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A SURVEY OF ORGANIC FARMING  
IN NEW ZEALAND

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## **Abstract**

The characteristics of organic farms and farmers were studied and management factors determined. The effects of changing over to an organic farming system were also examined.

A postal survey was sent to 77 organic farms and 32 conventional farms around New Zealand.

Farmers use organic methods for pragmatic rather than spiritual reasons. The majority come from diverse occupational backgrounds before becoming a farmer, unlike most conventional farmers who had been farmers all their working life.

Organic farms averaged 123 hectares, of which 83% was used for actual organic production. The conventional farms averaged 410 hectares. Properties usually had two or more types of farm enterprises present, with organic farms being more diverse: beef, vegetables and fruit being the more popular choices. Conventional farmers tended to stay with the more traditional enterprises of sheep, beef and wool.

Grazing and cropping systems on organic farms were not significantly more soil conservative. Compost and fish fertilisers were the most frequently used fertilisers on organic farms with reactive phosphate rock as a phosphate source. Conventional farmers used the traditional superphosphate, potassic super, longlife super and urea. Lime was used by both groups.

Organic farmers ranked internal parasites worse than any other problem, whilst conventional farmers felt it to be about equal to flystrike. Facial eczema and grass staggers noted as problems by the conventional group, were not even mentioned by the organic farmers. Thistles were a much bigger weed problem on organic farms than on conventional properties. Changing to organic farming did not change these problems, nor was there any significant difference in intensity of control methods used between the two farming systems.

Over a quarter of the organic farmers were involved in some processing of produce on their property, and on average labelled this as organic. Forty percent of organic produce was sold to conventional outlets.

Fifty-four percent of organic farmers and 94% of conventional farmers had all or nearly all of their income provided by their property.

There was no significant difference between organic or conventional

properties concerning labour.

Organic farming did not significantly change yields and income per hectare, either in the first or subsequent years after changing from conventional farming. Labour requirements also remained the same.

In conclusion, the majority of all the farmers surveyed felt satisfied with their present farming system.

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## CHAPTER ONE - INTRODUCTION AND OBJECTIVES

The widespread use of agricultural chemicals and manufactured fertilisers has been a characteristic feature of modern agriculture. With the use of these, farmers have been able to obtain higher yields per unit of land at lower labour and overall costs, thus leading to their becoming a standard feature in New Zealand agriculture.

The decreased profitability and rising rural debt of New Zealand agriculture that occurred during the late 1980's resulted from declining traditional export markets, high exchange rates and low commodity prices. Shrinking export quotas and protectionism were also to blame. Market restrictions on chemical use, such as the ban on beef hormones by the European Economic Community, and the removal of price supports and input subsidies have also played a part in the lower returns to New Zealand farmers.(Fisher 1989)

Publicity and concern over the dangers of chemicals used in the production and processing of foods is increasing along with the awareness of the vulnerability of the world's ecosystem as a whole. Animal welfare groups are also increasing the public profile of stock management methods, especially with respect to intensive stock systems.

A growing concern over the use of agrichemicals combined with current economic conditions indicated a need for alternative production technologies. One alternative available is a return to farming without the use of synthetic fertilisers and chemicals, a system presently known as organic farming. Organic farming embodies the removal of chemical inputs from production, an environmental philosophy and an emphasis on soil husbandry.

The public, farmers and research institutions are showing a high level of interest in organic farming. The Ministry of Agriculture and Fisheries has committed research and marketing resources to organic farming, setting up two organic production systems, one at

Flock House, Bulls and the other at the Levin Horticultural Research Centre. This is done with a view to developing a commercial export industry (Scott 1987, Galloway 1988). Consumer demand for organic produce is increasing both domestically and overseas (Horticultural Market Research Unit 1986).

The Ministry of Agriculture and Fisheries has carried out two surveys of organic farming in recent years. The first by Gunning and Cullen (1983) and the second by Haystead (1987). The latter monitored paired farms over a three year period. These reports showed that there is potential for profitable organic production.

A later survey carried out by Fisher (1989) focused on identifying barriers to the adoption of organic farming. Pest control was identified as the main technical problem for organic farmers, and the period of transition from conventional to organic agriculture was a major barrier due to investment costs and low income.

However, Gunning and Cullen (1983), Haystead (1987) and Fisher (1989) did not answer some questions regarding organic farming practices. There was little information on the management of organic properties, the type of farmers involved, labour input and the effects of changing from conventional to organic farming. In the project described here it was proposed to answer some of these questions by a postal survey.

The objectives of this survey were:

- a) to identify the farm and farmer's characteristics
- b) to determine management factors of organic farmers
- c) to assess effects of changing from conventional to organic farming

## GLOSSARY OF TERMS

**Bio Gro** is the organic food trademark owned and administered by the BPC.

**bio-dynamics (BD)** is a farming system that incorporates all of the Bio Gro standards and regulations, but is based on a series of 1924 lectures by the philosopher Rudolf Steiner. Bio-dynamic farmers use homeopathic sprays, an astrological calendar, and other practices to stimulate cosmic and terrestrial forces into their farm. <sup>The</sup> system features a distinctive philosophical base, and a strong sense of community between BD farmers and consumers. Bio-dynamic farming has been practised in New Zealand since the late 1920's.

**Bio-Dynamic Farming and Gardening Association (BD Assn.)** owns and administers the Demeter label.

**Biological Producers Council (BPC)** is a semi-voluntary organisation that owns and administers the Bio Gro label.

**conventional farming** refers to a production system which uses a full range of production techniques such as pre- and post-plant tillage practices, synthetic fertilisers and pesticides.

**conventional producers** are those farmers that are using conventional techniques and are unaware, uninterested or not presently employing organic methods on their farm.

**Demeter** is the trademark and production standard of the BD Assn.

**ecological agriculture** is the concept and design of the farm as an ecosystem. As a management philosophy, it emphasises farm design as a solution to production problems, the interconnection between and hierarchy of systems, and the environmental effects of management practices. Using a wholistic approach, therefore, chemical use is not precluded where the environmental costs of chemicals are less than non-chemical management strategies (Fisher 1989). **Permaculture** is based on these concepts.

**fertiliser** is a material which enhances the fertility of the soil (MacIntyre 1987).

**International Federation of Organic Agriculture Movements**

**(IFOAM)** is an international OF organisation to which the BPC is affiliated. IFOAM standardised production specifications for organic produce, and coordinates scientific research on OF.

**low input farms** are designed to reduce the amount of materials brought onto the farm from outside to a level substantially below that required to maximise net production per hectare (Vine and Bateman 1981). Unlike OF, low input farming refers to the quantity, not the quality of farm inputs. Low input farms tend to intergrate all suitable techniques rather than exclude chemicals.

**MAF** Ministry of Agriculture and Fisheries of New Zealand.

**organic farming** as strictly defined for this thesis is the **Biological Producers Council Standard for Organic Food Production**. There are several differing interpretations of the terms organic farming which will be discussed in the literature review.

**organic produce** refers to produce grown by organic farming methods.

**pesticide** is the generic name referring to most of the lethal chemical techniques employed by humans to limit or prevent pest damage to agricultural products.

**pests** are organisms which are declared or perceived as detrimental to agricultural enterprises. They include weeds, fungi, nematodes, insects and other animals.

**sabbatical farming** is an organic farming system where every year one seventh of the farm is fallowed for one year. The area fallowed is rotated around the farm.

**sustainable farming systems** involve the succesful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the quality of the environment and conserving natural resources (Chantalakhana 1990).

**transitional organic producers** are those which have achieved transitional Bio Gro status and usually have converted less than two years ago to organic farming.

**Willing Workers On Organic Farms association (WWOOF)** is an international volunteer organisation which allows members to experience life on organic farms in other countries. Participants work on organic farms in exchange for their board and keep.

## CHAPTER TWO - LITERATURE REVIEW

### 2.1.1 Organic farming - Historical

Texts and articles that document the methods and techniques of organic farming tend to be dated. Other researchers (Conacher and Conacher 1982, Scofield 1986 and Conford 1988) have dated the development of modern organic techniques from King (1911), Howard (1940) and Balfour (1943). Scofield (1986) felt that the roots however lie earlier in the agriculture of the anthroposophic followers of Rudolf Steiner. Steiner gave a series of eight lectures in 1924 (Kolisko and Kolisko 1978) at the request of a group of German farmers concerned about the increasing degeneration they had noticed in the seed strains and in many cultivated plants. The biodynamic movement was developed from these lectures. In truth however, organic farming is probably as old as agriculture itself. Prior to the introduction of farm machines and synthetic fertilisers, biocides and veterinary products, farming was essentially 'organic' by necessity. In the British Isles the deep-rooting herbal ley was an integral part of the system. Apart from the ley's own value as a crop, the period of ley was a time when (Widdowson 1987):

a/ soil organisms can work undisturbed and so build up fertility;

b/ leguminous plants sown with the grass can build up a supply of nitrogen through the rhizobial symbiosis;

c/ grasses and deep-rooting herbs can bring up from considerable depths minerals which are of value to the grazing herbivores;

d/ roots of these deep-rooting plants, when they die, leave channels in the soil, and these channels assist drainage and aeration.

The term 'organic farming' was first used in the book 'Look to the Land' by Lord Northbourne (1940) (Scofield 1986). Present day organic farming does not necessarily mean the return to peasant techniques. The United States Department of Agriculture (USDA 1980) survey found modern organic farms had incorporated the use of modern machinery, recommended crops, waste recycling and soil conservation methods. These farms were well managed, productive and efficient.

An early experiment comparing organic farming with 'chemical' farming was carried out by Balfour (1943, 1975). The trial ran from 1939 to 1969. An area of 216 acres was divided into three units, each to be run as a self-contained small farm. Two of these, each having an effective area of 75 acres, were stock-bearing sections. One stock-bearing farm was called the Organic section. Here the fields received only the crop residues and animal manures produced on that section. The second stocked section received likewise, but also the standard supplementary applications of chemical fertilisers. This was called the Mixed section. The fields of the stockless section would have the crop residues returned to it, together with chemical fertilisers, but no animal residues. This section was 32 acres. The main rules of the experiment were:

a/ all three sections adhered to a strict rotation. On the two stock bearing sections these were to be identical and based on a ley system of farming.

b/ no importation of feed stuffs on either stock bearing section, whether from outside or transferred from another section.

c/ the organic section was to operate as near to a closed cycle as possible, with only livestock end-products to be exported (this was also the case on the Mixed section), and only breeding males, some small seed and dried seaweed (an organic mineral food supplement) to be imported.

d/ the unit of time for any comparisons or assessments to be a full rotation period. The duration of each rotation was nine years.

Stock-bearing sections carried a herd of Guernsey dairy cattle and light Sussex poultry for egg production. Both these sections also ran pigs at first but these were changed to Clun Forest sheep as the latter placed less demand on grain crops and were better scavengers of surplus fodder. Crops grown on the stockless section were wheat, barley and pulses followed by a clover crop that was ploughed back

in. These crops were also grown on the stocked sections with the addition of oats, lucerne and root crops.

It was reported that organic methods gave an improved qualitative as well as quantitative response in crops and livestock. For example, the organic herd consistently produced a higher milk yield on a lower ration of concentrates than did the Mixed herd (Table 2.1), although the statistical significance of the difference was not given.

**Table 2.1**

**Dairy cattle intakes and production**

	Organic	Mixed	difference
<u>feed (lb/day 1960-61)</u>			
hay	11	11	
silage	40	ad lib	
straw	5.5	- -	
<u>lb concentrates/day/gallon of milk</u>			
1st gallon of milk	1	1.5	
2nd gallon of milk	2	2.5	
3rd and each subsequent gallon	3	3.5	
<u>total milk production (lb milk/yr)</u>			
1961	75,872	73,776	-2,096
average for 1955-61	75,605	70,510	-5,095

Due to the use of fertilisers on the Mixed section which succeeded in increasing the grain yield, it was possible to keep more poultry on this block. However, the organic flock produced more eggs per weight of food than the Mixed flock.

Tests showed that the dry matter content of the organic leys was far higher than that of the Mixed leys, sometimes even double. The levels of available minerals were shown to fluctuate according to the seasons, maximum release coinciding with time of maximum plant demand. The effect of having a closed system on the mineral status and the mining of these minerals from the soil did not show up any significant long term trends, deleterious or otherwise.

However the experiments were stopped earlier than planned for financial and political reasons. At the end of the findings, lists of unsolved questions and problems were presented, along with their significance and suggested methods for investigation. Overall however, the trials suggested that the organic ley system was productive and comparable to, or even better than, the mixed ley system used in this trial.

Over the last decade the increase in organic farming has paralleled the increasing public interest in health (Hill 1986, MacRae *et al* 1989 Chamberlain *et al* 1989). The latter has made the consumer more interested in the presence of 'non-food' elements, particularly additives such as colourings, flavourings and preservatives. On top of this there is concern about 'unseen' additives in food, namely the effect of increasing use of artificial fertilisers, herbicides and pesticides in agriculture. Harwood (1984) and MacRae *et al* (1989) discussed the problems involved in the study of sustainable farming systems and especially the need to adopt a diverse scientific approach.

Later analyses of organic farming include those of Oelhaf (1978, 1982), USDA (1980), Vine and Bateman (1981), Conacher and Conacher (1982), Blobaum (1983), Lockeretz, *et al* (1984) and Vereijken (1989).

Oelhaf (1978, 1982) in an economic and ecological comparison of organic and conventional farming felt that while organic food production solves most of the environmental and health problems which are of concern today, it does so at a price. This price increase was estimated to be 9.2% averaged over the major crops for the production costs. It was also estimated that an extra 9.5% increase in land surface would be required to produce the same amount of crops. As farm prices of food make up about 38 percent of the retail value, Oelhaf concluded that retail prices would rise only 3.5 percent. Oelhaf estimated that a change to organic farming would increase labour by 16 percent. It was noted that this was about

three percent of the number of people who were unemployed in America in 1977. The comment was made that the estimates were subject to a considerable amount of uncertainty. He concluded that the nature of organic farming research needs and widespread market failure in agriculture resulted in a research bias towards conventional farming.

The United States Department of Agriculture survey (USDA 1980) assessed the nature and activity of organic farming nationally. The organic farms in the survey represented a spectrum of practices, attitudes and philosophies, from purist philosophy to a more flexible approach with limited use of chemical fertilisers and pesticides. Motivations for changing to organic methods ranged from protecting soil, human and animal health from potential hazards of pesticides, desire for decreasing production inputs, concern for the environment, to protection of soil resources. The change to organic farming was found not to mean a regression to farming methods of the 1930's. Instead use was made of modern farm machinery, recommended crop varieties, certified seed, sound methods of organic waste management and recommended soil and water conservation practices. There was relative success in the control of weeds and pests, but phosphate and potassium were found to be mined to some extent. Labour requirements were increased and energy requirements decreased after conversion. Economic returns above variable costs were higher on the conventional farms than the organic farms. Yield levels were taken as reported and not measured quantitatively. The USDA felt that the future expansion of organic farming was unsure, depending on the availability and price of fertilisers (especially nitrogen fertiliser) and farm labour, produce/price relationships and the domestic and world demand for food. Concern for soil and water conservation, health and the environment play a part together with the United States policies towards the development and promotion of organic farming.

The aim of the Vine and Bateman (1981) study was to evaluate the potential of organic farming in England and Wales. This did not

involve finding the average statistics for the whole organic farming fraternity, but rather what was possible to achieve under an organic farming regime. Of the farms used in their study, less than 30 farms had been going for three or more years and had full physical and economic data for one year. They found that the majority of organic farms had lower incomes than their conventional counterparts. Labour employed on the organic farms was found to be no different from that on comparable conventional farms. The comment was made that the variability in the performance of these farms suggested that their relative position could be made stronger if advisory facilities were available specifically geared up to their methods. Possible benefits to society from organic farming that were mentioned were long-term benefits to the soil, wild-life conservation and to pest and disease control strategies.

An Australian survey (Conacher and Conacher 1982) also concluded that organic farming was economically feasible, and the effects of the organic farming were positive on environmental problems such as erosion control. As in the other surveys, lack of available technical advice on organic farming methods was identified as a major problem.

Blobaum (1983) studied the barriers to the conversion to organic farming practices. Nearly three quarters of the respondents in this study had farmed with chemicals before switching to organic methods. One in four reported some off-farm employment but only one in five worked off the farm more than 100 days a year. This was compared with 30 percent of all farmers in the North Central states who worked off-farm for 100 days or more. Seventy-nine percent of the farmers who had switched over from conventional farming had done so in the nine year period up to 1977, with the decisions being fairly evenly distributed as follows:

- a/ encouragement of friend or relative - 26% of total making switch to organic farming
- b/ attendance at organic farming meeting - 21%
- c/ concern over livestock health and performance - 18%

- d/ encouragement of organic fertiliser agent - 15%
- e/ increasing farm production costs - 12%
- f/ concern over poor tilth and other soil properties - 11%
- g/ concern over soil and water pollution - 11%

The main reasons for hesitating before converting to organic methods were in order of importance: lack of information, fear of radical drop in yield, concern over weed problems and concern over landlord objections. Asked to list the greatest disadvantages of organic farming, the farmers listed weeds as a major problem. High labour requirements, lack of special markets and social pressure were the next most serious disadvantages mentioned. As the survey only involved farmers that had successfully made the transition to organic farming and not those that had tried, the responses could have had some bias in favour of organic farming.

Lockeretz (1978, 1982) and Lockeretz *et al* (1984) conducted a five year study which covered a range of topics. These included sociological, economic and scientific factors on organic farms in the United States. The project had been initiated because of the energy crisis in 1973. The study revealed that the organic farmer had much in common with the conventional farmer. Their reasons for farming organically were usually pragmatic rather than spiritual or religious. Energy requirements of organic farmers during the five year survey were 40% of that used by conventional farmers per unit value of produce. The main source of the higher energy use on the conventional farms was the energy required for fertiliser manufacture, especially nitrogenous fertilisers. Energy requirements were averaged over the whole farm, neglecting differences in crops grown with their inherently different energy requirements. The net income per hectare of the two groups was about equal on average.

The Dutch trial (Zadoks 1989, Vereijken 1989) was set up in a similar manner to the earlier work by Balfour (1975). Three farms were set up: The Current farm which represented the current farming as it was practised in the area around the research farm.

This was a cropping farm with a four year rotation of potatoes-peas/onions/carrots-sugar beet-winter wheat. The Integrated farm was to develop a farming system which had an integration of purposes, especially the reduction of inputs derived from non-renewable resources, avoidance of pollution, and financial results approaching those of the Current farm. Size, rotation, and other design aspects were similar to those of the Current farm, so comparisons could be made. The Organic farm followed the principles of biodynamic farming, and grew the same main crops as on the other two farms but on a different rotation. Twenty head of dairy cattle (Friesians) were carried to provide farmyard manure as well as satisfy the principle of having stock present in a biodynamic farming system. The rotation on the organic unit was: potatoes/onions - winter wheat - carrots/chicory - peas - pasture (Italian ryegrass and red clover) - cabbage/fodder beet - winter wheat - three year pasture ley (perennial ryegrass and white clover).

