pointed out, however, that no single application of nitrogenous manures will have a marked- lasting effect. The nitrogen manuring must be considered as part of a long-range plan whereby clover-dominant swards are translated to grass-dominant swards, and until some years of manuring have been conducted little information of a definite nature can be expected.

TABLE I.—SHOWING INDIVIDUAL FARMS CLASSIFIED ACCORDING TO PASTURE TYPE, TOGETHER WITH FEED-FLAVOUR INTENSITY OF NIGHT CREAM FOR EACH TYPE OVER SPECIFIED TEN-DAY PERIODS: MORRINSVILLE DISTRICT.

100 = very strong feed flavour. 0 = no feed flavour. The letter at the head of each column is the supplier's *nom* de plume.

Periods.	Farm Type																				
	1.		1–2.			2.				2–3.			3.			3A.	4.	4A.			
	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.	K.	L.	M.	N.	O.	P.	Q.	R.	S.	T.
Aug. 11-20	0	1	0	18	0	0	1	3	0	0	0	5	..	9	17	2	0	0	0	0
,, ..	2	3	11	12	0	0	4	21	0	4	4	10	17	34	12	2	0	2	0	0
Sept. 21-31 1-10 ..	0	7	3	7	0	0	12	16	1	1	6	1	22	16	28	0	0	24	14	0
,, 11-20 ..	6	1	0	14	3	0	5	26	3	17	7	9	30	14	37	0	0	23	27	0
	3	2	0	19	3	7	24	41	33	34	22	32	45	11	58	4	0	9	31	0
0%. 21-30 1-10 -	14	8	0	35	41	30	39	43	46	49	29	39	44	47	62	10	3	27	30	20
,, 11-20 ..	29	13	10	29	46	40	47	60	53	58	46	63	49	56	78	25	2	24	11	29
,,	10	6	8	23	40	42	36	50	52	58	36	56	60	72	71	23	.	11	33	20
Nov. 21-31 1-10	5	4	6	13	29	17	25	44	46	53	38	43	45	70	61	60	0	0	3	8
,, 11–20 ..	10	15	32	34	20	47	50	50	57	64	51	70	75	74	81	78	0	15	50	27
,, 21–30 ..	16	10	19	29	22	39	44	48	58	58	48	60	70	70	67	85	8	10	9	17
Dec. 1–10 ..	0	2	5	9	5	20	14	25	38	45	20	43	38	46	45	45	3	7	0	14
,,	1	0	14	9	5	14	30	45	18	34	26	37	40	..	43	..	0	0	0	10
,, 11–10	0	1	13	1	15		22	32	20	25	1	18	20	10	33		0	10	3	10
Jan.	3	4	15	14	..	11	34	30	20	15	5		6..	.	528	..	0	..	0	2
,, 11-20 . .	7	9	23	8	.	13	40	23	24	10	16	6	.	.	26	..	0	..	0	0
,, 21–31 .	1	7	17	4	..	10	35	14	29	11	13	4	.	.	17	0	0	0		0
Feb. 1-10 . .	3	17	9	5		11	28	1	20	17	3	1	..	0	5				6	0
,, 11-20 ..	1	19	14	7	..	5	28	17	13	11	9	4	..	0	1	0	0	0	0	0
,, 21–29 ..	7	11	12	19	..	4	32	11	15	13	7		4..		1..	.	0	1	3	0
March 1-10 ..	7	12	9	16	..	1	27	11	10	7	3	1	1		5	0	0		0	1
,, 11–20 ..	11	9	7	13	..	11	22	7	9	10	2	4	.	.	6	6	1	0	1	0	0
,, 2131 . .	5	9	6	10	.	4	15	5	12	5	3		3..		15	0	0	0	1	0
April 1–20 . .	2	10	1	6	..	1	19	9	6	7	2	0	..	0	0	0	0	3	0	0
,, 21-30 . .	10	15	0	12	.	1	18	3	15	5	1	0	. .	0	0	0	0	5	5	0

FEED FLAVOUR IN RELATION TO SPECIFIC FIELDS OF THE SAME PASTURE TYPE.

