Biodynamic milk producing systems

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Summary. Biodynamic and conventional dairy farms are compared to evaluate differences in their production, economics, soils, pastures, animals and milk. Inputs are less with biodynamics but production is lower. Soil chemistry appears similar but there are structural advantages observed on some biodynamic farms. Blood results showed low selenium levels in conventional cows and low phosphorus levels in biodynamic cows.

Introduction

Biodynamic (bd) and organic dairy farms do not rely on many of the inputs used by modern commercial dairy farms. However they do not simply reduce or *omit* inputs but strive to improve their soils and the health of their plants and animals without using synthetic fertilisers, pesticides, and stock medicines.

In Australia, the bd system dominates unconventional dairying. It began with a series of lectures in 1924 by the Austrian scientist and philosopher, Rudolf Steiner (I) and has evolved from practical applications, experience and research. The term conventional *(cv)* is used for modern commercial farms that use synthetic chemical inputs.

The management of bd farms differs from cv farms in approach and practice. The bd approach to management is holistic to the extent that the farm itself is viewed as a single entity that is managed as though it is a single organism. They aim to develop their soil to be more biologically active where plants obtain their nutrients from biological processes and not by soluble salts derived from artificial fertilisers. Harmony with nature is sought and they are careful not to upset this in their management. Bd farms aim to be closed and self-sufficient but it is recognised that this is difficult on dairy farms because of the level of production needed for economic viability.

The approach of cv dairy farmers is more production and profit oriented. The environment is considered less when compared to bd farmers. Quality of milk is viewed as important by cv farmers but they see milk quality more in terms of the quality demanded by milk processing factories. Bd farmers, however view quality more in terms of the naturalness of its production and perceived health benefits to consumers.

In practice, management differences are more tangible. Bd farmers do not usually use nitrogen and phosphatic fertilisers. Special preparations prescribed by Steiner are used by all bd farmers. The best known is '500' prepared from cow manure buried in a cow horn over winter to cure to a humic-like substance which is specially mixed in water before spraying on to land. The prophylactic use of drenches, vaccines and antibiotics is common on cv farms but rare on bd farms. Table 2 shows other differences.

At present most organic and bd milk produced in Australia is not processed or marketed separately. Precise data on the extent of alternative dairy farms are unavailable but we have located 23 bd and 7 organic dairy farms in Australia. Most are in Victoria - 16 bd and 3 organic. This is certainly an underestimate because we have not attempted a thorough survey and we have been notified of many more but have not as yet confirmed their status. In Victoria, 4 bd and 1 organic farm process their milk on-farm to cheese, icecream or yogurt and another 3 bd and I cv farm have the milk collected separately for packaging and sale as bd or organic milk.

This study attempts to provide some basic biological and economic data for a more rational assessment of the biodynamic method of dairy production.

Methods

A survey to compare the practices, production and biology of bd and cv dairy farms is in progress. Seven bd dairy farms in northern Victoria who have been bd for at least 3 years and with an average of 16 years of bd have been paired with their closest cv neighbour that has similar soil type, breed of dairy cows and size of operation. Samples of soil, pastures, blood, faeces, tissue from cull cows and milk have been collected and analysed for 110 different parameters for the 1991-92 lactation. Data on management, production and herd health have been collected and the financial performance of the farms compared.

Results and discussion

Milk per hectare on cv farms is 34% greater than on bd farms (Table 1). Since stocking rates are similar, production per cow is mostly responsible for the differences. The extra 610 kg grain per ha fed to cv cows (Table 2) accounts for about 26% of the 2320 L/ha difference assuming a kg of grain produces a litre of milk. The balance of the difference is therefore due to either pasture intake or quality or both. Dry matter digestibility of cv pastures in summer and autumn averaged 66.3 % which was 2.4% units higher than bd ($p < 0.01$). Nitrogen content was 0.5% units greater for cv ($p = 0.05$) for the same period. Because pasture quality determines intake, it is not possible to apportion the relative contribution of quality and intake quantity to the difference in milk production per hectare.