All three farms were set up by 1979 and the first report covered the five year period of 1980-84. This early period showed the organic dairy farm was too highly stocked (Meijer 1989) and so the stocking rate was adjusted in 1986. In the preliminary cropping report (Maenhout 1989) an appropriate rotation was felt to be vital to maintain soil fertility. It was noted that the rotation used proved adequate to do so, as well as to restrict weed competition. Weed competition was strong in the other two sections and the use of herbicides was high. Potatoes yielded low on the Integrated and Organic farms (Spiertz 1989) compared with the Current farm. Sugar beet and winter wheat performed similarly on the Integrated farm as on the Current farm but very poorly on the Organic farm. It was felt that the maintenance of fertility of the arable section of the Organic farm was achieved at the expense of the grassland fertility (Smilde 1989). With disease and pest control, considerable reduction of pesticide application was already possible (Rabbinge and Zadoks 1989). Weed management proved to be a more difficult problem on the Integrated and Organic farms (Hoogerkamp 1989). Throughout the first five year period, the organic farm labour was running at a loss

(Lalkens and Meijer 1989). The Integrated farm made a smaller profit than the Current farm. The Current farm was comparable to that of a reference group of private farmers in the area. At the end of these five years some major changes were made to the crop rotation to improve financial results and the trials are being continued.

A number of research projects in organic or sustainable farming, especially in North America but also elsewhere, have been carried out with an emphasis on soil conservation (Reganold 1989, Pimentel *et al* 1989, Kaffka and Koepf 1989, Watson 1990 and Patriquin *et al* 1986). Pimentel *et al* found conversion to organic methods reduced soil erosion from eighteen tonnes per hectare per year to one tonne per hectare per year.

In New Zealand a number of studies have been carried out recently. The Ministry of Agriculture and Fisheries (MAF) published a report on biological farming (Gunning and Cullen 1983). This report offered little support for the organic movement in New Zealand. The only positive outcome for organic farmers from the report came in the Minister's response which encouraged MAF scientists to monitor the progress of nine organic farms in a paired study with conventional farms over the next three years. The results of this work by Haystead were published in 1987.

Four paired dairy and five paired mixed units made up the study group. There was a tendency for soil test values to be higher on conventional farms (Haystead 1987), but there were no significant differences between the organic and conventional farms and no significant trends over the three years of the study. Even though some of the organic farms had been operating for more than five years, there was no indication that any significant drop in soil fertility had occurred prior to or during the study. The pastures on some organic farms had less ryegrass and more broad-leaved and annual grass species than the adjacent conventional farms but there were no indications of degeneration or loss of clover from the sward. There were no differences in soil biomass between the

organic and conventional farms, although two of the organic dairy farms had a greater earthworm biomass. The major stock losses in the study occurred on the conventional farms and, if anything, animals were less healthy under conventional management. Most of the organic farms in the survey were using fairly well known traditional remedies and animal health strategies with an emphasis on disease prevention. Many farms were operating selection strategies in which animals showing resistance to problems such as bloat and parasites were used as breeding stock and badly affected animals were culled. It was concluded that organic farming does work but can result in lower yields and income in sheep and cropping situations. Haystead also stated that skilful marketing was the key to success, without which the organic farmer receives no reward for the extra trouble needed to produce what many people regard as a better product.

Fisher (1989) carried out a study identifying barriers to the adoption of organic wheat farming in Canterbury, New Zealand. Pest control was the main technical problem identified. The period of transition from conventional to organic agriculture with its associated investment cost and low income also caused worry to farmers contemplating a conversion to organic farming.

Many researchers in New Zealand tended to be sceptical about the success of organic farming and work on the subject was scarce. In the last decade, however, there has been a rapid increase in the demand for more information on alternative sustainable farming methods, both in New Zealand and overseas, which has led to a proliferation in research on the subject. Europe and the United States of America have been in the forefront in this, due no doubt in part to pressure put upon agriculture by environmental lobby groups and growing problems of pollution and deteriorating environments.

In general however, although the ability of an organic farm to be economically viable is in doubt by some workers, and it is often commented that the management skills required are good as chemicals can not be used if things go wrong. The benefits of

improved soil conservation and greatly decreased pollution have not been refuted.

### **2.1.2 Organic Farming - Present Status**

In Europe organic farming has slowly developed over the last thirty years. At present it accounts for less than one percent of all the farming in the European Economic Community (Ott *et al* 1990, Nychas and Peter 1990). A 1987 survey by the European Commission found that 77 percent of consumers were willing to pay a higher price for 'more healthy food' (Davis *et al* 1990). In Germany there are approximately 3,000 organic farms (Boehncke pers. comm. 1991), making up about 1% of the total number of farms. This compares with 0.1-0.2 percent of ten years ago. France has about 5,000 organic farms with a total surface area of 75,000 ha; and in Italy there are about 800 organic farms covering 15,000 ha. (Favaretti and Galletto 1991).

In the United Kingdom 14,000 ha. was farmed organically in the autumn of 1989, with a further 4,100 ha. in the process of conversion (Woodward and Lampkin 1990, MAFF 1991). The average organic farm had 24 ha. in full organic production with a further 7 ha. in transition. A campaign 'Twenty Percent by 2000' was launched in 1989 by the British Organic Farmers to change twenty percent of British farmland to organic production by the year 2000. This reflected a growing demand for organic cereals (up 400 percent) and organic meat (up 300 percent) from 1988 to 1989 (Davis *et al* 1990). The number of farms becoming certified under the organic trademark increased from one per month in 1984 to fifty per month in 1987 (Easton 1987).

The USDA report (USDA 1980) estimated that there were 11,200 organic growers in the United States if a strict definition of the term organic farming was used. At least 24,000 farmers in all practised organic techniques on part of their cropland.

In New Zealand approximately 10,000 hectares, less than one

percent of New Zealand's agricultural land, is farmed organically at present (Davis et al 1990). By 1988, "Demeter" certified lamb, wool and kiwifruit were exported (Proctor 1988), and at least one farmer per week was converting to biodynamic methods. Two experimental units have been set up by MAF, one of these being a horticultural unit at the Levin Horticultural Research Station. The other unit at Flock House near Bulls is evaluating a mixed sheep and cereal system, with emphasis on internal parasite control (Stiefel and Roberts 1989). A hill country sheep and beef breeding unit comparison has been put into place by the Department of Scientific and Industrial Research (DSIR) at Ballantrae near Palmerston North. Both the two latter livestock units have reported in their early findings that crossover grazing and a drop in stocking rate (10% at Ballantrae) greatly reduced worm burdens without the need for drenching.

Davis *et al* (1990) commented that from overseas experience, the organic movement can expect to grow to ten percent of the home market in the next five to ten years. Blakely (1990) predicted that by the end of the 1990's, 20% of New Zealand farmers will be growing produce organically, and the rest will be using far fewer chemicals.

### **2.1.3 Organic Farming - Definition**

The definition of organic farming used in this thesis is that of the Bio Gro Standard for Organic Food Production. "Bio Gro" is the organic trademark of the Biological Producers Council (BPC) of New Zealand, and the Bio Gro standard specifies restricted and permissible farm practices and includes guiding management principles. The BPC is affiliated to the International Federation of Organic Agricultural Movements (IFOAM), an international organic quality control body. IFOAM was set up in 1972 in response to a growing concern among influential people concerning the environment and the pathway of agriculture (Crowder 1990). The Bio Gro trademark was internationally recognised in November 1989 (Anon 1989). The trademark "Demeter", is owned and administered by the Bio-Dynamic (BD) Farming and Gardening Association of New

Zealand. The standards for the Demeter mark are similar to the Bio Gro trademark, specifying similar chemical restrictions, and can be considered as a special case of organic farming.

Although organic farming excludes the use of pesticides and chemically processed fertilisers, the actual term has been given a number of different definitions by different groups. As the main international governing body, IFOAM has stated (Fisher 1989) the aims of organic farming as:

- 1/ To produce a sufficient quantity of highly nutritious foodstuffs.
- 2/ To provide agricultural producers with a safe and satisfying work environment and a reasonable return.
- 3/ To raise livestock in conditions which allow them to perform all the innate aspects of their behaviour.
- 4/ To work in conjunction with natural processes, rather than try to dominate them.
- 5/ To enhance soil fertility, with great emphasis being placed on soil organic matter and soil biology.
- 6/ To close the production system as much as possible. On-farm resources and local renewable inputs are preferred. The farm should be as self-regulating and self-sustaining as possible, with little need for external control and inputs.
- 7/ To minimise environmental degradation, and to preserve the genetic diversity of the agricultural system and its surroundings.

These principles are said to form the basis of a set of Standards with which a farmer must comply for Bio Gro certification. The specifications are reviewed every two years. A precis of the standards as approved by IFOAM's Technical Committee is as follows (Fisher 1989):

- 1/ All inputs to the farm must be of a type approved by the BPC. Slow release and humus-based fertilisers which encourage and require biological activity in the soil are preferred. These include animal manures and plant materials, compost, biological activators, rock minerals and herbal and homeopathic solutions.

2/ Chemically synthesised compounds, such as superphosphate, anthelmintic drenches, growth hormones and pesticides are not permitted at any stage of the production, processing and distribution stages. However, limited chemical use is permitted where herbal or physically prepared remedies are not available as a curative rather than a routine measure.

3/ Animals must be managed with respect to their welfare, and a diseased animal must not go untreated in order that it may be called organic. Livestock treated with restricted animal remedies lose their Bio Gro status for 12 months, and must be kept separate from the organic flock for a designated period.

4/ Livestock brought onto the farm each year must not exceed ten percent of the capital stock figures. They must be kept separate from the organic flock for a period and require 12 months to elapse before they can be sold as Bio Gro.

5/ The amount of supplementary feed brought onto the property from non-Bio Gro sources may not exceed 15 percent of the total annual dry matter intake of the animal. Animals grazing on non-Bio Gro land or consuming more than this amount lose their Bio Gro status for 12 months.

6/ Plant and equipment which come into contact with chemicals (for example a contractor's spray rig) are prohibited if uncontaminated alternatives are available.

7/ There must be no parallel production: Crops to be sold as organic must be clearly distinguishable by marking, variety, breed or type from conventionally grown produce.

8/ The label is two-tiered. For both full Bio Gro and Bio Gro in transition, the farm area must be farmed using organic methods for a minimum period of 24 months. The farm area is the unit which is awarded the Bio Gro label. Full Bio Gro is awarded when the BPC is satisfied that the need for routine use of restricted practices has been eliminated.

The Bio Gro label can be issued for part or all of the farm production system, and can also be awarded to approved 'organic' commercial products.

9/ Organic produce must have an acceptably low level of chemical residues. This is one percent of the conventional maximum permissible levels (as specified in the New Zealand Food Regulations) for human consumption. Possible chemical contamination from neighbouring land, the water source, persistent soil residues, major roads (lead contamination), shared farm equipment and industry should therefore be minimal.

10/Farm practices must not violate the principles outlined in the standards.

11/Annual inspections of the farm are made at the cost of the producer.

Whereas the New Zealand organic standards rigorously ban the use of chemical inputs, the United States Department of Agriculture (USDA 1980) definition does not, but instead states that:

'Organic farming is a production system which avoids or largely excludes the use of synthetically compounded fertilisers, pesticides, growth regulators and livestock feed additives. To the maximum extent feasible, organic farming systems rely upon crop rotation, crop residues, animal manures, legumes, green manures, off-farm organic wastes, mechanical cultivation, mineral-bearing rocks and aspects of biological pest control to maintain soil productivity and tilth, supply plant nutrients and control insects, weeds and other pests.'

The USDA also defined only the organic farming technology, without considering the organic food product. The British Organic Farmers and Organic Growers Association (MAF 1991) defined organic agriculture as follows:

'Organic farming seeks to create an integrated, sustainable agricultural system relying first and foremost on ecological interactions and biological processes for

crop, livestock and human nutrition and protection from pests and diseases.'

External inputs are allowed, however, and in special situations non-organic inputs may be allowed if no organic substitute is available. In this system the term 'organic' is properly used to describe the production system rather than the end product, which is generally not tested for residues and not explicitly claimed to be residue-free. The products of organic farming are more accurately referred to as 'organically grown' rather than 'organic', though the latter term is obviously widely used.

The Bio Gro standard is, in contrast, based upon perceived market specifications for organic food and is a lot more strict and thereby harder to follow.

## **2.2 Survey Methods**

The main methods for collecting information for this type of research are by a mail questionnaire, telephone survey or a personal interview. Each of these methods has its advantages and disadvantages (Parker and Hughes 1989).

Personal interviews are likely to have the highest response rates of all these methods - over 95% is not unheard of. The interviewer is face to face with the interviewee and can thus be expected to gain more accurate and in depth answers. There is also more opportunity for discussion of the answers once they have been given. However, time, travelling and expenses involved in this type of survey would limit its size.

Telephone surveys can achieve a high response rate. They may be fast and can be cheap if few toll calls are required. The major disadvantage apart from the toll costs as already mentioned is that they are impersonal.

Mail surveys are usually cheaper than other methods and sometimes faster. A wider distribution of properties is also possible. The

respondents may be more prepared to give accurate replies to personal questions by mail than if the surveyor is present. The absence of the interviewer will mean that interviewer bias, where the interviewer may direct the answers to some degree, will not occur (Chan 1979). The biggest drawback to this method is that its response rate is generally low compared with the other methods. As well, there is little control over the completeness of answers. Usually 50-75% is regarded as all that can be expected. Erdos (1983) stated that no mail survey can be considered reliable unless it has a minimum of 50% response. The response rate can be improved by enclosing a stamped, addressed return envelope, a covering letter ensuring confidentiality, and the use of reminder letters. A short covering letter is equally effective as a long covering letter (Chan 1979), and the use of full names for addressing is better than addressing 'to the householder'.

Effectiveness of advance notification identifying the researchers, discussing the study's purpose and requesting co-operation has been tested by a number of workers. A review by Chan (1979) concluded that generally there was no increase in response rate, although the speed of response was accelerated. Questionnaire length itself was shown not to interfere with response rates. Instead it was shown to be of more importance as to how interesting the question contents were to the respondent.

A pre-test of the questionnaire on a small scale is useful (Cochran 1977, Chan 1979) and often leads to improvements in the questionnaire. A pre-test involves sending the questionnaire to a sample of people as similar as possible to the people who will be receiving the actual final questionnaire. It may also bring to light other troubles that may be serious on a large scale, for example, that the cost will be much greater than expected.

## 2.3 Statistical Analysis

### 2.3.1 Sampling Error

Several sources of error may occur in the survey itself (Cochran 1977). The error of estimate arises solely due to the sampling variation that is present by surveying only a sample of the population instead of the complete population. Additional sources of error are:

- a) non-response, which may occur by oversight or be due to failure to locate some individuals or their refusal to answer the survey when located.
- b) errors of measurement on a unit. The respondent may not possess accurate information or may give biased answers.
- c) errors introduced in editing, coding and tabulating results.

### 2.3.2 Principal Components

Given a need to discriminate amongst the farmers surveyed, the response data matrix  $X$  of  $n \times p$  dimensions, where  $j=1, \dots, n$  farmers, and  $k=1, \dots, p$  attributes, was used for the multivariate analysis. The best discriminatory score amongst the farmers is the largest possible separation between them, i.e., the variance is large. The principal component is the best linear function of the attributes for this purpose (Press 1972, Overall and Klett 1972 and Morrison 1976). A principal component analysis partitions the total variance of the system into successively smaller portions by means of an orthogonal transformation of the co-ordinate axes (Tietjen 1986, Cooley and Lohnes 1971). Scores are produced for any solution :

$$u_j(l) = x'jv_l$$

where  $l=1, \dots, p$  solutions.

The prime property of this is that the variance of the score is a local maximum in the infinity of local possible sets of coefficients

$v_j$ , and hence the best possible discriminator amongst the farmers. This produces a net score  $u_j$  over several attributes.

non sequit

There are  $p$  solutions to the eigenstructure of the dispersion matrix  $D_x$ . This eigenstructure solves a set of equations which have the following constraints (Morrison 1976): - coefficients have certain sizes to avoid infinite solutions, i.e. let  $v'v=1$ ; - and scores are independent of each other ( $I+I'$ ). This provides up to  $p$  linear scores. Each score aggregates data in different ways. Due to this, different scores emphasise attributes differently. Some of these scores may contain virtually all the dispersion of the data. This should allow the replacement of many attributes with few scores, but still account for most of the variance of  $x$ . Thereby we achieve parsimony (Morrison 1976, Cooley and Lohnes 1971).

Given that the variance of the scores:

$$\partial^2_{u(I)} = v' D_x v$$

and the eigenstructure solution is:

$$D_x v = v \mu$$

where  $\mu$  is a Lagrange multiplier

by pre-multiplying both sides by  $v'$  we get:

$$v' D_x v = v' v \mu$$

which means that:

$$\partial^2_{u(I)} = \mu$$

as  $v'v = 1$  as defined by the constraint.

Pearson (1901) provided the mathematical basis for principal components methodology by first describing the line of best fit through an ellipsoidal cluster of points. Hotelling (1933) formulated the modern definition as the axes which successfully account for maximal variability in a sample.

Rao (1964), Hope (1968) and Kshirsagar (1972) discussed the various useful properties and uses of principal components in applied research:

1/ The eigenvectors are orthogonal, so the principal components represent jointly perpendicular directions through the space of the

original variables.

2/ The principal component scores are jointly uncorrelated.

3/ The first principal component has the largest variance of any unit-length linear combination of the observed variables. The  $j$ 'th principal component has the largest variance of any unit-length linear combination orthogonal to the first  $j-1$  principal components. The last principal component has the smallest variance of any linear combination of the original variables.

4/ The scores on the first  $j$  principal components have the highest possible generalised variance of any set of unit-norm linear combinations of the original variables.

5/ The first  $j$  principal components give a least-squares solution. In other words, the first  $j$  principal components are the best linear predictors of the original variables among all possible sets of  $j$  variables.

6/ In geometric terms, the  $j$ -dimensional linear subspace spanned by the first  $j$  principal components gives the best possible fit to the data points as measured by the sum of squared perpendicular distances from each data point to the subspace.

The model is (Harris 1975, Lindeman et al 1980, Morrison 1976)

$$PC_j = x_{1j}b_{1j} + x_{2j}b_{2j} + \dots + x_{ij}b_{ij}$$

where

$PC_j$  is the  $j$ 'th principal component,

$x_{ij}$  is the value of the  $i$ 'th observation on the  $j$ 'th principal component,

$b_{ij}$  is the weighting coefficient of the  $j$ 'th principal component for predicting the  $i$ 'th variable,

$i = 1, \dots, n$  no. of individual

$j = 1, \dots, p$  no. of variable

## **CHAPTER THREE - MATERIALS AND METHODS**

### **3.1 Survey Area**

Organic and biodynamic farms at present account for only a small proportion of all the farms in New Zealand (Davis et al 1990). It was therefore decided to send a survey to all New Zealand properties using organic and biodynamic methods in 1989 and for whom addresses could be found (n=77). A smaller group of conventional farmers who were members of three different discussion groups in the North Island were also surveyed at this time (n=32). These two groups of farmers were unpaired. Due to farms being spread throughout the country, the physical characteristics of the properties varied widely.

The locations of the properties that returned completed survey forms are shown in Figure 3.1.

### **3.2 Survey Method and Questionnaire Design**

#### **3.2.1 Survey Method**

A postal survey was chosen as the desired method. Allowing the maximum number of farms to be surveyed within the time and financial constraints, especially as properties were so widely scattered. This also gave the respondents time to answer 'thought' and 'calculation' questions more fully.

The questionnaire content was based on the variables required for the analysis to satisfy the research requirements. Help on the design, layout, question format and coding was gained from Parker and Hughes (1989).