Feed. flavour in relation to pasture composition as distinct from whole farms where more than one class of pasture may exist is shown in Table VII. In this table are shown grazings on fields of various dominants, and these definitely show that the clover dominant and subdominant fields are giving the most intense feed flavours ; that the grass-dominant and grass-subdominant fields are giving the lowest feed-flavour intensities ; and that the clover-dominant: fields with grasses subdominant are giving an intermediate feed-flavour intensity. This comparison is of interest in so far as it eliminates the possibility of herd and farm management being a predisposing, causative factor of feed flavour.

PEED-FLAVOUR INTENSITY IN RELATION TO PRODUCTIVITY OF FARM TYPE.

Grassiness 'in the sward does not necessarily mean that the farm is of exceptionally high productivity, but rather the reverse where clover is reduced below a certain percentage. The thriftiness of the grass also is to a large extent wrapped up in its association with clover, particularly with white clover: and the general palatability of the sward depends largely on its white-clover content. High productivity, however, can be secured where grass is dominant over clover, and it would appear that the ideal to aim

at is grass-dominance up to 65 per cent. to 70 per cent. of the sward, the remainder being largely white clover. This state of affairs should be possible in the Waikato for the months of September, October, and November at least, and these months, be it noted, are the worst for feedy flavours. In a normal year feed flavours decline rapidly in December and are seldom troublesome in the summer and autumn even when during these periods the swards are clover dominant.

In Table VIII are given the. monthly butterfat-production figures for .a number of the Morrinsville suppliers, and by reference to Tables I and II it may be learned into which pasture group these farms fall.

The main point of interest in Table VIII is the production peak of the main farm types. It will be noted that farms of type 1, 1–2, and. some, of type 2 show an early peak of production, this 'coming in October in each case, whereas those farms of type 2 mainly, types 2–3, 3, and 3A, have their peak of production in November and some in December. It is well known that in grassland farming earliness away in the spring, with an early rise to the peak of production, is associated with a general high average of production per acre, and this is particularly true in a normal season where dry conditions are expected after December. In the year under review this was not so. A cold spring (October) and a wet summer were experienced, and this has detracted somewhat from the comparative figures obtained over the season between the main farm types. Nevertheless, the figures indicate that the farm types A-E (Table VIII) have come to their peak early and have sustained their production well throughout, and these (see Tables I and II) arc low in feed-flavour intensity.

TABLE II.—SHOWING INDIVIDUAL FARMS CLASSIFIED ACCORDING TO PASTURE TYPE, TOGETHER WITH FEED-FLAVOUR INTENSITY OF MORNING CREAM FOR EACH TYPE OVER SPECIFIC TEN-DAY PERIODS: MORRINSVILLE DISTRICT.

100 = very strong feed-5avour. 0 = no feed-flavour. The letter at the head of each column is the supplier's *nom* de ***plume.***

