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The value of monozygotic twins in milk composition experiments.

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INTRODUCTION

Monozygotic (identical) twins have for many years been used to increase the statistical power of experiments in a range of scientific disciplines (Dick and Whittle, 1951). In dairy cows, variation within identical twinsets for a given biological parameter is usually substantially less than the variation between unrelated cows or between fraternal twinsets (Hancock 1953; Brumby and Hancock, 1956). Thus the number of identical twins required in an experiment is often considerably less than the number of unrelated cows necessary to achieve the same statistical precision. The experiments described here were conducted to quantify the twin efficiency values of a range of milk composition parameters.

MATERIALS AND METHODS

Milk samples were collected from 20 multiparous Friesian twinsets (i.e. 40 cows) on 2 occasions during each of spring and summer 1994/95. Throughout the collection period, cows grazed the same pasture under common management conditions. Samples were chilled immediately following collection and subsequently analysed for concentrations of fat, protein, lactose, nitrogen (N) fractions (total N, non-protein N, non-casein N, casein N), fatty acid profiles and minerals. Intraclass correlations (the correlation within twinsets) and twin efficiency values ($1/(1 - \text{intraclass correlation})$) were calculated for each parameter. Cows with mastitis were omitted from the analyses (2 cows only). Twin efficiency values estimate the number of unrelated cows required to achieve the same statistical power as one member of a twinset in a split-twin experiment.

RESULTS

Depending on the parameter, intraclass correlation coefficients ranged from 0.49 to 0.97, corresponding to twin efficiencies of 2 to 36 (Table 1).

TABLE 1: Twin efficiency values for milk yield and selected milk components in spring and summer.

Component	Twin efficiency value	
	Spring	Summer
Milk yield	9	8
Fat	12	25
Fat yield	6	8
Protein	9	24
Lactose	10	22
Casein	8	13
Whey protein	3	4
Non-casein N	3	4
Non-protein N	2	6
Na	5	3
K	16	36
Fatty acid C16:0	7	5
Fatty acid C18:1	5	8

For some components, twin efficiency values were affected by time of season.

DISCUSSION

The use of identical twins will enable a reduction in the number of cows used in experiments evaluating effects of farm practices on milk composition. This represents considerable savings in experimental costs, although the extent of the benefits may be dependent upon the time of year the experiments are conducted. It is important to acknowledge that the usefulness of twins is reduced in experiments where within cow comparisons are made (e.g. cross-over experiments).

REFERENCES

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