#### **3.2.2 Layout**

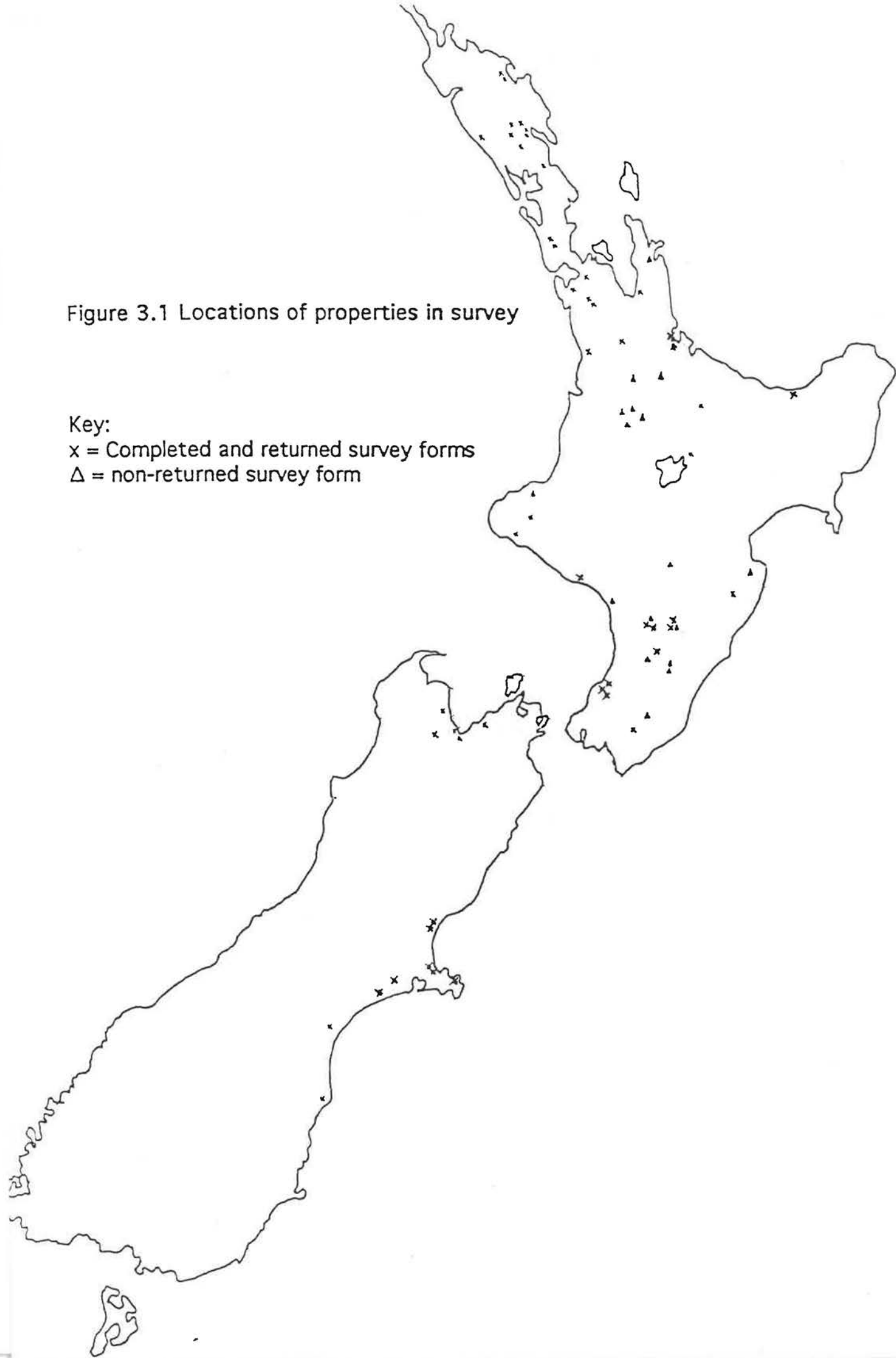
The questionnaire was divided into four sections and covered nine

Figure 3.1 Locations of properties in survey

Key:

x = Completed and returned survey forms

Δ = non-returned survey form



pages in total. The first section covered the farm status and the farmer's personal background. This included questions on what category they felt their farm was in (conventional/ organic/ biodynamic), certification level, and how long they had been using their present system of farming. Other questions covered reasons for changing their farming system and the operator's prior occupational background. This information was used to look at the farmer's level of commitment and involvement in organic farming, and the type of people becoming involved with organic farming.

Farm characteristics such as size, production enterprise, farm costs and income, and the marketing and selling of produce were covered in section two. The first of these questions gave a general farm description. The marketing questions were used in analyses on consumer preparation, processing (industrialism) and marketing strategies (specialisation) of the farmers. An idea was also gained as to how many of the farmers obtained most of their income from their property.

Section three dealt with the management of the property. This included such things as farm system, soil status, health problems, labour, advice and information. The objective here was to look at the management factors of organic farmers, with special reference to problems specific to this system of farming.

The fourth section asked the farmer to give their impressions and evaluation of their present farming system, and their satisfaction with it.

The complete survey form is included in the appendices.

### 3.2.3 Question Type

Question design was such as to allow appropriate statistical analysis as required to fulfil the objectives. Most questions were multiple choice which were ordinal scores to allow for standard analytical procedures to be carried out. Other questions were dichotomous (yes/no type), or set to give ratio data (such as farm size). A few questions were open ended to allow the farmers to expand on their answers. These latter responses were used more to provide background information.

Several of the ordinated multiple choice questions had a number of responses that could be made by any one farmer (this involved questions 3c,8,9c,10a,15 and 20a). For these the answers were ranked as increasing with a stronger trend to organically inclined responses and these ranks were put to the power of two so the resulting score can only be one particular combination of responses. For example in question 10a the farmer was asked what they labelled their products as. If the farmer used both their own label (scored as 2) and the organic label (scored as 4), their final score would be six. As the other two options were biodynamic (scored as 8) or no specific label (scored as 1), this score of six can only be a result of those two responses.

A section was provided at the end for respondents to add any comments they felt relevant. An "other" option was included where necessary to safeguard against possible incorrect entries or non-responses, although care was taken to include all reasonable options as felt by the researcher. This was borne out by the fact that the "other" option was rarely used. The "other" option occurred in nine questions (questions 1,3c,7,8,9c,10a,10b,15 and 20a), and with exception of question 7 - products grown on the property, this option was used 42 times. Of these, 26 were for the markets of the organic

produce (Question 10b) and as the majority (24) were for direct sales this was made into a separate market. Of the remaining 16, six were producers using personal labels on their produce in question 10a. It was concluded that the "other" option had been of minor importance in this survey

Question four in the survey asked farmers for their previous occupations if they had not always been a farmer. The resulting responses were sorted into six categories. The criteria used for this were as follows: (Krause 1971)

A. professionals have

- i. existing theory and skills
- ii. training institutions
- iii. a community mandate
- iv. a code of ethics
- v. the client's welfare as the primary objective

B. semi-professionals have characteristics as in (i) to (iv) of A., but differ from the professional category on the following:

- i. shorter training period
- ii. regular supervision on the job

C. trade

The primary objective of this occupation is profit making.

D. clerical, sales and service personnel have

- i. training on the job

E. workers

- i. manual labour is required on the job.

F. other

This category includes occupations not classified under the

previous five categories.

### **3.3 Administration of the survey**

#### **3.3.1 Pre-testing**

A draft copy of the questionnaire was sent to seven farmers in April 1989 to assess the clarity of the questions to the respondents. These farmers were chosen for proximity (Central Districts area) thereby facilitating follow-up in the case of non-response. Most of these farmers had also indicated to the Soil and Health Association that they would be willing to participate in surveys or studies of their properties.

Of these, six were returned within a fortnight and the seventh was returned after sending a reminder letter with a second survey form. The form was also checked by three university staff who had previous experience with agricultural surveys or who had particular knowledge or interest in aspects of the research project. These were Mr C. Matthews (Agronomy Dept.), Mr M. Collins. (Agronomy Dept. Farm Machinery section) and Mr A. G. Robertson (Agronomy Dept. retd.).

As a result of this trial survey two questions were changed to allow for more clarity in the farmer's response. These were questions 20b and 20c where the farmer was asked to assess the availability of advice (20b) and if information was easy to find (20c). The trial group tended to give two scores for each, one for general and one for within the Biodynamic organisation. These questions were expanded to give separate answering facilities for general and for within the Biodynamic organisation

### 3.3.2 Survey Practice

Names and addresses of organic farmers were obtained through New Zealand Soil and Health, Willing Workers On Organic Farms (WWOOF) Association, university staff and through word of mouth. Efforts were made to exclude properties from which no financial returns were achieved. Addresses of 32 conventional farmers were obtained from Mr P. A. MacGillivray of the Agriculture and Horticulture Systems Management Department, Massey University.

The main survey was sent out during the first week of June 1989 to 77 organic farmers. A covering letter was enclosed along with a stamped addressed return envelope. The letter gave a brief summary of the aims of the research and promised a summarised report to those that returned a completed questionnaire.

A copy of the letter has been included as Appendix II.

A further 32 surveys were sent out to conventional farmers in January 1990. Again a covering letter and stamped addressed return envelope were enclosed.

Late in September 1989 a reminder was sent to farmers who had not responded to the first survey. A copy of the survey and covering letter were also enclosed. The final result was 52 (67.5%) of the organic farmers and eighteen (58.1%) of the conventional farmers returned a completed survey. This was an overall effective response rate of 64.8%. Of those unanswered, one had sold his farm, one did not feel eligible to answer as he was not the owner or part-owner of the property, and one did not want to fill in the questionnaire without some form of monetary payment. One was also returned by the postal system.

## **3.4 Data Processing and Analysis**

### **3.4.1 Data Collection and Editing**

All questionnaires were numbered before being posted, allowing identification of farmers to whom a summary would be sent. It also identified the area where the respondent resided.

Questionnaires were checked for completeness. Where necessary, acres were converted to hectares. Where the farmer had not answered a particular question, this was recorded as a zero, or if it did not apply to his operation it was left as a missing value. For example, a zero was used in question 10b if no produce was sent to a particular type of market. Conversely, a missing value was recorded in question 15 (stock management systems), if a farmer did not carry any stock.

### **3.4.2 Coding of Responses**

Each question's response was numerically coded, or if the data was missing, a space was entered. Metric data were entered directly into computer files. Questions with yes/no type answers were coded (no=0 and yes=1). Attitudinal questions were coded with numerical values increasing with the intensity of the adverb describing the options. Where more than one answer was given, exponential scales were employed (see 3.2.3 Question type). The coding values for the responses are listed in Appendix I on the survey copy.

Scales used for each variable are given in Table 3.1

### **3.4.3 Statistical Analysis**

Statistical analysis was carried out using Statistical Analysis Systems (SAS Institute Inc. 1985). This program was chosen due to its ability to cope well with complex multivariate data sets and

availability of a wide range of procedures.

The functional relationships between a number of factors were examined using principal components analysis (SAS,1985) on all suitable data. Suitable data was defined as that having an ordinal or ratio scale with a range of at least three definition points. A scale of five is preferred as the minimum, but this reflected a shortcoming in the survey design. This excluded responses using binomial or nominal scores. The output data sets contained means, standard deviations, simple and partial correlations, eigenvalues, eigenvectors, and the pattern matrix for eigenvalues greater than one. The latter three were used in the principal components analyses (see 2.3.2 Principal Components).

Means and standard deviations are reported for all data in Chapter Four: Results.

Partial correlations are the correlations between two variables when all others are fixed. If  $R$  is the symmetric matrix of simple correlations among a set of  $p$  variables  $x_1, \dots, x_p$ , then the inverse of  $R$ ,  $R^{-1}$  is also symmetric. The equation for the partial correlation  $r$  between  $x_i$  and  $x_j$  can be written as (Steel and Torrie 1980):

$$r_{ij,1 \dots i-1,i+1 \dots j-1,j+1 \dots p} = \frac{-R_{ij}}{\sqrt{R_{ii}R_{jj}}}$$

The background of principal components is given in Chapter Two: Review of Literature, section 2.3.2. The principal scores are written as the matrix (Morrison 1976, Sarle 1985):

$$Y = XB$$

where

$Y$  is an  $n$  by  $p$  matrix of the centered observed variables,  
 $X$  is the  $n$  by  $l$  matrix of scores on the first  $j$  principal components,

B is the  $j$  by  $p$  matrix of weighting coefficients,  
 $i = 1, \dots, n$  farmers,  
 $j = 1, \dots, p$  variables,  
 $k = 1, \dots, l$  solutions.

The aim was to discriminate best among the respondents by finding linear functions of the original variables such that the new principal scores had maximum variance (Cooley and Lohnes 1971).

As principal components analysis is a method for reducing  $p$  correlated measurement variables to a smaller set of relatively few composite variables (Overall and Klett 1972), a cut-off of 70% in the cumulative proportion accounted for by the eigenvalues was decided to give a good level of parsimony. Factor structures and standardised scoring coefficients are given at this point along with their separate and cumulative proportions. Scores are also plotted.

Principal components analyses were carried out on a number of sets of variables, as shown in Table 3.1. Principal component analyses were often carried out on a single question which contained a number of answers, here only a single symbol is indicated (\*,+ or #) in the Table. A column of identical symbols (\*,+ or #) indicates a principal components analysis (PC) was done on that group of variables, i.e.:

- 1-the first column of \* was a "personal" PC
- 2-the second column of \* being an "involvement" PC
- 3-the third grouping analysed the farm description
- 4-the fourth a "marketing" PC
- 5-the fifth a "farm system" PC investigating the degree of soil conservation techniques used.
- 6-the first group of + was a "labour" PC
- 7-the second group making up an "information" PC
- 8-a third group being a "biodynamic information" subset
- 9-the column of # was comparison and farmer "self-evaluation" PC.



using principal components analysis. See Table 3.2

**Table 3.2**

**Information graphed**

variable	scale	graph type
farm enterprises present in survey	nominal	histogram
trace elements tested for by farmers	nominal	histogram
fertilisers used on farms	nominal	histogram
Animal health problems	nominal	histogram
plant health problems	nominal	histogram
weed problems	nominal	histogram
prohibited chemical usage	binomial	pie chart
produce processed on organic farms	nominal	pie chart

Some of the data that were used elsewhere in statistical analyses were also graphed when it was felt these gave a useful picture (Table 3.3).

**Table 3.3**

**Data both graphed and statistically analysed**

variable	scale type	graph type
farm type	ordinal	pie chart
degree of adopting OF methods	ordinal	histogram
certification held by farm	ordinal	pie chart
years since adopting OF	interval	histogram
areas farmed OF and CF	interval	histogram
markets of organic produce	ratio	histogram
proportion of income that is from farm	ordinal	histogram

## CHAPTER FOUR - RESULTS

### 4.1 Farmers and their Attitudes

Of the surveys returned, there were 20 conventional, 20 organic, 29 biodynamic and one permaculture property represented (Figure 4.1). The response rate of 64.8% was better than the 50% minimum response rate needed to be considered reliable (Erdos 1983). Within the organic farming respondent group, the degree to which the farmer had changed to an alternative system lay halfway between organic and biodynamic on a scale of 1-4 (Table 4.1), where: 1=conventional, 2=organic, 3=biodynamic and 4=permaculture. On average 88% of the principles and methods have been adopted by organic farms (Figure 4.2). Certification level, however was low, falling between transitional Bio-Gro and full Bio-Gro at 1 and 2 respectively, other responses were 0=none, 3=Demeter and 4=both Bio-Gro and Demeter (Figure 4.3). Eighteen of the farms in the organic group had no certification whatsoever (35%). The average term for which these farms have been using these methods is 6.5 years. The graph of years versus number of farms followed a normal curve (Figure 4.4), with the chi square value of 13.093 being less than the table value of 13.339 at P=0.50 level for fourteen degrees of freedom.

**Table 4.1**  
**Personal data of organic farms**

Descriptive statistics*	mean	std.dev.	range
farmtype (degree of alternativeness)	2.5192	0.6414	1-4
adoption of methods	8.7885	2.4361	1-10
years since conversion	6.4615	3.0258	0-14
level of certification	1.5962	1.4326	0-4
anthropomorphic incentives	26.1150	16.8800	0-63
esoteric incentives	10.9230	7.7126	0-31

\*note - scale types of data are given in Table 3.1 in Chapter 3: Materials and Methods.

Farmers were given a range of responses to choose from as their incentives to farm alternatively. Any combination could be given, with scores ranged from 0-63 for anthropomorphic incentives and 0-31 for esoteric incentives (see Materials and Methods, section 3.2.3). The reasons for adopting organic methods tended to be more for anthropomorphic (scientific), rather than esoteric (personal beliefs) reasons (41.45% and 35.24% respectively),