Periods.	Farm Type																			
	1.		1-2.			2.				2-3.			3.			3A.	4.	4A.		
	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.	K.	L.	M.	N.	O.	P.	Q.	R.	S.	T.
Aug. 11–20	0	0	0	1	0	0	0	0	0	0	0	0	..	0	0	0	0	0	0	0
,, 21–31	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
Sept. 1-10	0	0	0	0	0	0	0	6	0	0	0	2	0	17	0	0	0	0	8	0
,, 11–20	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
Oct. 21-30	0	0	0	0	0	0	0	1	0	0	1	3	1	0	1	0	0	0	0	0
1-10	0	2	0	4	5	0	0	13	0	8	2	4	1	1	15	0	0	0	1	1
,, 11–20	0	4	0	8	10	0	8	24	1	4	8	8	4	24	20	0	0	2	1	0
,, 21–31	0	0	1	6	3	2	3	18	3	12	3	13	8	53	17	0	0	2	11	2
Nov. 1-10	0	0	0	0	2	1	2	9	1	14	9	7	5	51	17	14	0	2	0	0
,, 11–20	0	1	5	4	4	9	5	20	9	25	11	15	12	46	26	23	0	1	19	4
Dec. 21-30	1	0	1	4	2	6	11	19	11	29	18	16	15	47	38	31	0	0	2	2
1-10	0	0	0	2	0	0	2	7	5	11	4	9	12	26	14	7	0	0	0	0
,, 11-"0	0	0	0	3	2	0	3	19	2	7	5	10	7	13	17	3	0	0	0	0
,, 21-31	0	0	0	0	1	0	0	22	0	4	0	1	1	1	12	1	0	0	0	1
Jan. 1-10	0	0	4	0	..	0	1	17	0	1	0	0	..	1	0	0	0	0	0	0
,, 11–20	2	0	3	0	..	0	4	11	0	0	7	0	..	0	3	0	0	0	0	0
,, 21-31	0	0	2	0	..	0	7	3	1	0	5	0	..	0	0	0	0	0	0	0
Feb. 1-10	3	2	0	0	..	0	14	0	3	4	1	0	..	0	0	0	0	0	0	0
,, 11–20	0	0	0	0	..	0	14	0	0	0	0	0	..	0	0	0	0	0	0	0
,, 21–29	1	3	1	1	..	1	13	4	0	2	1	0	..	0	0	0	0	0	0	0
March 1–10	0	7	0	0	..	0	12	2	1	1	0	0	..	1	0	0	0	0	0	0
,, 11–20	2	3	0	3	..	2	8	6	0	0	0	0	..	1	0	0	0	0	0	0
,, 21–31	0	0	0	0	..	0	8	0	0	0	0	0	..	0	0	0	0	0	0	0
April 1–20	0	0	0	0	..	0	11	3	0	0	0	0		0	0	0	0	0	0	0

Dominant white-clover pastures, farm type 2, have also done remarkably well for the season and have given a very long spread of high productivity. There is no doubt that white clover in farms A to F is largely responsible for the sustained production in these farms also, the rye-grass of the pastures being largely responsible for the early production peak. It will be noted that farms in the type 3 group and some in the 2-3 group fall away in production fairly rapidly after the November-December peak, and this may be accounted for by the short seasonal growth of the annual clovers-suckling clover and subterranean clover-compensated, however, this year by a fair summer growth of white clover throughout most of the pastures. Farm P, type 3A, is of interest as showing the late start in the spring, thedelayed peak of production, and the rapid wane after that peak had been reached. This peak represents the normal flush peak of suckling clover, and by reference again to Table I it will be noted that this flush of production coincides with a period of high feed-flavour intensity.

In Table IX the per-cow and per-acre butterfat-production figures are given, and these, taken in conjunction with total production and feed-flavour intensity, go to show that the tendency for high per-acre production goes hand-in-hand with a low feed-flavour intensity. Farm C is rather low, but this farm ran sheep on the dairy-farm until fairly late in the spring. Farm G -a dominant white-clover - rye-grass farm-stands high in per-acre production. This farm. and farm B are alongside one another and are under the same ownership and general management. A comparison of the feed-flavour intensities of these two farms is of interest.

Generally speaking, it will be noted from a comparison of the per-acre production (see Table IX) with feed-flavour intensity (Table I)-that a high feed-flavour intensity is associated with a low per-acre production, and a low feed-flavour intensity is associated more with a high per-acre production+

The per-cow production does not correlate with feed-flavour intensity, nor yet with a high or a low per-acre production. Nevertheless, there are some interesting points here. All ol over pastures, so long as the cows are adequately fed, are high milk-producers. The only farm which the figures would indicate to be inadequately fed is farm P (Table IX), where the rise in per-cow production coincides markedly with the flush suckling clover peak in November and December. Farm K would appear to be inadequately fed in September and October ; Farm N fed bran to tide over low-production periods, and this farm, although on poor country, heads the list in per-cow production. A point of interest from the farm-management point, of view is the comparatively low per-cow production. of farms B and G and the relatively high per-acre production of these farms, and- the question that naturally arises is whether slight overstocking,- to a point is not preferable to understocking. It certainly emphasizes the fact that full utilization of the herbage produced is essential to a high per-acre production on farms where copious growth is produced, and this,.. where the cow production is watched overclosely, may be lost sight of by some farmers.

The main point the writers wish to make here, however, in introducing these production figures is to show that farmers can forge ahead with manuring and stocking to effect pasture improvement and at the same time rest assured that the quality of their cream will not suffer from the point of view of feed flavours ; all evidence to date goes to show that the. quality will be improved from this point of view.