A preliminary report on the economic comparison by Wynen(2) shows that the cash costs of bd farms are about 40% lower than cv farms mostly due to lower feed costs and animal health costs. However, production costs per litre of milk were higher on bd farms because litres of milk per hectare were higher for cv farms. This financial analysis does not include the off-farm effects. In The Netherlands Berenschot(3) showed the net cash benefits to be less for bd when compared to cv, but when the off-farm environment effects were taken into account, the total economic benefit was in favour of bd.

Table 2. Feed and pasture inputs on biodynamic and conventional farms[a]

Table 1: Milk production from biodynamic and conventional farms[a]

	Biodynamic	Conventional
Cows milked	90	118
Area of effective pasture ha	48	55
Stocking rate cows/ha	1.9	2.1
Milk L/ha	6,737	9,057

[a]Preliminary results 1991/92

The soil pH, Olsen P, organic carbon, electrical conductivity, zinc and exchangeable cations were not significantly different when measured in June 1990. Parker (4) working on one pair of farms found that total phosphorus was 2220 and 2225 kg P/ha in the topsoil (0-100 mm) of the bd and cv farms respectively. Olsen P was 34.2 mg P/ha in the bd topsoil and similar at 37.5 mg P/kg in the cv topsoil. However, in the subsoil, TP at 100-200 min was 1296 kg P/ha on cv and 794 kg P/ha on bd.

In 1990 some soil physical properties of one pair of farms were studied by Cock(5) who showed the cv surface soil had a greater porosity than the bd soil but at the BI horizon, the reverse was the case. In the B2, there were differences in favour of the bd soils but they were not as large. He also found some significantly lower soil strengths in the surface soil as measured by penetrometer resistance. Water stable aggregates > 2 mm were greater down to 200 mm in the bd soil. Significantly greater root densities down to 600 mm were found. On another farms pair, Lytton-Hitchings (6) found greater soil porosities in bd soils down to 420 mm.

	Biodynamic	Conventional
Grain kg/cow/year	59	369
Superphosphate(9.1% P,11.5% S) kg ha/year	0	308
Urea kg/ha/year	0	38
Irrigation interval days	14	8
Pasture harrow no./year	8	1
Pasture topping no./year	3	5

[a]Preliminary results 1991/92

Pasture mineral analysis in Table 3 shows nitrate nitrogen significantly higher in cv pastures. Nitrate in the grass component was higher in cv than bd but for the clover component. the opposite was true. Botanical compositions were similar, especially in the summer and autumn. This is a little surprising since irrigation over the summer and autumn was less frequent with bd and white clover *(Trifoliwn repens)* is more sensitive to water stress than the grass components (7).

Table 3. Mineral analysis of biodynamic and conventional pasturea

	Biodynamic	Conventional	Significance
Total nitrogen %	2.06	2.62	0.05
Nitrate nitrogen ppm	11.9	78.1	0.085
Total phosphorus %	0.25	0.34	0.052
Total potassium %	2.46	2.38	ns
Total calcium %	0.41	0.49	ns
Total magnesium %	0.27	0.28	ns
Total sulphur %	0.25	0.27	ns

[a]Results October 1991

Out of 18 tests on blood from milking cows, only P and Se, as measured by glutathione peroxidase, showed any significant differences. Blood P levels that are considered deficient were measured in 4 out of 5 cows from one bd farm, however the cows exhibited no symptoms of P deficiency. As sulphur in the soil can suppress the uptake of Se by pastures, Se intake by cows would be expected to be less from cv farms because of their long history of high superphosphate applications. Only one cv farm had 4 out of the 5 cows tested below the normal range of 40 to 300 units. Bd cows averaged 128 while cv were lower at 86 units ($p=0.03$).

Faecal egg counts for strongyles, fasciola and paramphistomes showed no differences between bd and cv cows and calves despite routine drenching for worms and fluke on cv farms. Minimal use of drenches occurred on some bd farms but only where animals were diagnosed or strongly suspected as having a health problem due to parasites.

Herd health records indicate bd farms have less animal health and fertility problems than cv farms, despite little or no use of stock medicines.

Mineral analysis of milk shows no differences in milk composition.

In terms of their aims, both farms are successful. Cv farms achieve high levels of production and high cash operation surpluses though they rely on high inputs of fertiliser, drenches and grain supplements. Bd farms appear to have better soils, healthier and more fertile animals and rely much less on off-farm inputs.

Acknowledgements

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