Figure 4.1 Farming systems present in survey

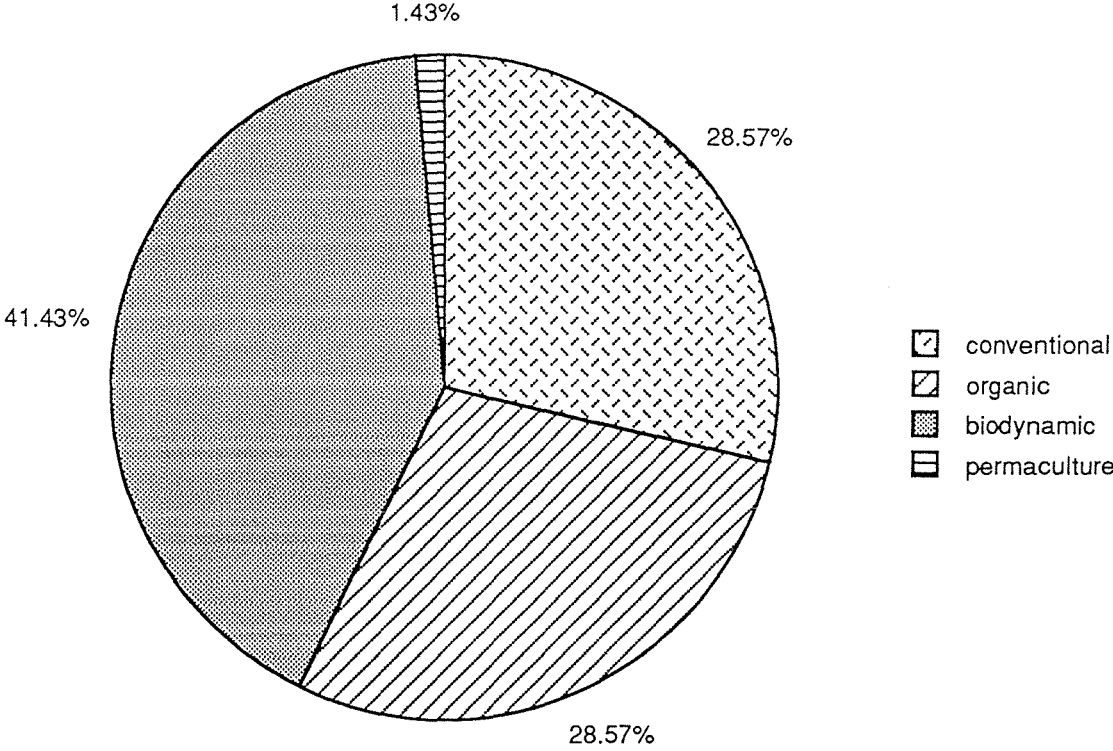


Figure 4.2 Degree of adopting organic and biodynamic practices by organic farms

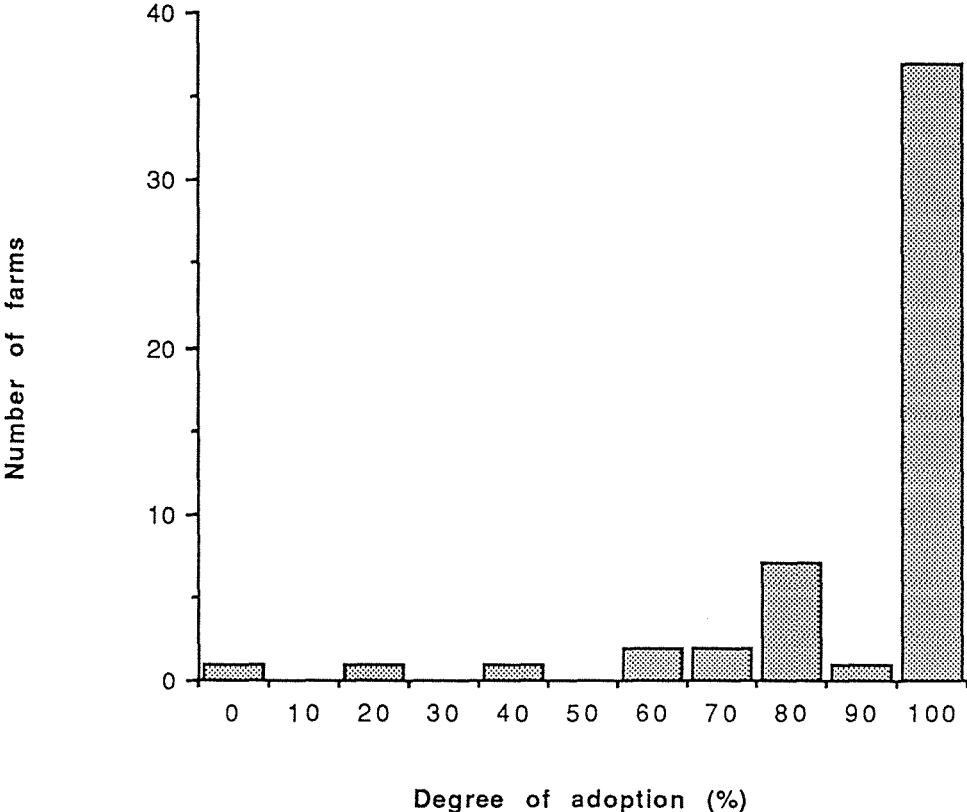


Figure 4.3 Certification held by organic farms

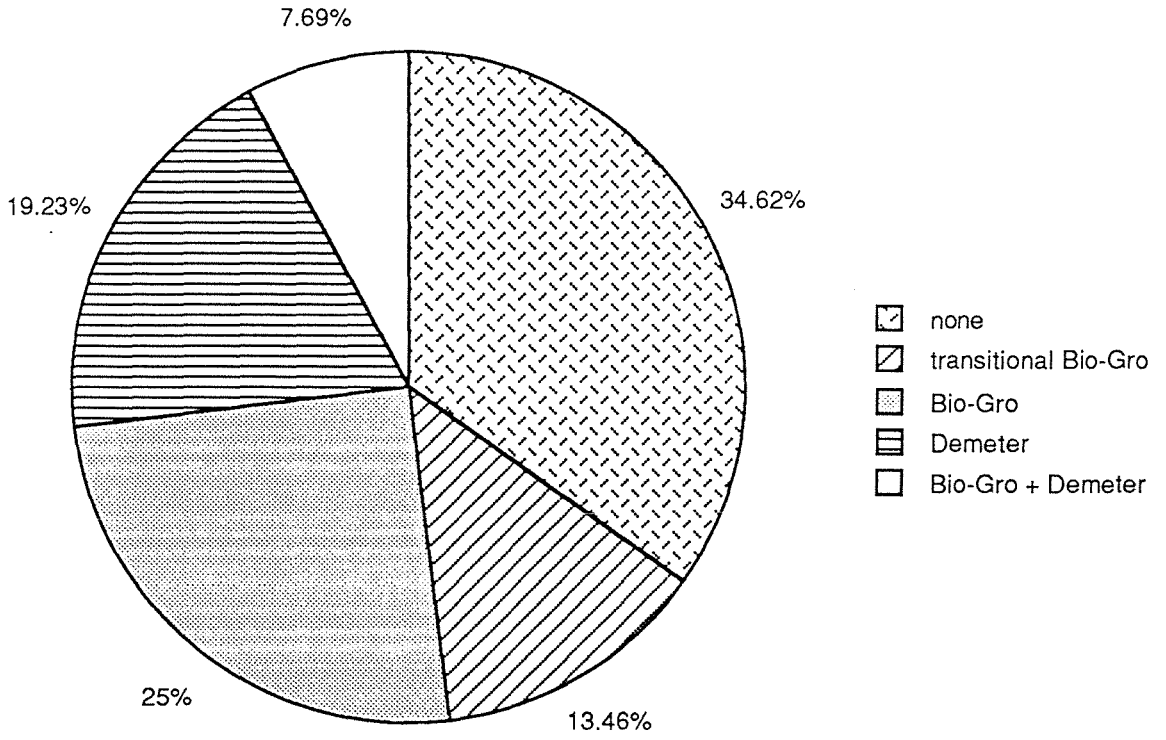
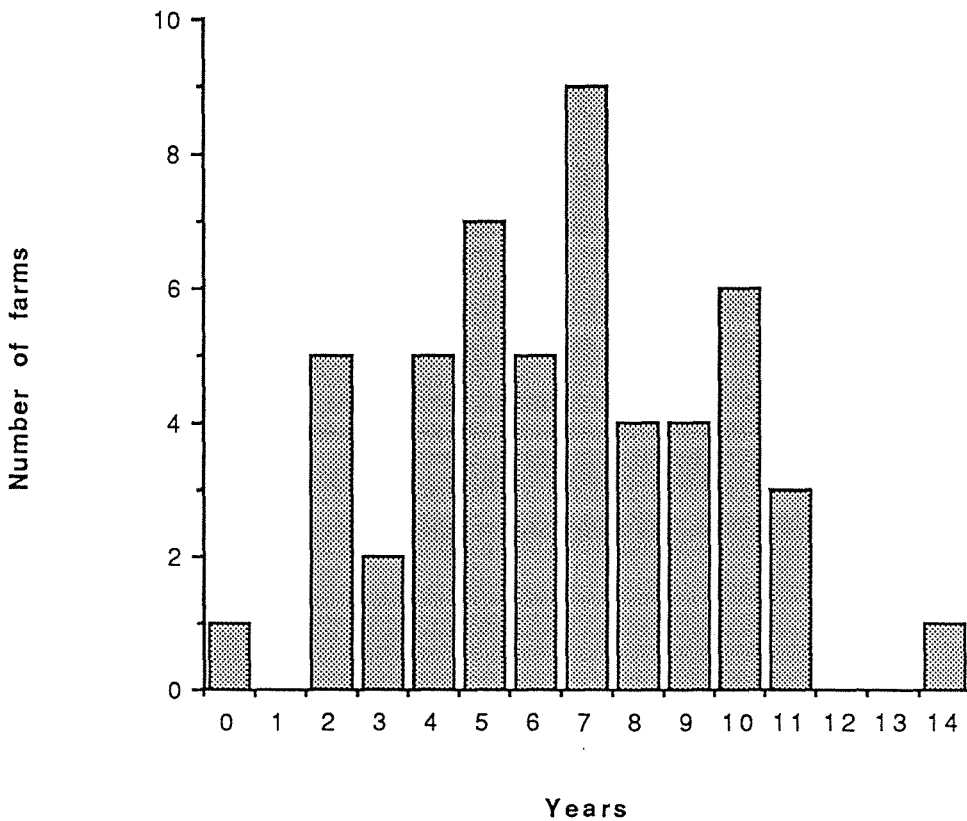


Figure 4.4 Years since adopting organic and biodynamic practices by organic farmers



although neither were very high. This implies that the farmers adopted organic farming methods more for pragmatic reasons. This opposes the popular conception that the organic farming fraternity are idealists.

**Table 4.2**  
**Correlations of personal data**

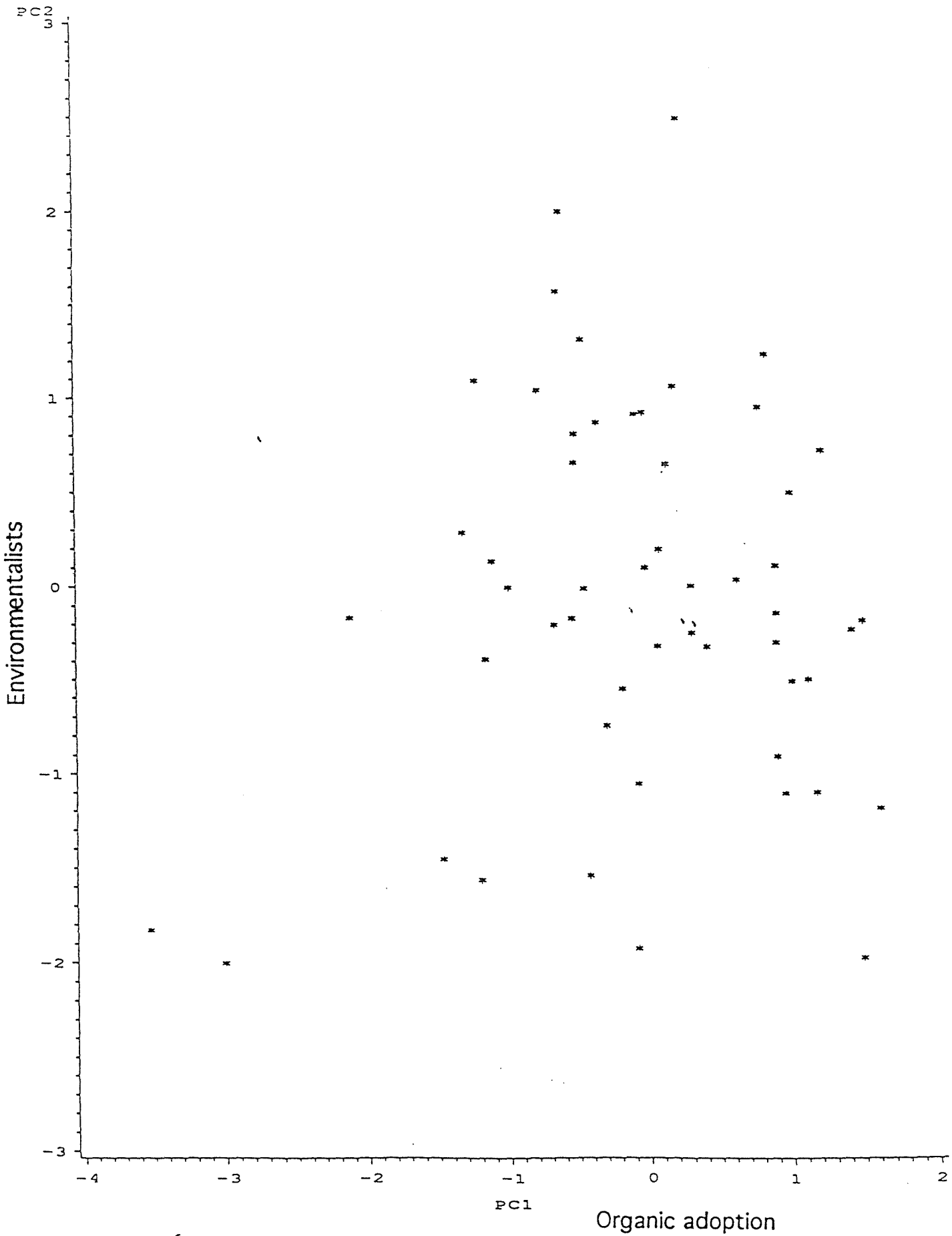
variable	1	2	3	4	5	6
1-farmtype	1.000	0.218	0.428	0.110	0.332	0.116
2-adoption of methods		1.000	0.194	0.125	0.038	0.209
3-years since conversion			1.000	0.160	-0.106	-0.177
4-level of certification				1.000	-0.312	0.076
5-anthropomorphic incentives					1.000	0.034
6-esoteric incentives						1.000

There is a medium correlation (see Table 4.2) between degree of alternativeness and the number of years that these principles and methods have been adopted. A lower correlation is present between degree of alternativeness and level of scientific reasons for adopting this system of farming. A low negative correlation is present between the level of scientific reasons and level of certification.

The first factor structure (Table 4.3) in the principal component analysis discriminated strongly for long-term organic farmers who tended to have some degree of certification. As all scores were positive, factor one was also a general score for the adoption of organic methods (Organic Adoption). Factor two selected for more recently commenced farmers with a high level of scientific interests, who did not certify their property (Environmentalists). Factor three was highly positive for recent farms where the personal beliefs of the farmers were more predominant (Alternative Lifestylists). The plot (Figure 4.5) of factors one and two did not distinguish any clean cut groups, although there were a few small outlying groups. One pair in the lower left quadrant has adopted very little of the organic methods and has done so for esoteric reasons.

As factor structures usually closely resemble the standardised scoring coefficients, they will be omitted from now on unless there is an obvious disparity.

Figure 4.5 PC 2 versus PC 1 for personal data



**Table 4.3****Result of Principal Component(PC) analysis on personal data\***the dispersion matrix  $D_z$ 

accounted for:	1	2	3	4	5	6
proportion	0.3461	0.2173	0.1723	0.1031	0.0944	0.0668
cumulative propn.	0.3461	0.5634	0.7357	0.8388	0.9332	1.0000
factor structures:	factor1	factor2	factor3	factor4	factor5	factor6
farmtype	0.8003	0.2531	-0.1792	0.1805	-0.1517	-0.4557
adoption of OF	0.7353	0.0324	0.1776	-0.5504	0.3518	0.0036
years	0.7325	-0.1784	-0.4138	-0.0435	-0.3636	0.3555
certification	0.4770	-0.6571	0.1400	0.4426	0.3489	0.0597
scientific	0.1832	0.8590	-0.1291	0.2750	0.2876	0.2314
esoteric	0.3125	0.1932	0.8732	0.0981	-0.2883	0.0988
standardised scoring coefficients						
farmtype	0.3854	0.1941	-0.1734	0.2919	-0.2677	-1.1367
Adoption of OF	0.3541	0.0248	0.1718	-0.8899	0.6210	0.0089
years	0.3528	-0.1368	-0.4003	-0.0704	-0.6418	0.8866
certification	0.2297	-0.5040	0.1354	0.7155	0.6158	0.1488
scientific	0.0882	0.6588	-0.1249	0.4446	0.5077	0.5771
esoteric	0.1505	0.1482	0.8448	0.1586	-0.5090	0.2465

\* - All factor structures and standardised scoring coefficients are reported in this table. Further tables will report only to the 70% cumulative proportion level as discussed in Materials and Methods.

A question asking whether the respondent had always been a farmer showed that unlike conventional farmers (78% had always been a farmer) organic farmers were more likely to have had a different previous occupation (only 35% had always been a farmer). Past occupations of farmers were classified into the six categories of professional, semi-professional, trade, clerical sales and service personnel, worker and other (see Materials and Methods). The 'other' category included unemployed (1 person), and travelling (2 people). Some farmers have had more than one prior occupation.

**Table 4.4****Past occupational groups of farmers**

Occupation	Organic		Conventional	
	No	%	No.	%
always was a farmer	18	35	14	78
professional	16	31	0	0
semi-professional	7	13	1	6
trade	24	46	1	6
clerical, sales & service personnel	4	8	0	0
worker	9	17	0	0
other	3	6	1	6

Of the farmers who had had different prior occupations, organic farmers often had a professional (31%) or trade (46%) background. The professional category would require a higher educational background. This may have made the farmer more aware of conservation and/or health issues. Upon becoming farmers, they opted to farm using an alternative system such as organic farming. There was no notable trend shown by the few conventional farmers who had had a different prior occupation.

## 4.2 Farm Description

The average farm size in the survey within the organic group was 123 hectares, with 102 hectares being used for organic production. Among the conventional farms surveyed, the average farm area was 410 hectares. The largest property was 1800 hectares, the smallest 1 hectare, both were organic farms. Conventional properties ranged in size from 68 hectares, to 1471 hectares. Figure 4.6 shows that the areas surveyed that were farmed organically or conventionally followed similar distributions.

The origin of replacement stock and seed that was brought in was usually unknown or from conventional sources on both sets of farms. As long as the proportion of replacement stock does not exceed ten percent of the total stock numbers on that farm, this does not affect that property's status as organic. The animals or plants brought into the system from a non-organic source do have to undergo a 'quarantine' type system for a specified period of time depending on what it is, before it can be sold as organic.

The first factor in the principal component analysis (Table 4.5) strongly discriminated for both farm size and area used for organic production, so thereby sorting out the large organic farms. The second score, being highly positive for farmers that knew the origin of their replacements combined with a medium weighting on the area farmed organically, discriminated for the organic awareness farmers. The plot of these two factors (Figure 4.7) grouped all the conventional farms in the bottom section of the graph. The outlying observations at the top all belonged to organic farms, with an extreme point belonging to the largest organic farm.