TABLES III AND IV.—SHOWING INDIVIDUAL FARMS CLASSIFIED ACCORDING TO PASTURE TYPE TOGETHER WITH AVERAGE FEED-FLAVOUR INTENSITY IN CREAM FOR EACH TYPE OVER SPECIFIC TEN-DAY PERIODS : FRANKTON DISTRICT.

100 = very strong feed flavour. 0 = no feed flavour. The letter at the head of each column is the supplier's nom de *plume*.

Periods.	Farm Types																				
	1.	1–2.						2–3.												3.	
	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.	K.	L.	M.	N.	O.	P.	Q.	R.	S.	T.
Table III.-Night Cream.																					
Oct. 11-20	35	41 36	1[illegible]	51	53 43 47	45 34	1[illegible] 1[illegible]	47 56	55 68	40	58 38	55 48	52	43 51	58 58	70	47 62	58 53	54	16 8	
„ 21-31																					
Nov. 1-10	32	38	28	43	48	43	50	55	52	50	56	51	50	51	48	67	56	57	63	14	
„ 11-20	25	38	43	31	34	-38	37	49	60	63	44	49	53	54	52	63	52	60	64	28	
„ 21-30	23	46	41	38	38	34	35	47	51	57	42	41	54	49	51	51	53	61	66	28	
Dec. 1-10	26	27	41	37	31	30	33	36	53	44	38	33	46	58	47	55	44	56	40	31	
„ 11-20	22	31	40	30.37		28	44	31	45	48	41	26	48	26	30	531	39	53	55	23	
„ 21-31	25	23	40	23	27	30	43	33	40	33,	40	10	50	30,	30	50	33	37	60	17	
Jan. 1-10	'16	23	18	30	17	18	23	28	25	32	20	14	27	17	17	30	21	17	42	7	
„ 11-20	28	35	38	35	38	45	44	35	40	35	33	30	37	20	30	48	53	30	50	14	
„ 21-31	27	41	43	35	36	24	48	33	38	53	40	39	37	26	50	[illegible]	[illegible]	39	56	27	
Feb. 1–10	20	23	18	30	40	35	40	50	43	33	40	27	44	38	27	39	38	35	50	15	
„ 11-20	21	33	36	40	40	38	44	38	33	43	42	34	37	23	43	[illegible]	40	35	45	6	
„ 21-29	32	37	36	37	30	40	43	37	47	35	45	40	50	25	50		20	38	36	8	
March 1–10	24	32	27	33	30	33	35	32	35	32	27	26	38	30	33	30	38	28	37	39	14
„ 11-20	10	16	21	20	10	25	20	28	17	30	11	19	32	16	20	30	23	..	33	8	
„ 21-31	24	20	24	27	35	26	35	38	18	20	21	20	36	12	23	46	60	40	28	6	
Table IV.—Morning Cream.																					
Oct. 11-20	..	11	7	14	13	16	8	14	9	27	8	9	15	32	10	19	16	17	16	8	
„ 21-31	14	18	15	14	13	14	13	14	23	25	11	8	10	33	18	21	27	24	32	16	
Nov. 1-10	17	15	10	17	23	9	17	21	28	20	13	8	15	36	14	20	17	17	33	14	
„ 11-20	12	20	20	8	15	19	9	16	30	37	21	16	18	43	21	19	24	30	23	28	
„ 2130	9	20	12	11	12	16	12	19	22	31	13	11	13	24	19	17	28	32		28	
Dec. 1-10	9	9	19	13	18	13	10	14	23	29	13	6	24	16	28	21			43 34	41	
„ 11–20	12	13	17	11	9	12	13	8	24	35	16	6	12	10	14	21	10	41	32	23	
„ 2131	27	10	10	3	7	3	30	13	10	30	10	3	10	10	13	13	20	20	37	17	
Jan. 1-10	11	7	10	3	3	1	4	14	5	18	6	1	9	9	9	7	10	6	26	7	
„ 11–20	14	18	10	12	6	20	16	18	10	33	20	14	16	12	10	20	24	15	26	14	
„ 21–31	17	21	16	9	17	16	22	14	21	38	16	13	19	12	25	17	23	21	34	27	
Feb. 1–10	8	12	10	17	15	10	12	20	26	30	15	12	27	14	23	13	13	18	20	15	
„ 11-20	7	6	6	9	17	9	14	11	13	18	9	4	19	4	10	13	13	20	12	6	
„ 21-29	0	4	6	5	3	8	18	10	5	14	10	3	16	4	13	14	9	17	11	8	
March 1–10	1	10	7	10	6	7	10	16	3	13	7	6	22	4	22	13	8	24	23	14	
„ 11–20	0	4	6	5	3	8	18	10	5	14	10,	3	16	4	13	14	9	17	11	8	
„ 21-31	7	6	6	9	17	9	14	11	13	18	9,	4	19	4	10	13	13	20	12	6	