Figure 4.6A Total farm size of properties in survey

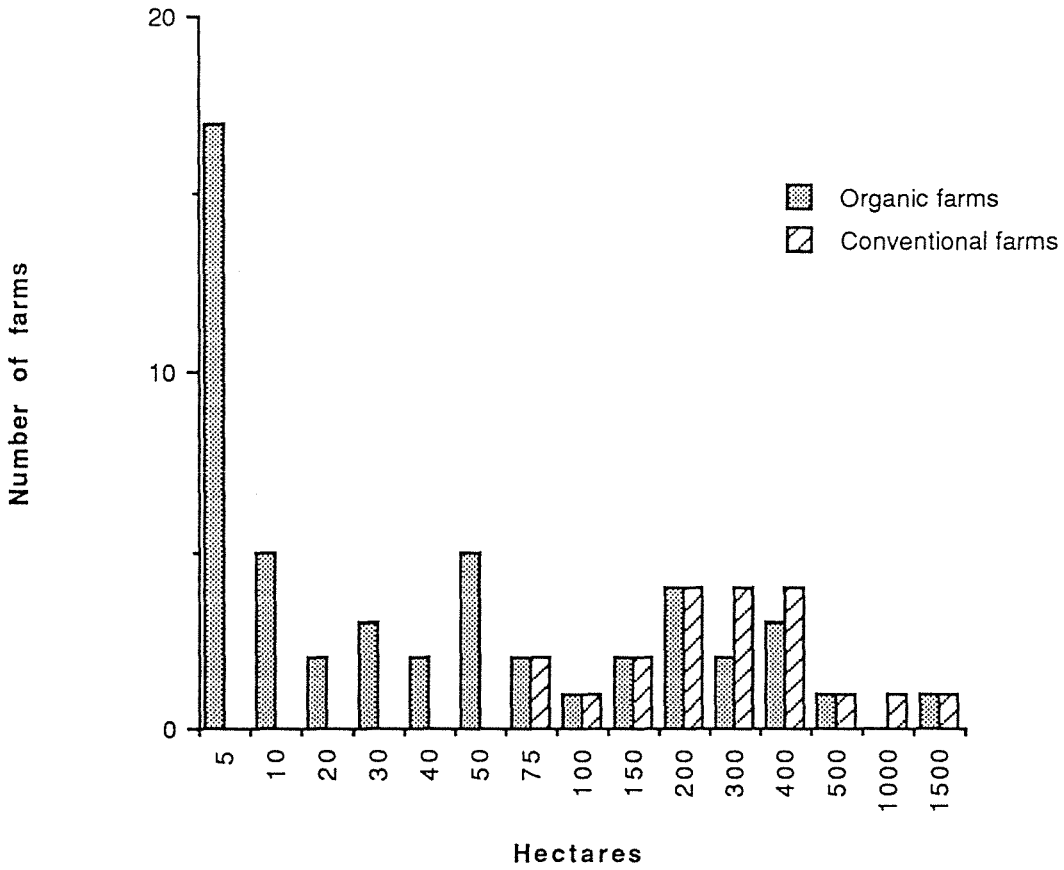
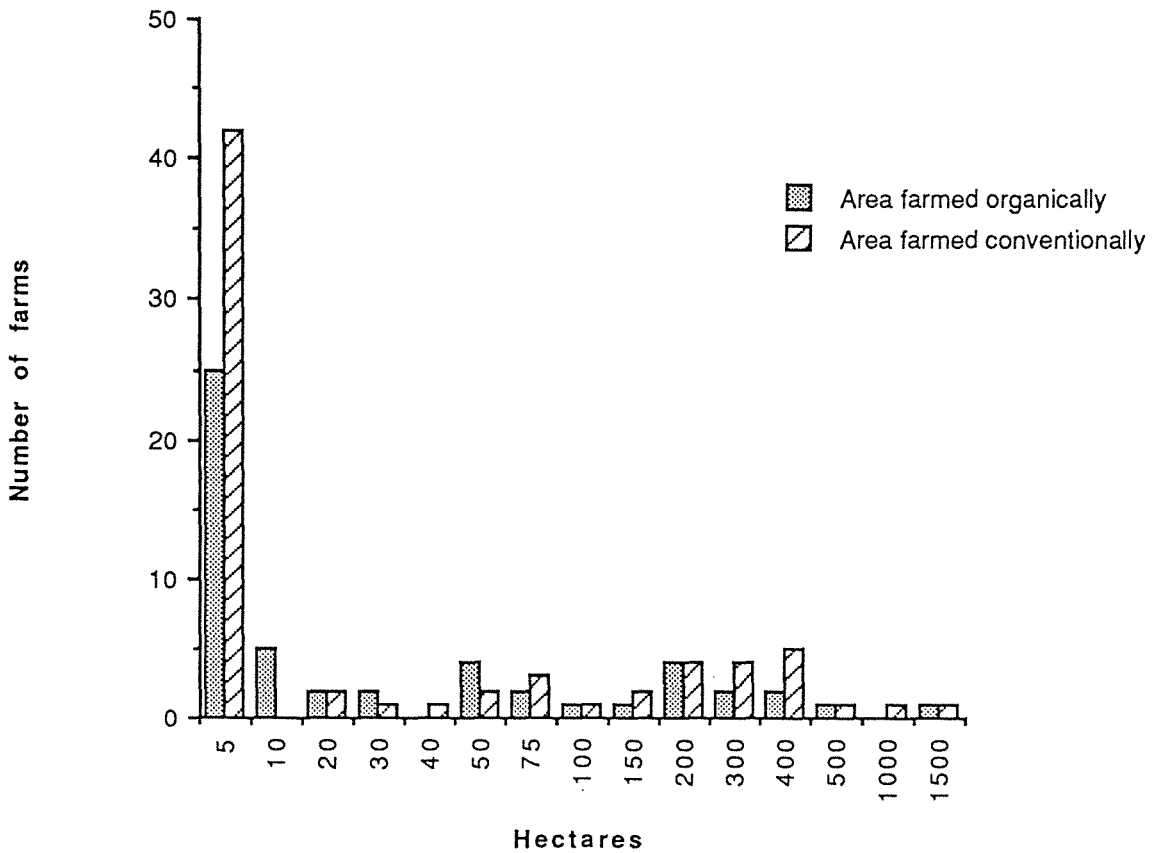


Figure 4.6B Area of properties farmed organically and conventionally





**Table 4.5**

**Results of PC on farm description data**

<b>Dz accounted for:</b>	<b>1</b>	<b>2</b>
proportion	0.5595	0.3307
cumulative proportion	0.5595	0.8902
<b>standardised scoring coefficients</b>		
total area	0.54419	0.00942
area farmed organically	0.49206	0.43136
origin of replacements	-0.23981	0.90647

Most properties had two or more farm enterprises. Beef, wool and sheep were the most popular with the conventional group. Beef was also popular on the organic farms surveyed, as well as vegetable, fruit and nut production (Figure 4.8).

**4.3 Farm Management**

**4.3.1 Farming System**

Farmers were scored on the level of soil conservative system used, with higher scores given to minimum tillage or lower grazing pressure. Organic cropping and horticultural units tended towards the use of medium to high soil conservative tillage methods (Table 4.6). In comparison, the conventional farmers made more passes with machinery and were thereby more intensive in their soil tillage techniques. The grazing systems used on both the organic and conventional farms were of medium to high intensity with a high level of grazing pressure placed on the pasture. The *t* value for the cropping systems was 2.32. This meant it was significant at  $P < 0.05$ . For the grazing systems  $t = 1.09$ . This was not statistically significant.

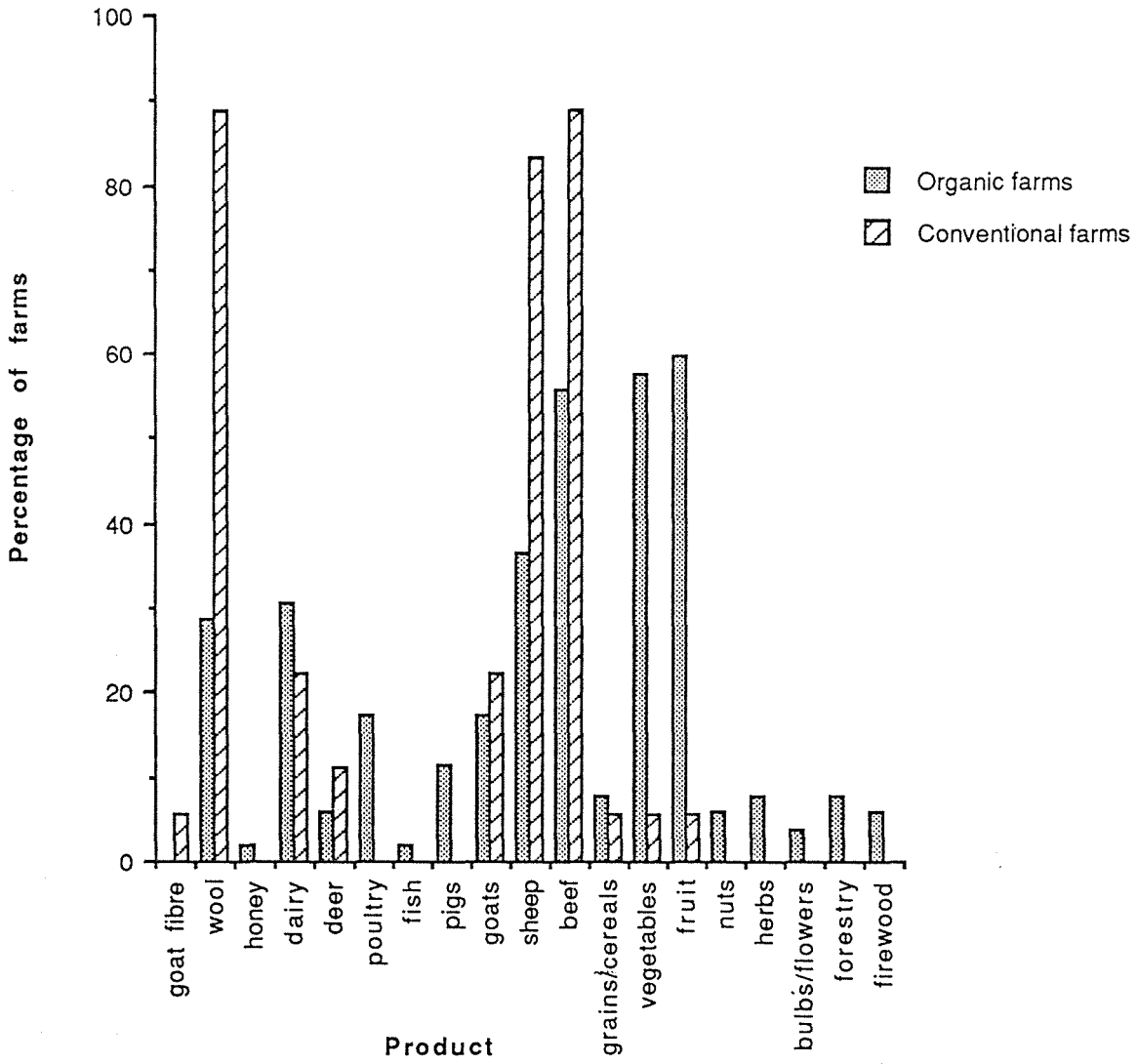
**Table 4.6**

**Degree of adopting soil conservative management techniques**

Farming system	organic mean	conventional mean	<i>t</i> test
cropping (scale of 1-63)	32.75	22.67	2.32
grazing (scale of 1-31)	8.59	7.11	1.09

Using the principal component analysis (Table 4.7), factor one selected out the cropping farms with special emphasis on those

Figure 4.8 Farm enterprises present in survey



using soil conservative tillage techniques. The second score was a cropping/pastoral contrast. The plot (Figure 4.9) of factors one and two discriminates between the crop and pastoral/mixed properties, and between the conservative and the intensive systems. As there appeared to be some distinctive grouping of results, a cluster analysis was done on the PC scores. The most significant F test value ( $F=0.314 \times 10^{-9}$ ) was at the nine cluster level. These groups are indicated on Figure 4.9. Groups seven and eight are all sabbatical farmers (refer to glossary). The three conventional farmers on this plot are merged in with groups three (1) and six (2). The data was weakly structured in this analysis due to a large number of missing data ( $n=30$ , 57% missing data). This is reflected by the need to use both factors.

**Table 4.7**  
**Results of PC on farm management data**

<b>Dz accounted for:</b>	<b>1</b>	<b>2</b>
proportion	0.5265	0.4735
cumulative proportion	0.5265	1.0000
<b>standardised scoring coefficients</b>		
cropping	0.68909	0.72662
grazing	0.68909	-0.72662

#### 4.3.2 Soil Fertility

A higher proportion of the conventional farmers than of the organic farmers carried out soil tests (Table 4.8). A contingency table resulted in a  $X^2$  value of 329.62 that was significant at  $P < 0.001$ . There was no significant difference ( $X^2=3.198$   $P > 0.5$ ) between the organic and conventional farmers in the number testing for major nutrient and pH levels. Organic farmers were more likely to test for trace elements, and for a wider range of these (Figure 4.10)

Figure 4.9 PC 2 versus PC 1 for farm system analysis

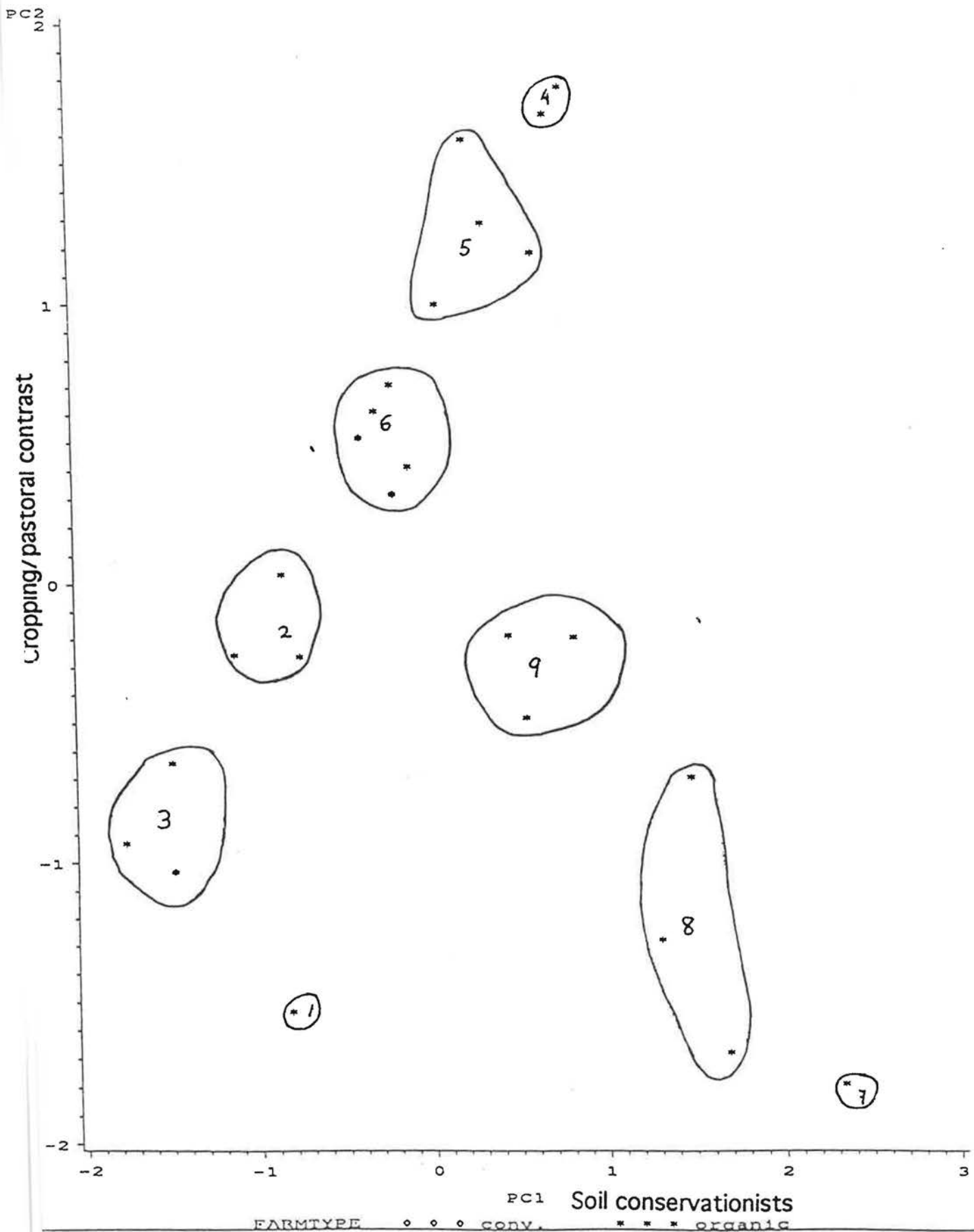
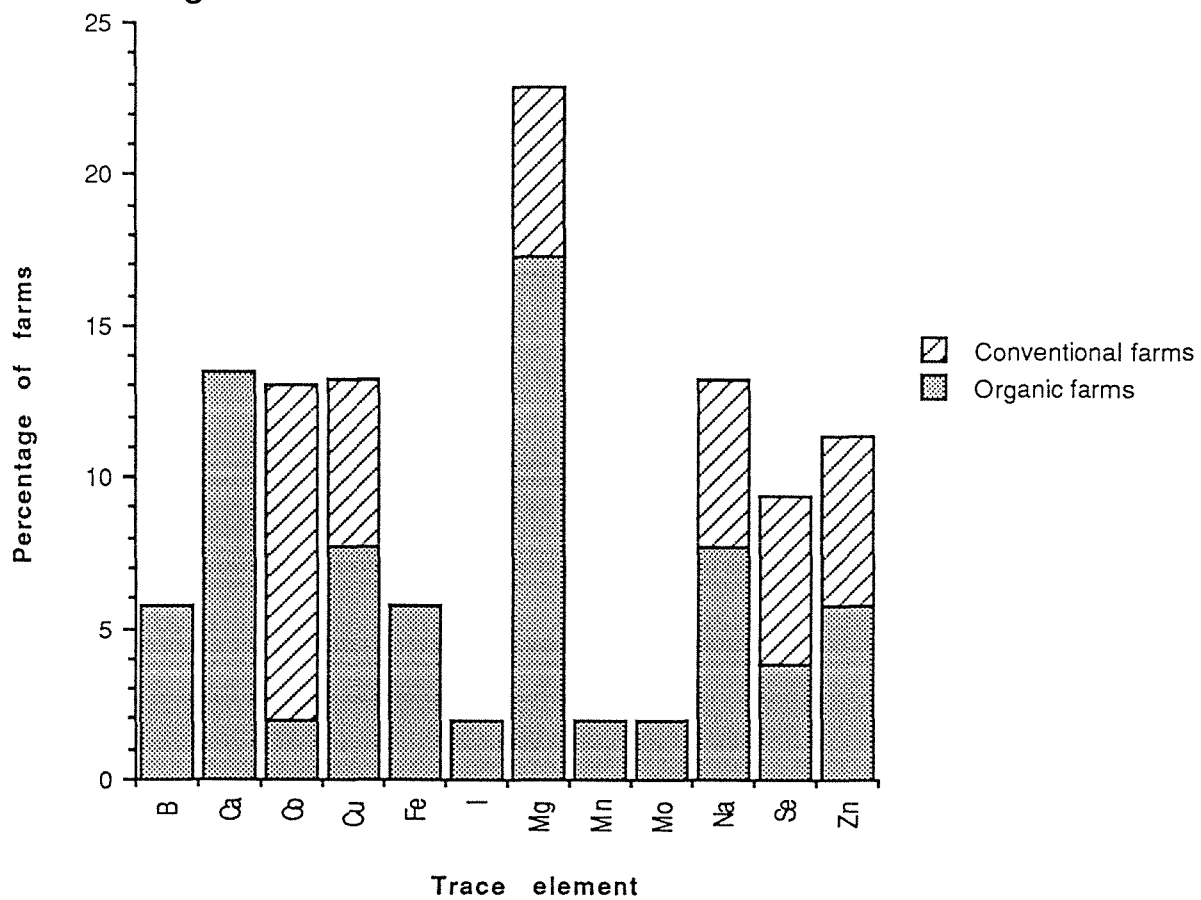


Figure 4.10 Trace elements tested for



**Table 4.8**  
**Soil test data**

	organic	conventional
proportion of farmers that do soil tests	61.5%	77.8%
major elements tested for - pH	9.6%	27.8%
Olsen P	13.5%	33.3%
P retention	3.8%	5.6%
K	9.6%	27.8%
S	3.8%	33.3%
N	1.9%	0.0%

All the conventional farms surveyed used fertilisers (organic or chemical) and 82.7% of the organic group did so. As to the type of fertilisers used (Figure 4.11) there is a significant difference ( $X^2=108.992$ ,  $P<0.001$ ). The organic farmers rarely use any of the highly soluble fertilisers available. Their main source of phosphate appears to be from reactive phosphate rock. Conversely, the main phosphate sources of the conventional farmers are potassic super, superphosphate and longlife super. Two of the conventional farmers (11%) used reactive phosphate rock and another stated he used blood and bone.

### 4.3.3 Problems

Problems were divided into animal health, plant health or weed problems.

In animal health, internal parasites and flystrike were prominent with both groups of farmers (Figure 4.12). Conventional farmers found flystrike was only slightly less of a problem than internal parasites whereas the organic farmers mentioned flystrike less than half as often as internal parasites. Of the other problems mentioned, organic farmers included external parasites, mastitis, foot problems (lameness), bloat and mineral deficiency. The first three were not noted as problems by the conventional farmers who as well as bloat and mineral deficiency problems mentioned grass staggers and facial eczema.

Fungal diseases were the most common plant health problem in the organic group followed closely by the Lepidoptera and Coleoptera insect groups (Figure 4.13). These three were also noted by the conventional farmers but in the reverse order and lower magnitude. Organic farmers also mentioned problems with Hemiptera, Thysanoptera, Mollusca and Collembola, in that order.

Figure 4.11 Fertilisers used on organic and conventional farms

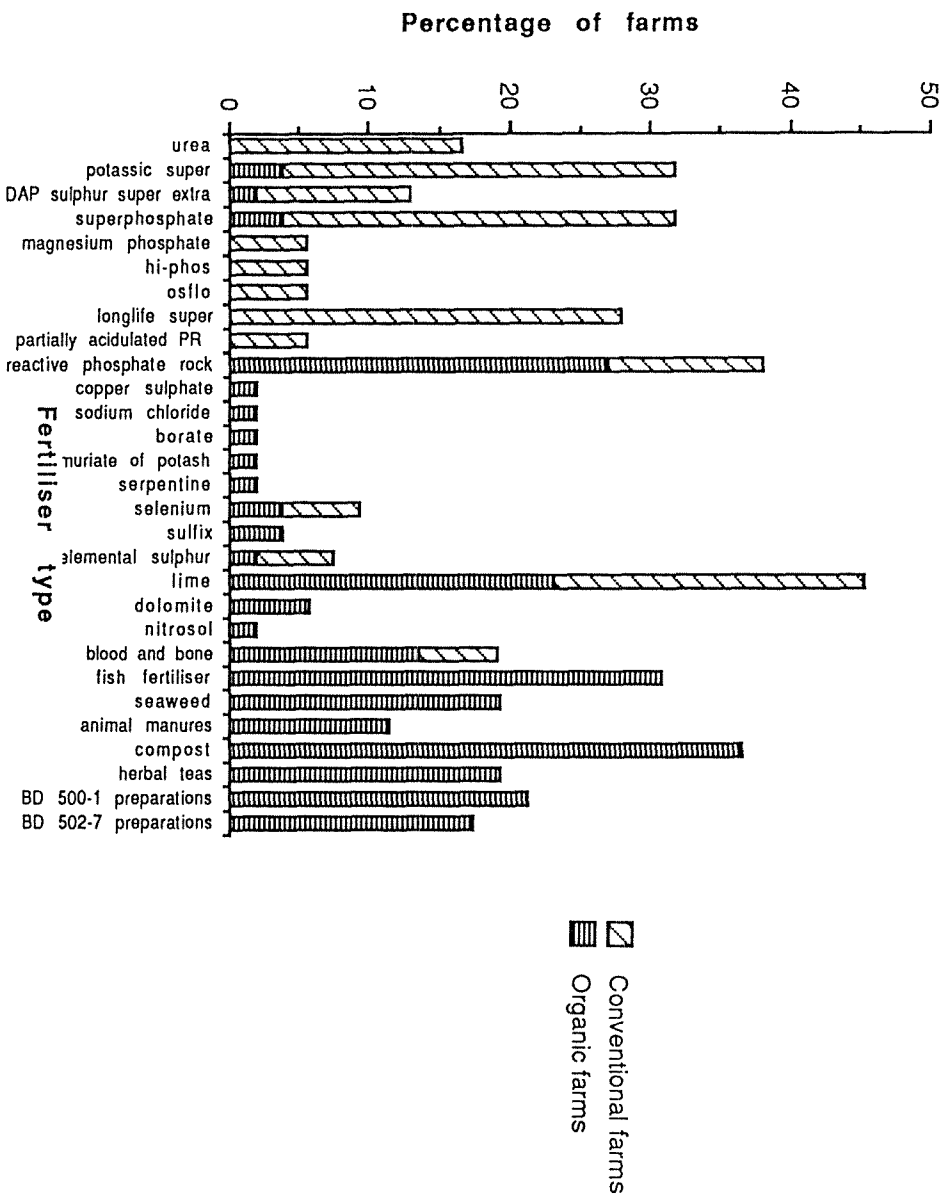
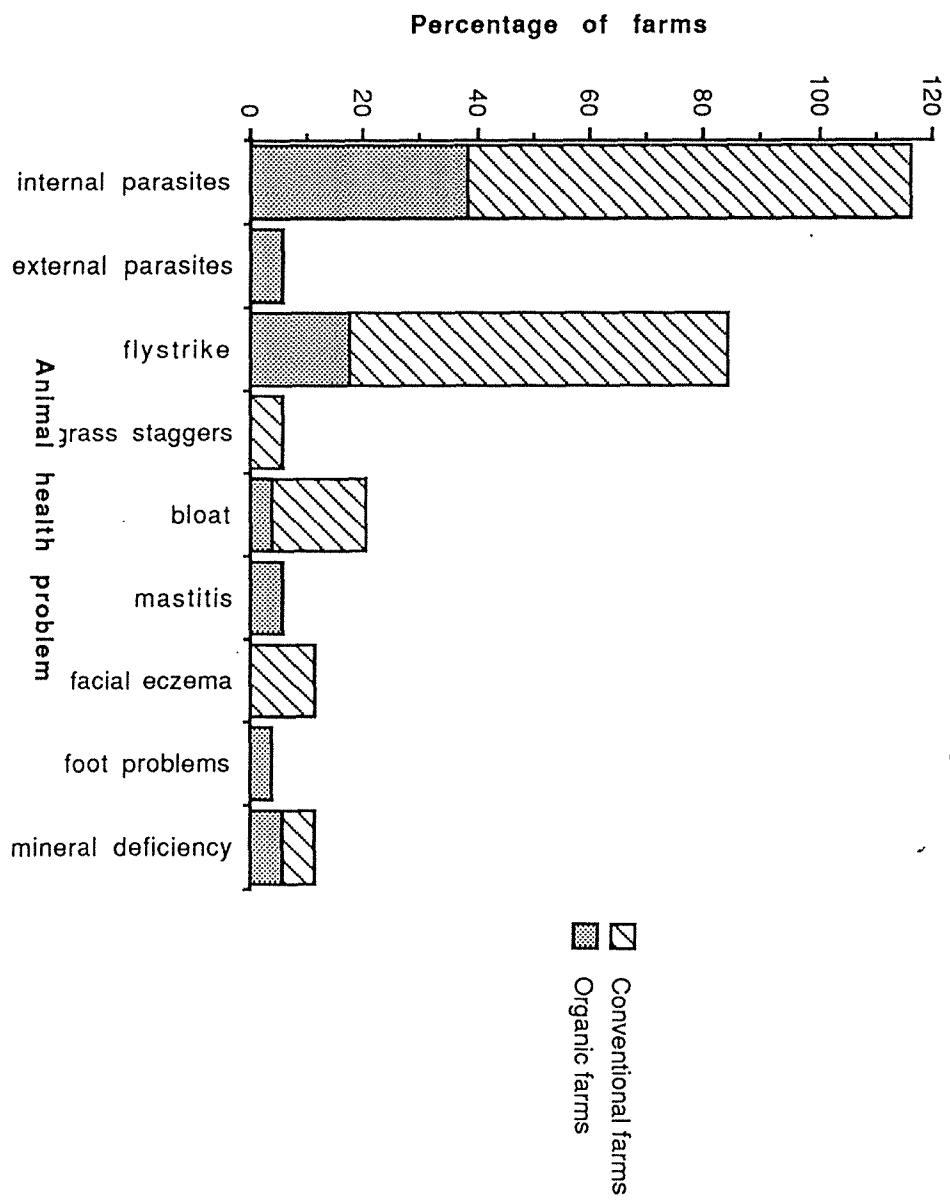


Figure 4.12 Animal health problems



Arable enterprises with their higher rating of importance of plant health and weed problems were more common in the organic group of respondents

Both groups of farms noted thistles and other Asteraceae as their most common weed problems (Figure 4.14). Thistles were mentioned twice as often as other Asteraceae with organic farmers but with conventional farmers this difference was much less. Other common weeds on organic properties were plants of the Poaceae and Polygonaceae families. Common on the conventional farms was the Papilionaceae family. Organic farmers noted a wider range of weed species, which can be accounted for by the large range of horticultural enterprises present.

The organic farmers were asked to assess the effect of changing over to organic farming techniques on these problems. This ranking was on a scale of 1 (worsened badly) through 3 (no change was noted), to 5 (improved greatly). The status of any of the problems did not significantly change when the farm became organic. Only flystrike had significantly improved after changing over to organic farming (Table 4.9). Other animal health problems showed no change.

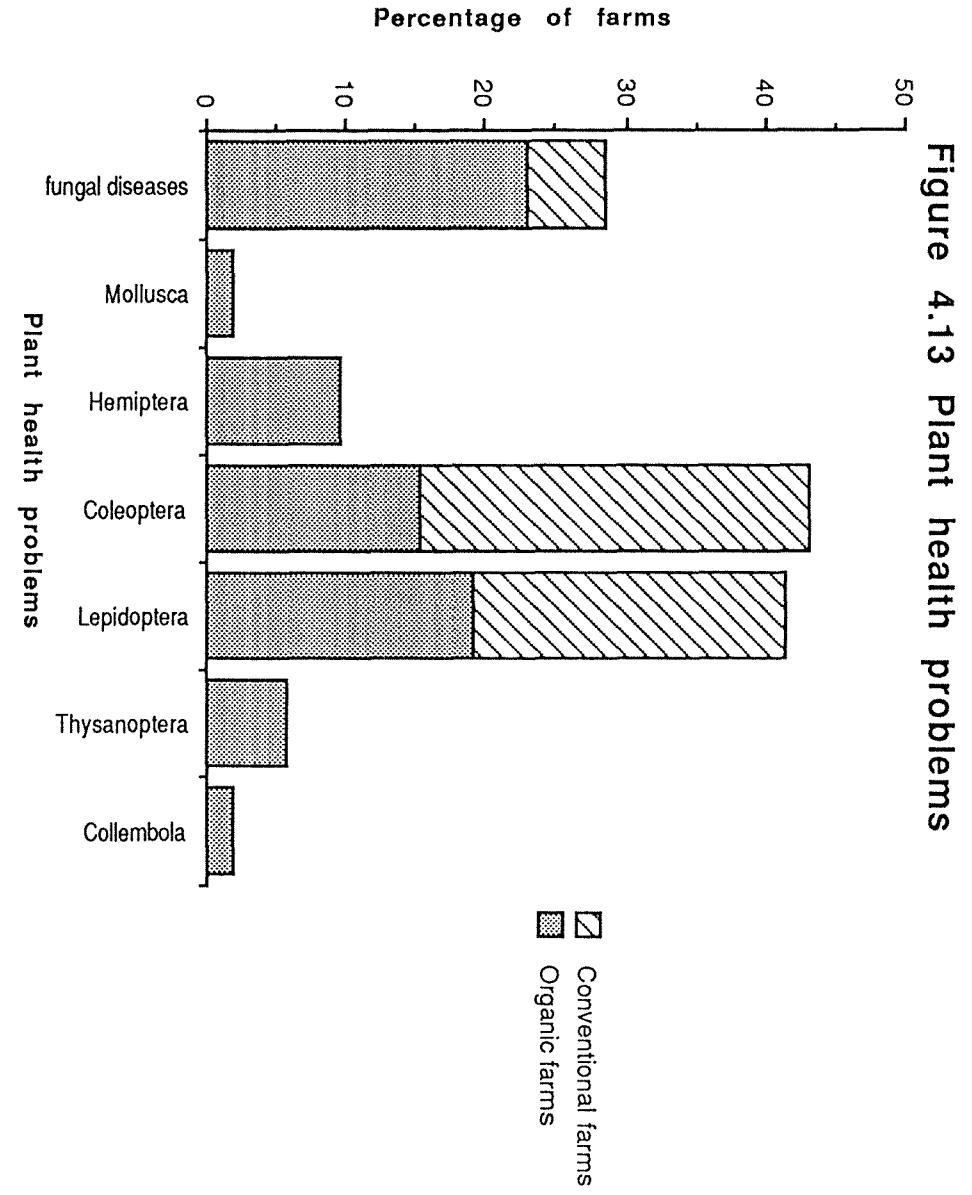
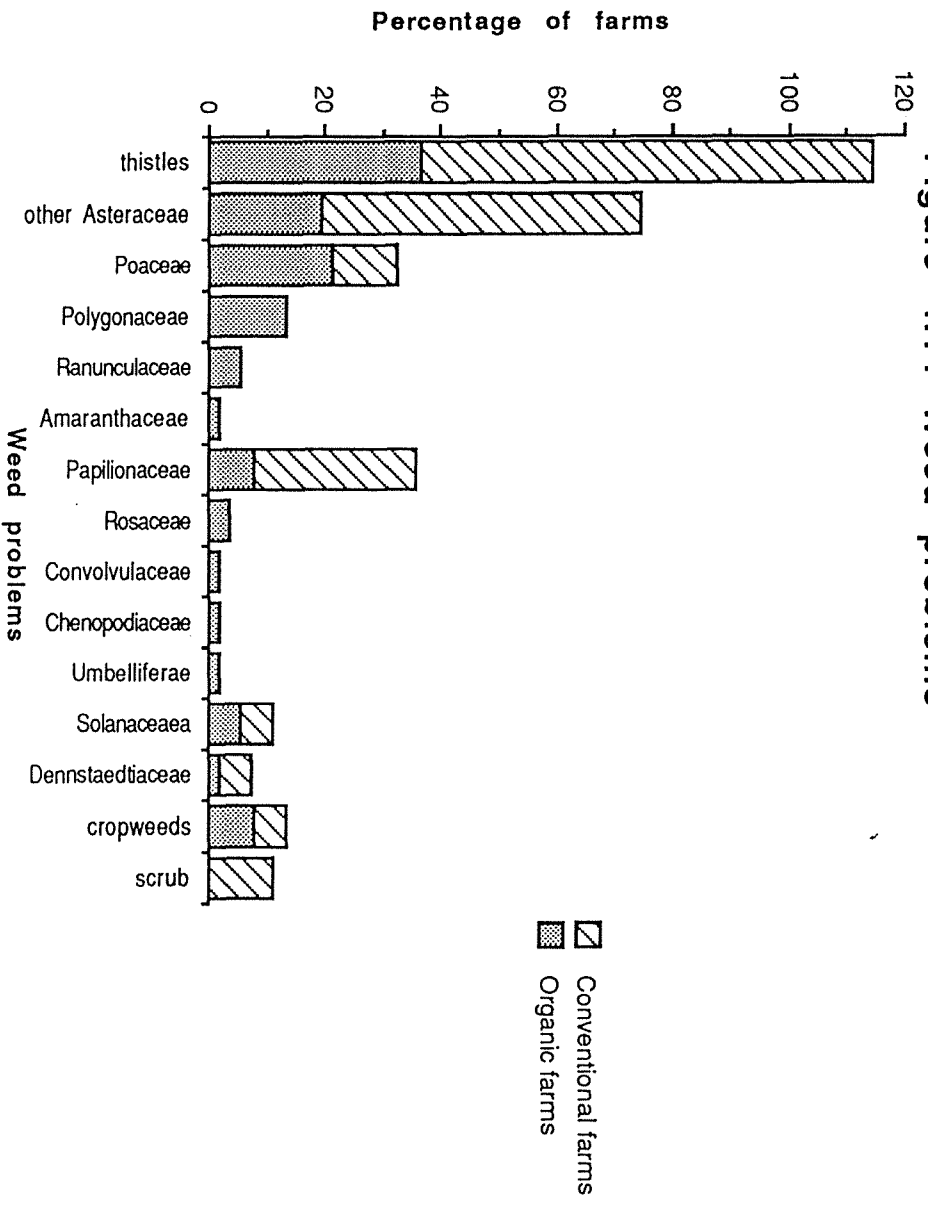
**Table 4.9**

**Change in animal health after changing to organic farming**

problem	means(1-5)*	t test value	P
internal parasites	3.038	0.525	ns
flystrike	3.115	1.761	P<0.1
feet problems	3.000	0	ns
bloat	3.019	0.438	ns
mastitis	3.038	0.989	ns
external parasites	2.981	0.986	ns
milk fever	3.000	0	ns
mineral deficiency	3.000	0	ns
facial eczema	3.000	0	ns

\* score 1-5: 3=no change, >3=beneficial

None of the plant health problems (Table 4.10) showed any significant change with a shift to organic farming methods.



**Table 4.10****Change in plant health after changing to organic farming**

problem	means(1-5)*	t test value	P
-----	-----	-----	-----
fungal diseases	2.942	1.143	ns
Lepidoptera	3.038	1.510	ns
Coleoptera	3.058	1.143	ns
Hemiptera	3.058	1.143	ns
Thysanoptera	2.981	0.588	ns
Mollusca	3.000	0	ns
Collembola	2.981	0.986	ns
-----	-----	-----	-----

\* - 1 = a lot worse, 3 = no change, 5 = greatly improved

One weed family (Table 4.11) showed a slight improvement (thistles), and one worsened (Poaceae). All others showed no significant change.

**Table 4.11****Change in weed status after changing to organic farming**

problem	means(1-5)	t test value	P
-----	-----	-----	-----
thistles	3.212	2.673	P<0.01
other Asteraceae	2.942	0.833	ns
Poaceae	2.904	1.693	P<0.1
crop weeds	2.981	0.326	ns
Polygonaceae	2.981	0.566	ns
Solanaceae	2.962	0.989	ns
Rosaceae	3.000	0	ns
Ranunculaceae	3.000	0	ns
Papilionaceae	3.019	0.438	ns
Amaranthaceae	2.962	0.989	ns
Convolvulaceae	2.981	0.986	ns
Umbelliferae	3.000	0	ns
Dennstaedtiaceae	3.000	0	ns
Chenopodiaceae	2.962	0.986	ns
scrub	3.000	0	ns
-----	-----	-----	-----

\* - 1 = a lot worse, 3 = no change, 5 = greatly improved

Internal parasites was correlated to flystrike and external parasites (Table 4.12), and bloat negatively to grass staggers.