TABLES V AND VI.-SHOWING INDIVIDUAL FARMS CLASSIFIED ACCORDING TO PASTURE TYPE, TOGETHER WITH AVERAGE FEED-FLAVOUR INTENSITY OF CREAM FOR EACH TYPE OVER SPECIFIED TEN-DAY PERIODS: TE AWAMUTU DISTRICT.

100 = very strong feed flavour. 0 = no feed flavour. The letter at the head of each column is the supplier's *nom de plume.*

Periods.	Farm Types																			
	1-2.				2-3.											3.		3A.	
	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.	K.	L.	M.	N.	O.	P.	Q.	R.	S.	T.
Table V.-Night *Cream.*																				
Oct. 1–10 ..	30	25	25	25	30	40	30	53	35	15	40	55	35	55	38	37	..	47	20	40
,, 11–20 ..	25	18	27	23	31	37	29	44	30	38	36	34	55	40	34	33	44	38	23	28
,, 21–31	33	23	30	36	30	41	30	52	41	39	30	44	44	43	39	38	39	43	36	40
Nov. 1–10 : :	27	22	28	36	30	41	33	41	44	45	39	51	42	48	39	43	49	40	34	43
,, 11-20 ..	20	23	38	40	36	39	30	60	41	21	37	50	50	54	46	51	67	37	30	43
,, 21-30 ..	23	32	37	36	61	50	44	62	55	44	46	56	55	60	51	50	70	..	33	38
Dec. 1–10 ..	30	30	35	33	51	53	56	64	73	48	47	58	55	57	55	51	68	70	40	55
,, 11-20 ..	25	32	34	28	38	44	40	57	50	33	39	46	43	43	60	32	50	70	37	44
,, 21-31 ..	32	32	43	32	35	40	46	69	..	28	49	37	30	45	..	23	45	..	30	34
Table *VI.-Morning Cream.*																				
Oct. 1–10 ..	5	13	3	18	3	8	3	25	15	10	13	35	20	20	10	10	15	17	3	10
,, 11-20 ..	1	5	0	10	4	10	9	18	8	10	14	24	21	10	10	8	11	10	5	1
,, 21-31 ..	10	11	9	25	8	22	16	24	21	20	17	30	31	20	20	16	18	23	12	17
Nov. 1–10 ..	3	13	11	29	13	19	13	21	18	23	18	29	24	23	15	20	23	23	10	16
,, 11-20 ..	0	6	11	21	4	14	16	23	16	19	16	29	28	20	16	19	25	26	10	12
,, 2130 ..	4	17	10	24	15	29	20	26	24	20	21	38	27	24	18	18	28	30	3	13
Dec. 1-10 ..	13	15	18	29	21	29	29	35	30	23	25	39	35	30	28	23	39	40	9	25
,, 11-20 ..	11	22	15	17	16	22	22	32	27	13	19	36	23	20	23	14	23	25	10	19
,, 2131 ..	11	19	20	24	16	20	24	50	20	14	24	19	30	23	15	13	15	..	16	15

TABLE VII.—SHOWING DISTRIBUTION OF FEED-FLAVOUR INTENSITY IN CREAM IN RELATION TO PASTURE COMPOSITION DURING THE MONTH OF NOVEMBER: MORRINSVILLE DISTRICT.

100 = very strong feed flavour. 0 = no feed flavour.