**Table 4.12**  
**Correlations amongst animal health data**

variable	1	2	3	4	5	6
1-internal parasites	1.000	0.436	0.300	-0.010	-0.005	-0.010
2-external parasites		1.000	0.035	0.020	0.009	0.020
3-fly strike			1.000	-0.035	-0.015	-0.035
4-grass staggers				1.000	-0.461	-0.020
5-bloat					1.000	-0.009
6-mastitis						1.000

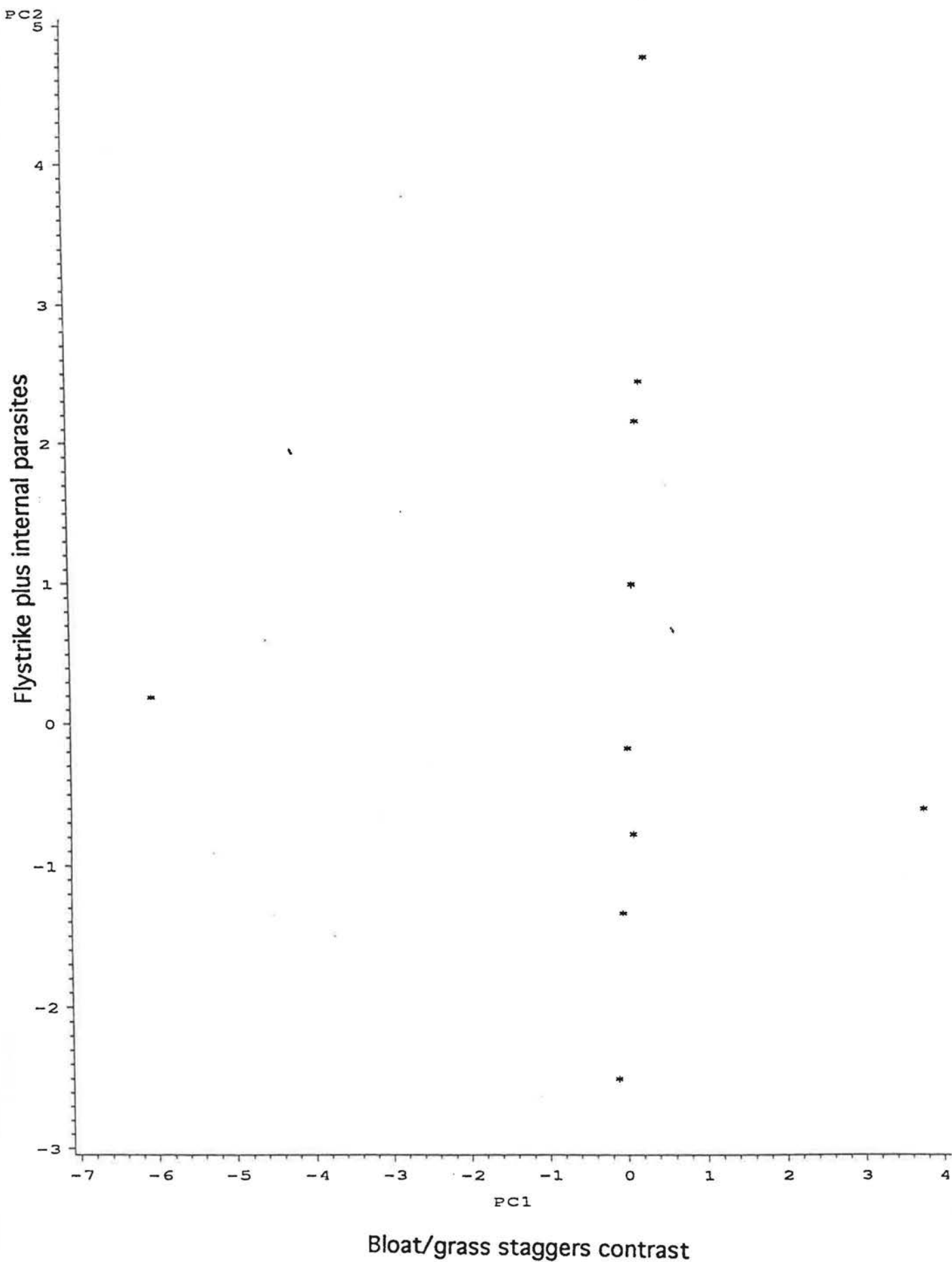
The plot (Figure 4.15) created using the first two scores (Table 4.13) from the principal component analysis for the animal health component identified clearly those farms that carried stock. A number of observations were hidden by all being clumped on a few co-ordinates. One poultry and several dairy farms were especially conspicuous with large scores. The first factor score provided a grass staggers/bloat contrast, with the second score as an internal parasite and flystrike combination. The third and fourth scores were strongly contrasting for or against external parasites, whilst both were strongly positive for mastitis.

**Table 4.13**  
**Results of PC on animal health data**  
 animal health

<b>D<sub>z</sub> accounted for:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
proportion	0.2437	0.2178	0.1699	0.1630
cumulative proportion	0.2437	0.4615	0.6315	0.7945
<b>standardised scoring coefficients</b>				
internal parasites	0.03808	0.60726	0.00000	0.15268
external parasites	-0.00904	0.08403	0.70027	-0.70433
flystrike	0.04790	0.61431	-0.00000	0.03553
grass staggers	-0.58495	0.02099	-0.00000	-0.03250
bloat	0.58118	-0.06669	-0.00000	-0.06755
mastitis	0.00904	-0.08403	0.70027	0.70433

In plant health (Table 4.14), fungal diseases were correlated with Lepidoptera and Thysanoptera. Coleoptera pests were correlated with Hemiptera and less with Lepidoptera.

FIGURE 4.15: PC 2 VERSUS PC 1  
FOR ANIMAL HEALTH DATA



**Table 4.14**  
**Correlations amongst plant health data**

variable	1	2	3	4	5	6
1-fungal diseases	1.000	0.022	0.039	0.409	0.333	-0.022
2-Hemiptera		1.000	0.366	-0.190	0.009	0.020
3-Coleoptera			1.000	0.266	0.015	0.035
4-Lepidoptera				1.000	0.009	0.020
5-Thysanoptera					1.000	-0.009
6-Collembola						1.000

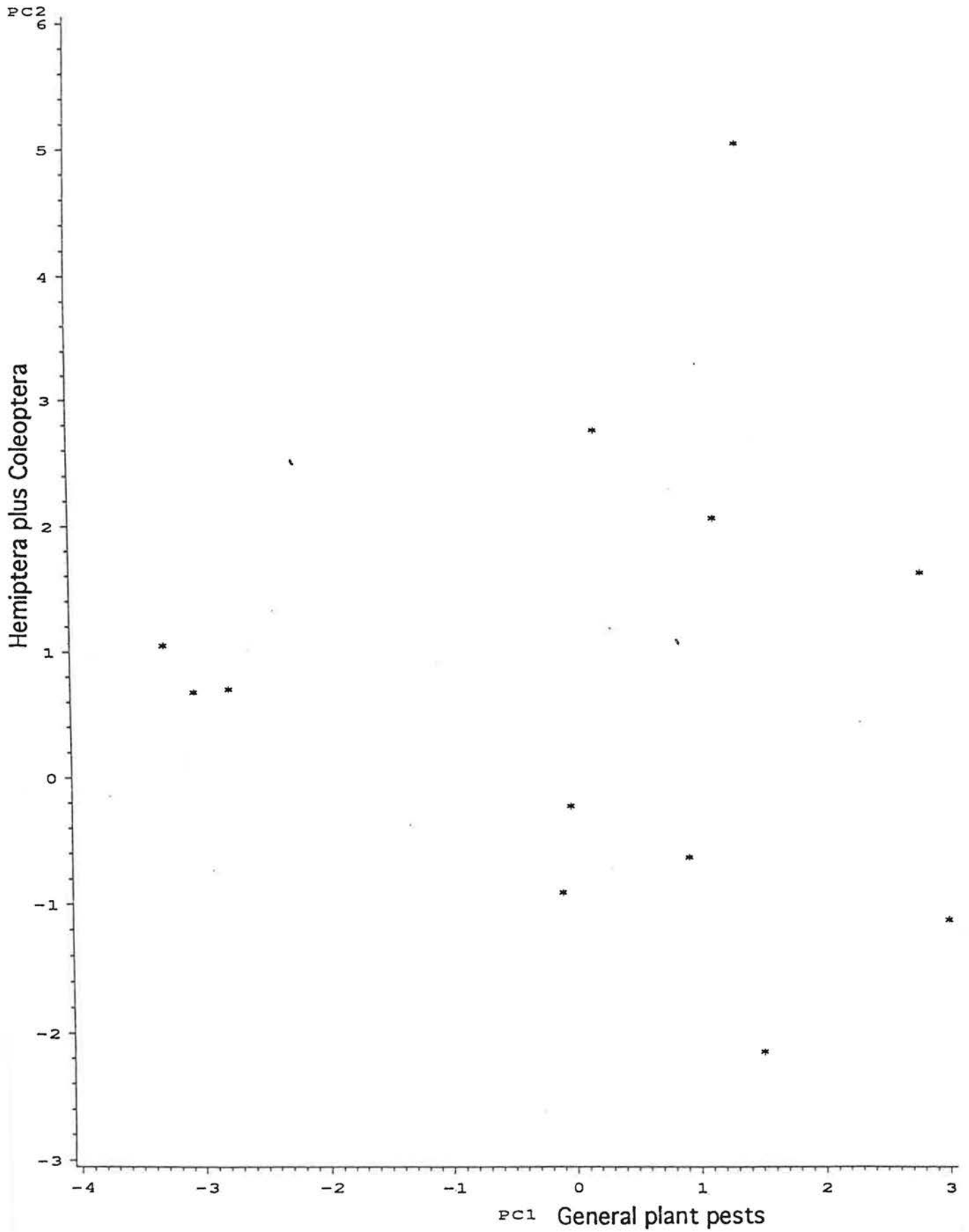
For the plant health PC (Table 4.15), the first score was a general score with a strong fungal disease/Lepidoptera pest combination. Factor two selected strongly for a Hemiptera/Coleoptera combination. The third score was a Lepidoptera/Thysanoptera contrast, with the fourth score strongly selecting for Collembola problems. The plot of the first two PC's again had a number of observations hidden around the central 0,0 co-ordinate (Figure 4.16). Several outlying observations identified properties where certain plant health problems as described above for each score, had either improved or worsened to some degree.

**Table 4.15**  
**Results of PC on plant health data**

<u>plant health</u>				
<b>D<sub>z</sub> accounted for:</b>				
proportion	0.2656	0.2251	0.1804	0.1650
cumulative proportion	0.2656	0.4907	0.6711	0.8361
<b>standardised scoring coefficients</b>				
fungal diseases	0.50153	-0.16903	0.17135	0.02742
Hemiptera	0.04694	0.61853	0.30236	-0.00985
Coleoptera	0.27565	0.53789	-0.20956	-0.12313
Lepidoptera	0.45847	-0.12181	-0.51174	-0.12476
Thysanoptera	0.29589	-0.12706	0.65796	0.23188
Collembola	0.00961	0.09487	-0.25368	0.96160

Thistle weeds were correlated to other plants of the Asteraceae family and to Papilionaceae (Table 4.16). Other plants of the Asteraceae family also had a low negative correlation to plants of the Solanaceae group. Rosaceae was correlated negatively to Poaceae and positively to Papilionaceae. Polygonaceae weeds were correlated to Convolvulaceae.

FIGURE 4.16: PC 2 VERSUS PC 1  
FOR PLANT HEALTH DATA

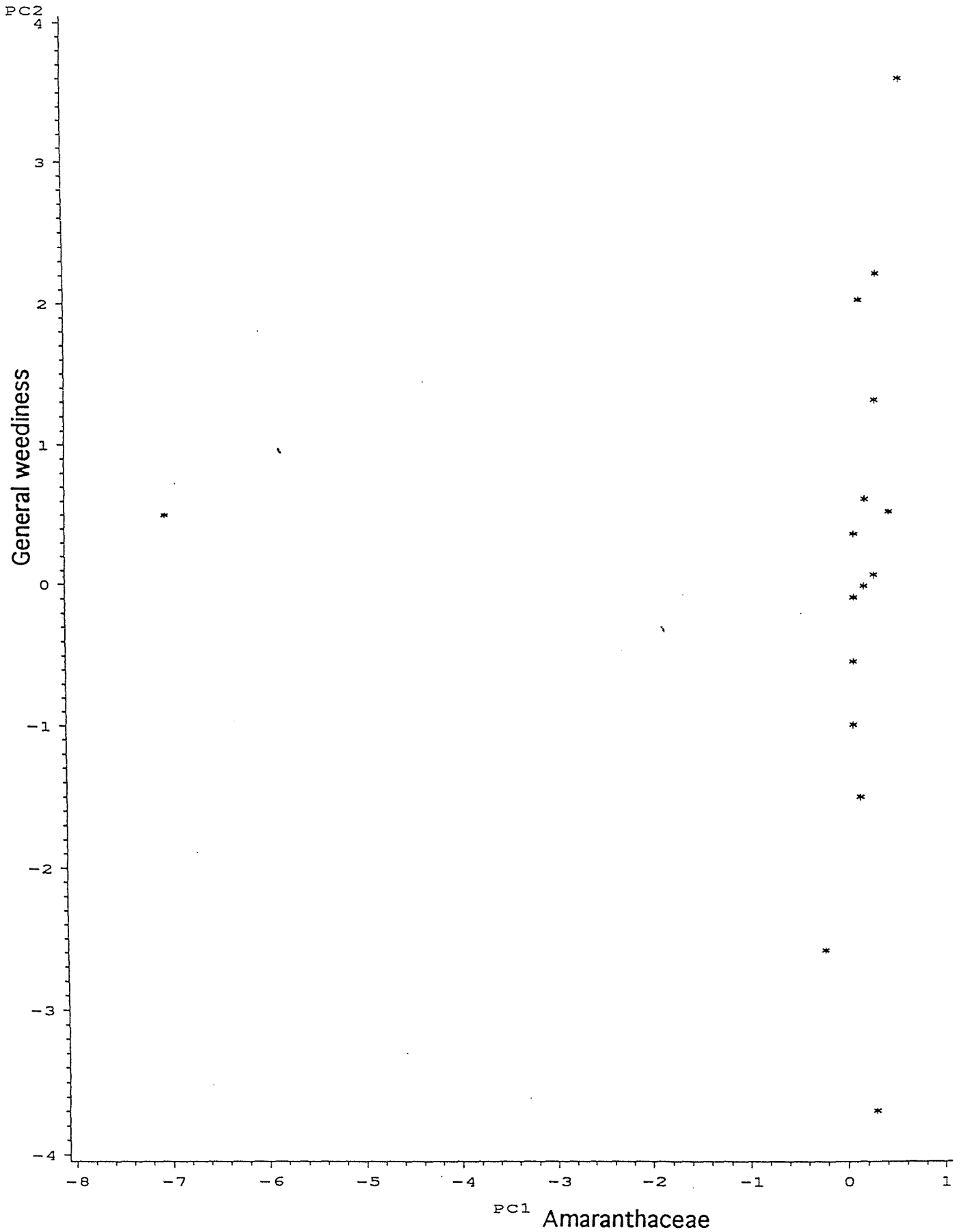


**Table 4.16**  
**Correlations amongst weed data**

variable	1	2	3	4	5	6
1-thistles	1.000	0.317	0.089	0.172	0.052	0.416
2-Asteraceae		1.000	0.164	-0.009	-0.016	0.132
3-Poaceae			1.000	-0.019	-0.033	0.015
4-Polygonaceae				1.000	-0.011	0.005
5-Ranunculaceae					1.000	0.009
6-Papilionaceae						1.000
<b>variable</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	
1-thistles	0.000	0.052	0.052	0.052	0.017	
2-Asteraceae	0.000	-0.016	-0.016	-0.298	-0.005	
3-Poaceae	-0.485	-0.033	-0.033	-0.033	-0.011	
4-Polygonaceae	0.000	0.574	-0.011	-0.011	-0.004	
5-Ranunculaceae	0.000	-0.020	1.000	-0.020	-0.006	
6-Papilionaceae	0.317	0.009	0.009	0.009	0.003	
7-Rosaceae	1.000	0.000	0.000	0.000	0.000	
8-Convolvulaceae		1.000	-0.020	-0.020	-0.006	
9-Chenopodiaceae			1.000	-0.020	-0.006	
10-Solanaceae				1.000	-0.006	
11-crop weeds					1.000	

The weed data was loosely structured with five factors required to account for 70% of the dispersion (Table 4.17). The first score discriminated strongly for Amaranthaceae. Factor two was almost a general factor, whilst the third provided a Poaceae/Rosaceae contrast. The fourth score was a Polygonaceae and Convolvulaceae combination and the fifth a Solanaceae and thistle/Asteraceae contrast. Figure 4.17 shows the plot of the first two scores that reveals one farm showing a great worsening of Amaranthaceae levels.

FIGURE 4.17: PC 2 VERSUS PC 1  
FOR WEED DATA



**Table 4.17**  
**Results of PC on weed data**

---

weeds

**D<sub>z</sub> accounted for:**

proportion	0.1829	0.1569	0.1435	0.1388	0.1049
cum. proportion	0.1829	0.3398	0.4833	0.6221	0.7270
<b>standardised scoring coefficients</b>					
thistles	0.0663	0.4025	0.1377	-0.1629	0.2999
Asteraceae	0.0100	0.2669	0.2865	-0.2274	-0.3319
Poaceae	-0.0388	0.0014	0.5112	0.0490	0.2142
Polygonaceae	-0.0096	0.3258	-0.0592	0.4474	-0.0260
Amaranthaceae	0.9870	-0.0876	0.0461	0.1039	-0.0090
Papilionaceae	0.0465	0.3492	-0.0862	-0.3084	0.2494
Rosaceae	0.0331	0.1516	-0.4752	-0.2306	-0.1604
Convolvulaceae	-0.0193	0.2895	-0.0809	0.4635	-0.0832
Solanaceae	-0.0165	-0.0871	-0.1635	0.0739	0.7244
crop weeds	-0.0044	0.0063	-0.0061	-0.0168	0.0086

---

All farmers were asked what control methods, if any, they employed on these problems. These were scored on the degree of intensity of these methods. This ranged from doing nothing, changing species density or use of pest tolerant species, spraying or mowing, cultivation, grubbing, dipping/drenching and vaccination, through to breeding for tolerance or resistance (Table 4.18). Any combination could also be used and scores ranged from zero to thirty-one (see Materials and Methods). Due to a number of missing data where farmers did not have a particular problem, a principal component analysis could not be carried out.

For animal health, conventional farmers tended to be more intense in their use of control methods against external parasites and mineral deficiencies than the organic farmers, who were more concerned with bloat. For plant health organic farmers were more concerned with Lepidoptera and Coleoptera, whereas the conventional farmers concentrated more on fungal diseases.

Conventional farmers also spent more time on controlling gorse (Papilionaceae). Instead, the organic farmers concentrated more on thistles, couch (Poaceae), and other crop weeds. Both groups of farmers were equally concerned with controlling other Asteraceae, which included ragwort.