Dominant.	Subdominant.	Number of Grazings.	Percentage of Grazings showing a Feed-flavour Intensity of Points.										
			0.	10.	20.	30.	40.	50.	60.	70.	80.	90.	100.
Grasses	Grasses ..	65	48	18	16	12	5	1	0	0	0	0	0
Grasses	White clover and suckling clover	212	10	8	15	19	17	10	7	5	6	3	0
White clover	Grasses	72	8	7	8	17	24	8	13	8	4	3	0
Suckling clover	Grasses	40	0	2	10	5	18	7	20	23	10	5	0
Suckling and subterranean Clover	Grasses	7	0	0	0	0	14	14	0	44	14	14	0
White clover	Suckling clover.	13	0	0	7	16	16	16	24	7	7	7	0
Suckling clover	White clover	8	0	0	0	0	0	11	11	34	0	11	34

TABLE VIII.—SHOWING BUTTERFAT-PRODUCTION, FACTORY FIGURES (IN POUNDS), MONTH BY MONTH, SEASON 1935-36, OF FARMS LISTED IX TABLES I AND II.

Farm.	June.	July	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	Total.
A	1,131	1,357	3,318	4,270	5,276	5,082	4,702	4 540	4,207	3,989	3,406	2,158	43,436
B	834	1,098	1,416	1,939	2,573	2,443	2,394	2,459	2,261	2,157	1,810	1,108	22,492
c.. . .	302	388	1,276	2,066	2,855	2,619	2,667	2,689	2,343	2,267	1,838	883	12,193
D.. . .	298	626	2.813	4.041	4.897	4.710	4.262	3.852	3.594	3.566	2.710	1.091	36,460
E.. .	728	894	1,719	2,531	3,133	2,989	2,877	2,812	2,518	2,505	1,961	1,230	25,897
F	846	1,213	1,930	2,336	3,015	3,181	3,158	3,073	2,621	2,491	1,988	1,219	27,071
G ..	685	1,256	1,684	1,810	2,280	2,331	2,178	2,285	2,115	2,168	1,851	1,285	21,928
H .. ::	514	1,257	2,428	2,677	3,296	3,158	3,027	2,774	2,491	2,488	1,846	1,058	27,014
1.: . .	76	239	967	1,202	1,419	1,373	1,254	1,196	1,027	984	781	266	10,784
J	264	605	1,068	1,336	1,818	1,920	1,813	1,772	1,573	1,647	1,255	668	15,739
K	315	442	1,444	1,905	2,789	3,052	2,928	2,910	2,585	2,446	2,082	950	23,848
L	310	797	1,982	2,544	3,929	4,261	4,416	4,193	3,657	3,390	2,313	711	32,503
M	367	420	570	553	882	1,009	1,160	1,162	1,074	985	831	429	9,442
N	164	232	760	1,067	1,510	1,744	1,886	1,779	1,642	1,641	1,248	638	14,311
O	292	490	1,292	1,474	1,937	2,053	1,822	1,715	1,455	1,364	989	566	15,449
P	117	300	970	994	1,537	1,871	1,868	1,609	1,358	1,159	836	431	13,050
Q .. .:	162	-135	626	892	1,487	1,779	1,885	1,891	1,638	1,545	1,198	661	13,899
R.. . .													
s.. . .													
T.. . .	542	348	402	921	846	1,174	1,279	1,204	1,071	1,096	967	713	10,563

TABLE IX.—SHOWING BUTTERFAT-PRODUCTION PER COW PER DAY AND BUTTERFAT-PRODUCTION PER ACRE (IN POUNDS) OF FARMS LISTED IN TABLE VIII AND IN TABLES I AND II.

Farm.	September.		November.	December.	January.	February	March.	April.	Average, Eight Months.	Production Per Acre.
A ..	1·10	1.23	1.21	1·08	1·05	1·04	0·92	0·82	1·05	231.0
B	0.78	O-96	0·94	0·89	0·96	0·92	0·82	0.71	0.87	239.4
C	0.84	1.08	0.99	0·98	0·98	0.98	0.92	0.78	0.94	194.7
D	1·25	1·40	1.37	1·22	1·12	1·12	1·04	0·82	1.17	228.9
E	..	..	..	..	..	..	..	..	..	..
F	0·85	1·01	1·07	0·99	0·98	0·91	0·88	0·82	0·94	190·7
G	0·80	0·95	0.98	0.88	0.94	0·95	0·92	0·81	0·90	243.6
H.. .	0.95	1.06	1·06	1-00	0.91	0·88	0·82	0·67	0·92	194.4
I ..	1·01	1·12	1.12	1·01	1·01	0·98	0·88	0·72	0·98	190.9
J .. :	1·02	1.15	1·18	1·09	1·06	1·00	0·97	0.77	1·03	145.7
K . .	0.74	0·99	1·19	1·02	1.01	0·92	0·85	0.74	0.93	174·1
L	0·85	1.14	1.23	1.22	1·16	1·08	0.93	0·66	1·03	216.7
M:: :	..	..	..	..	..	..	..	..	..	..
N	0·94	1·21	1·32	1·38	1·31	1·29	1·20	0·96	1·20	185·8
O	..	..	..	..	..	..	..	..	..	..
P	0·50	0·50	0·83	0·80	0·74	0·69	0·58	0·48	0·64	90·0
R	..	..	..	.	.	..	..	..	..	..
S	..	..	..	..	..	..	..	..	..	..
T	0·92	1·13	1·23	1·21	1·11	1·03	0·98	0·85	1·06	112·4

In conclusion the authors wish to acknowledge the work and co-operation of the directors, managers, and graders of the Morrinsville Co-operative Dairy Co., the New Zealand Dairy Co-operative Co., and the Te Awamutu Dairy Co-operative Co., and all farmers who throughout the season kept their stock records and otherwise collaborated with the Department in the work. Officers of the Dairy Division and Fields Division, Department of Agriculture, and officers of the Dairy Research Institute have also been closely connected with the work in the Waikato, and this is cordially acknowledged.

REFERENCE.

(1) LEVY, E. BRUCE : "Investigation of Feed Flavour in Butter." *Journal of Agriculture*, March, 1936, Vol. 50, p. 135.

DISCUSSION.

Mr. Lamont : Although the actual trials have shown that rye-grass produced no taint, the question I ask is, Might there not he conditions under which rye-grass could produce taint ? Might I draw attention to apparent anomalies in the figures to support this ? I also question the position in which the clovers were placed with regard to their production of flavour. It would be unfortunate if subterranean clover were classed as a bad flavour-producer on what appears to be inconclusive evidence.

Mr. *Cockayne* : It is perfectly clear that the. meticulous 'conclusions based on an experiment covering such a small amount of data is clearly a bit out' of place, either on the part of the person conducting the experiment or the person who is criticizing the results. As to whether perennial rye-grass itself might not be a cause of feed flavours, I think the work, so far as it has gone, both in the field and in the experimental work, indicates fairly clearly that the farmer who is feeding his cows on pastures containing large quantities of rye-grass gets a better factory-grading than where he is feeding his cows a large quantity of clover. That is the only really definite conclusion that has been reached.

Dr. Whitehead : The manufacturer is reluctant to process the cream more than is absolutely necessary. Those engaged in the manufacture of the dairy-produce and those on the scientific side must at the same time try to determine how to i-educe feed flavour. Much more is coming out of this work than merely questions of feed flavours : we are attempting to get information on the whole question of the relation of the composition of the feed to the composition of the milk, and there are indications that we are going to get such information.

Mr. Hodgson : In dealing with a problem such as this it is very apparent that many factors operate. The different species of plants and the different stages of growth of the species, the bulk of feed, and the time fed-all *are* factors. Further, all the factors concerned in the individual cow may or may not be considerable. I never mentioned the word "conclusion" during the whole of the paper. It has to be kept in mind that the work under discussion is only portion of a problem and has to be linked up with other work. It may interest Mr. Lamont to know that we had three cows grazing on rye-grass -from the 1st October to practically the end of May, and never got one bit of flavour from them. That in a general way is quite a bit of evidence that rye-grass is not a flavour-producing species.

Mr. Cockayne : As far as I can see, excessive clover-feeding close up to the time of milking is likely to cause feed-taint. Whether there is any very remarkable difference between any of the clovers in certain stages of their life is a matter for further work.