**Table 4.18****Intensity of control methods used on the problems**

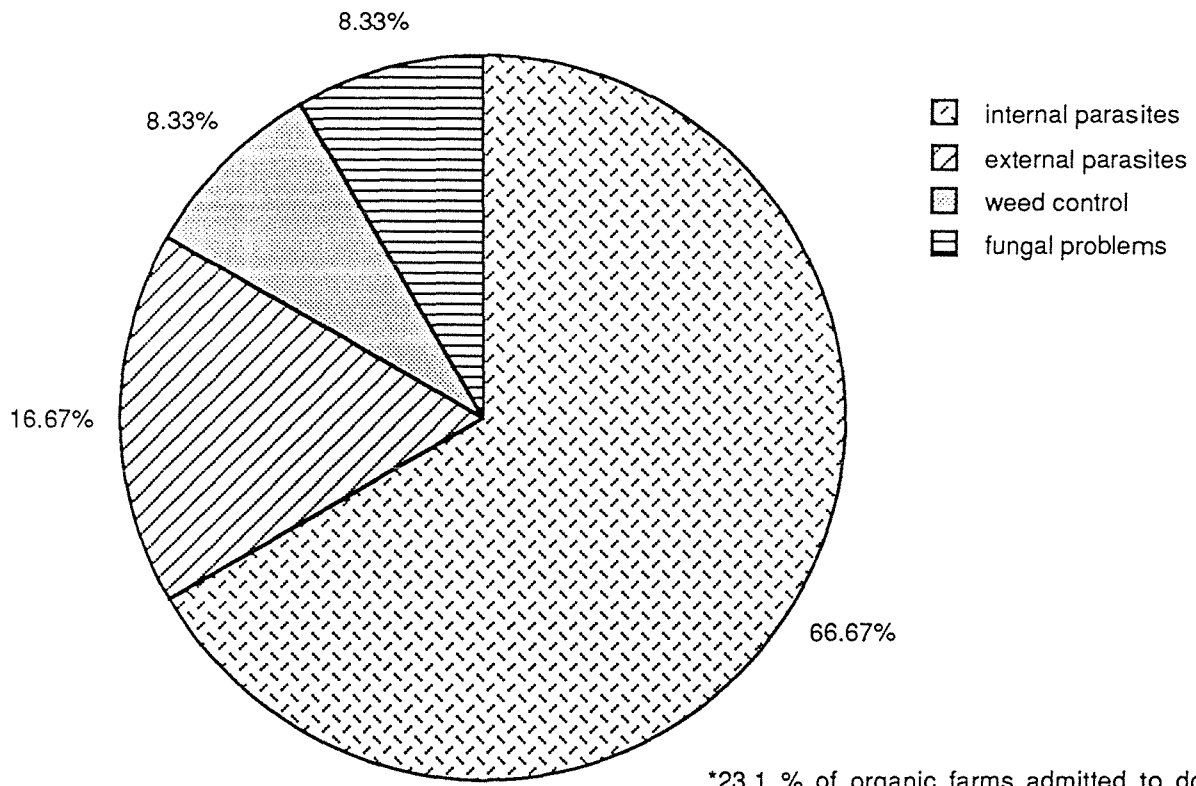
problem	organic farms mean	conventional farms mean	t test value
<u>animal health</u>			
internal parasites	8.571	10.267	1.000 ns
flystrike	6.222	7.833	0.917 ns
feet problems	12.000		
bloat	13.000	8.000	2.318 P<0.05
mastitis	5.333		
facial eczema		8.000	
external parasites	4.500	8.000	6.121 P<0.001
milk fever	8.000		
mineral deficiency	1.000	8.000	35.699 P<0.001
grass staggers	8.000	26.000	
<u>plant health</u>			
fungal diseases	3.273	4.000	2.340 P<0.05
Lepidoptera	3.333	2.000	4.857 P<0.001
Coleoptera	3.250	1.000	5.247 P<0.001
Hemiptera	3.600		
Thysanoptera	5.333		
Mollusca	6.000		
Collembola	4.000		
<u>weeds</u>			
thistles	5.000	3.000	2.162 P<0.05
other Asteraceae	4.800	4.200	0.917 ns
Poaceae	6.000	1.333	7.142 P<0.001
crop weeds	7.200	4.000	6.894 P<0.001
Polygonaceae	4.333		
Solanaceae	6.000		
Rosaceae	7.333		
Ranunculaceae	7.000		
Papilionaceae	3.000	4.400	2.637 P<0.02
Amaranthaceae	4.000		
Convolvulaceae	12.000		
Umbelliferae	8.000		
Dennstaedtiaceae	4.000	4.000	
Chenopodiaceae	4.000		
scrub		6.000	

Organic farmers were also asked if they had ever used a chemical not allowed by the BPC to combat a problem (Figure 4.18). Twelve farmers (23%) admitted doing so, most of them for controlling internal parasites in their stock.

#### 4.3.4 Labour

Conventional farms employed more labour than organic farms in all classes of employment (Table 4.19). As the variation was large, there was no statistical significance. However it has to be borne in mind that there were a large number of small properties among the organic farms.

Figure 4.18 Problems on organic farms where chemicals not allowed by the BPC were used\*



\*23.1 % of organic farms admitted to doing so

**Table 4.19**

**Labour units (people-months) employed on farms**

	organic	conventional	t	test value
permanent full-time	14.54	20.67	1.657	ns
permanent part-time	7.85	8.67	0.254	ns
casual	2.87	6.67	0.184	ns

There was a medium positive correlation between the size of the property and the amount of permanent full-time labour present (Table 4.20). Part-time and casual labour were not however related to the size of the properties.

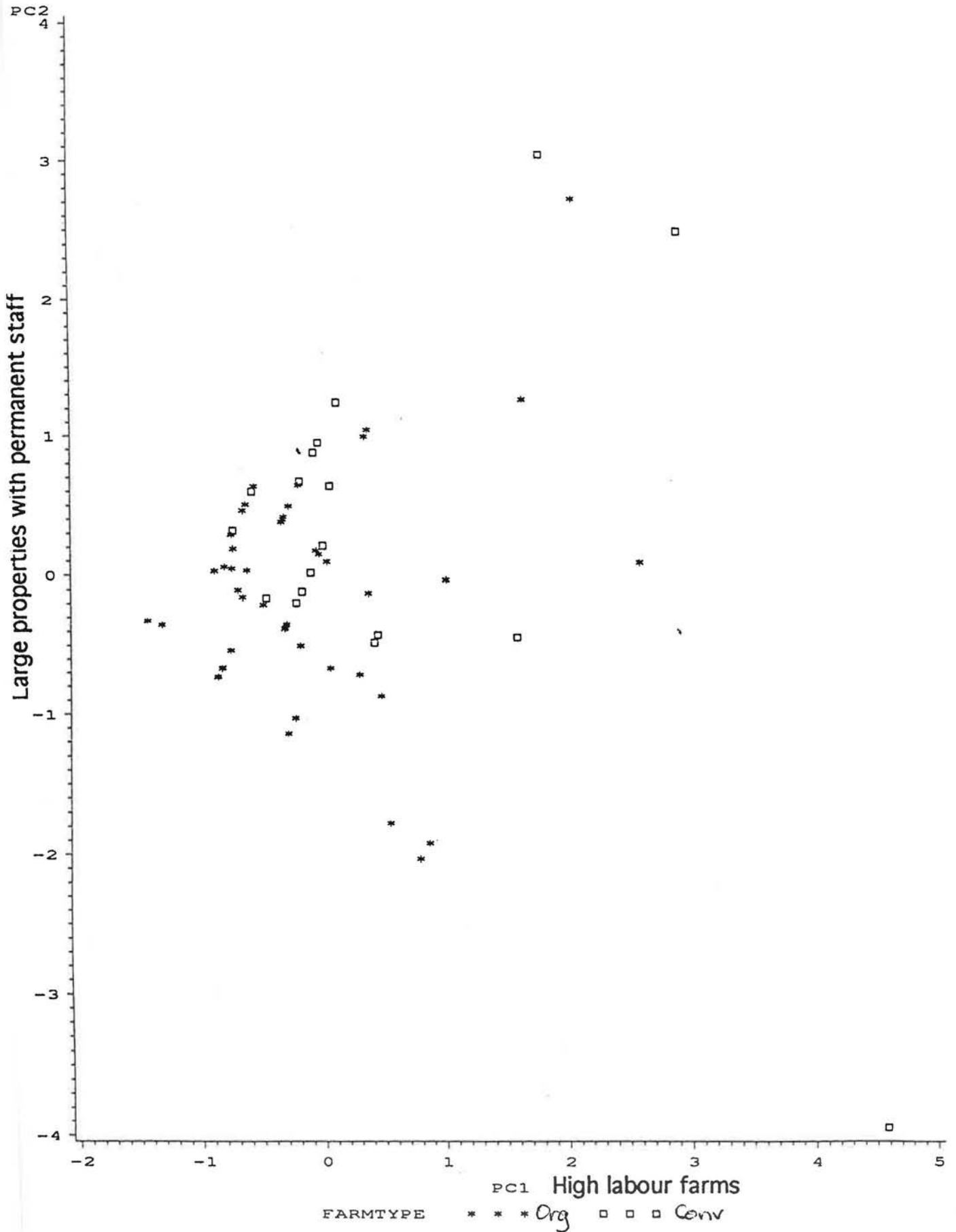
**Table 4.20**

**Correlations on labour data**

variable	1	2	3	4
1-area of farm	1.000	0.569	-0.046	-0.116
2-permanent full-time		1.000	-0.136	-0.132
3-permanent part-time			1.000	0.197
4-casual				1.000

A principal component (Table 4.21) analysis produced the first score as a general score, strongly discriminating for high labour requiring properties, with a low weight for property size. The second score selected large farms employing permanent full-time labour or those properties employing part-time and casual labour. Figure 4.19 shows the plot of these two scores. Organic properties did not stand out as being distinguishable from conventional farms. Three properties standing out in the top right hand corner are large farms with a high level of permanent staff.

Figure 4.19 PC 2 versus PC 1 for labour data



**Table 4.21**

**Results of PC on labour data**

---

<b>D<sub>z</sub> accounted for:</b>	<b>1</b>	<b>2</b>
proportion	0.4144	0.3300
cumulative proportion	0.4144	0.7444
<b>standardised scoring coefficients</b>		
area of property	0.2281	0.4270
permanent full-time labour	0.5798	0.3752
permanent part-time labour	0.5221	-0.3690
casual labour	0.5314	-0.4076

---

**4.4 Marketing**

Processing was done at conventional plants for all the conventional and most of the organic farms' outputs. Fourteen of the organic farms (27%) did some processing on their property, and one farm was a member of a small co-operative processing plant. Of the five types of produce that were processed on the organic farms, fruit followed by dairy products were the most popular (Figure 4.20). Produce of organic farms was usually labelled with the Bio-Gro label. The proportion each market represents is on a per farm basis and not on the total volume of organic produce. The majority of organic produce was sold through conventional markets such as freezing works or dairy factories where it was treated as conventional produce and no mark-up could be obtained (Figure 4.21).

There were medium to strong negative correlations present amongst the different outlets for the organic produce (Table 4.22). This was due to most or all the produce of any one farm being sold through one market. There were also low positive correlations between specialised labelling and direct sales and produce sold to health food shops, as well as with processed goods. This reflects the demands of a specific consumer group shopping for such goods.

Figure 4.20 Produce processed on organic farms\*

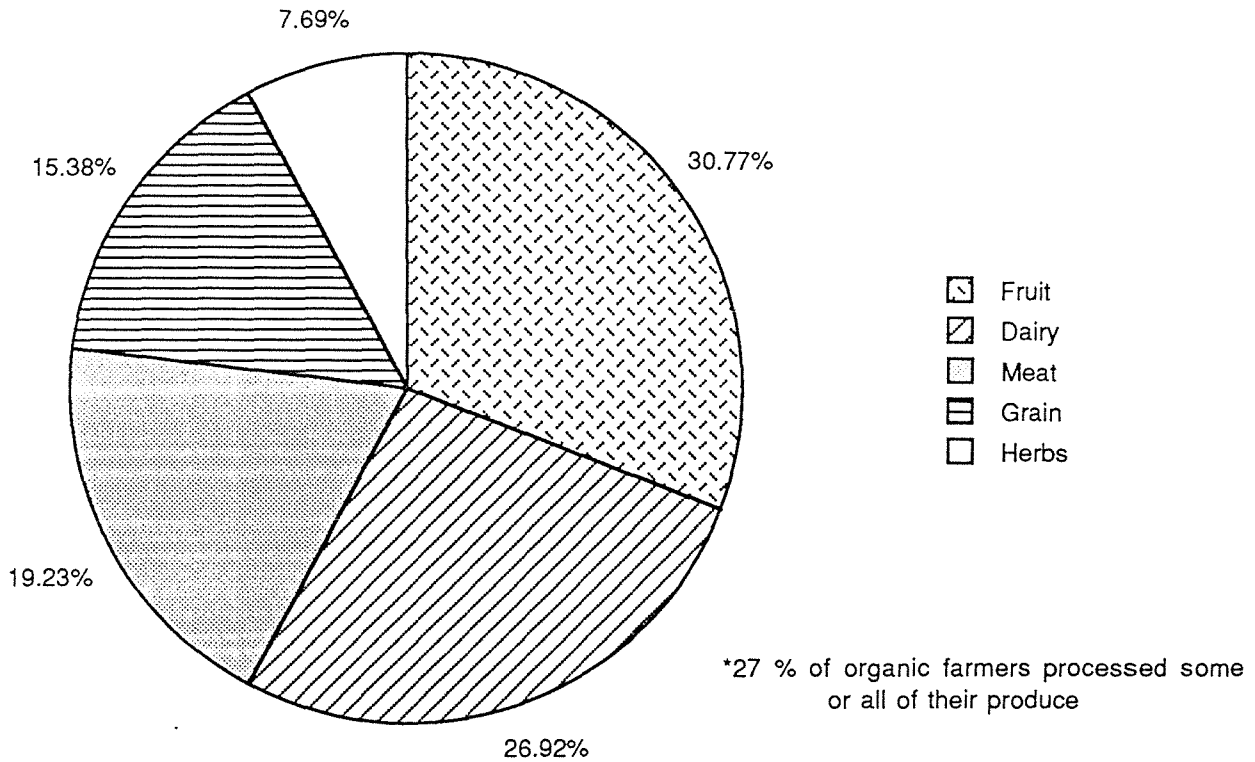
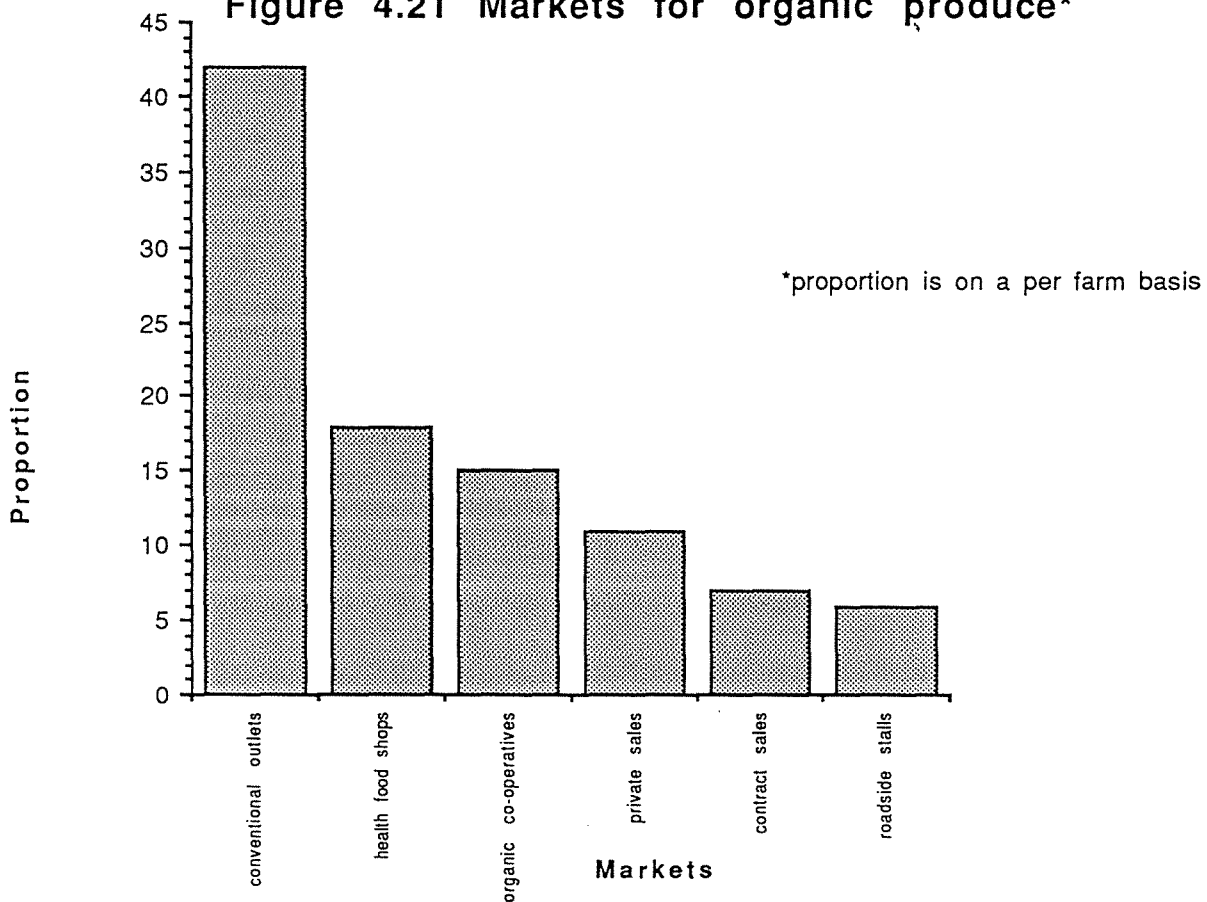


Figure 4.21 Markets for organic produce\*



**Table 4.22**  
**Correlations amongst marketing data**

<b>variable</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
1-industrialisation	1.000	0.219	0.028	0.065
2-specialised labelling		1.000	0.280	0.152
3-direct sales			1.000	-0.616
4-roadside stalls				1.000
<b>variable</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
1-industrialisation	-0.002	0.072	0.059	-0.030
2-specialised labelling	0.233	0.171	0.038	0.032
3-direct sales	-0.715	-0.734	-0.790	-0.657
4-roadside stalls	-0.637	-0.678	-0.706	-0.553
5-health food shops	1.000	-0.759	-0.851	-0.710
6-large organic co-ops		1.000	-0.852	-0.700
7-conventional markets			1.000	-0.800
8-restaurants				1.000

In the principal component analysis, factor one (Table 4.23) discriminated for farms where produce, usually processed, was sold specifically labelled to health food shops, privately or through the organic co-operatives. The second factor was strongly positive on processed and specially labelled goods, sold through conventional outlets. Factor three selected those with a high proportion of sales through private sales. The final significant factor showed those who sold processed products via the organic co-operatives.

**Table 4.23**  
**Results of PC on marketing data**

<b>Dz accounted for:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
proportion	0.2743	0.1642	0.1447	0.1309
cumulative proportion	0.2743	0.4385	0.5832	0.7141
<b>standardised scoring coefficients</b>				
processing of produce	0.1025	0.4305	0.0826	0.5213
organic labelling	0.3471	0.1975	0.1230	0.0170
direct sales	0.2330	0.1391	0.2799	-0.3380
roadside stalls	0.0604	-0.2022	0.5441	0.5447
health food shops	0.2735	-0.0489	0.0258	-0.3680
organic co-operatives	0.1799	0.0641	-0.6762	0.3325
conventional outlets	-0.3990	0.2976	0.0846	-0.0616
restaurants/cafe's	0.0198	-0.6178	-0.0497	0.1482

The plot (Figure 4.22) of factors one and two of the organic farmers showed some grouping of scores. A cluster analysis was done on these two PC scores and the most significant F test value was found to be at the 12 cluster level ( $F=8.117 \times 10^{-12}$ ). Group four made up of three individuals were farmers that sold labelled, processed products via private sales or the co-operatives. Group one, consisting of 12 individuals (some observations were hidden on this plot) sold unlabelled produce to conventional outlets. Groups two and twelve were farmers that sold their unprocessed, unlabelled produce on contracts to shops and restaurants. Group three farmers processed some of their produce before selling it on.

#### 4.5 Advice And Information

Both the conventional and organic farmers obtained advice and information from more technical sources, with the organic group tended to score higher. This difference was not significant however. Many used the services of advisors and/or inspectors as well as a combination of literature, discussion groups, clubs/organisations and talking with other farmers.

**Table 4.24**

**Availability of advice and information**

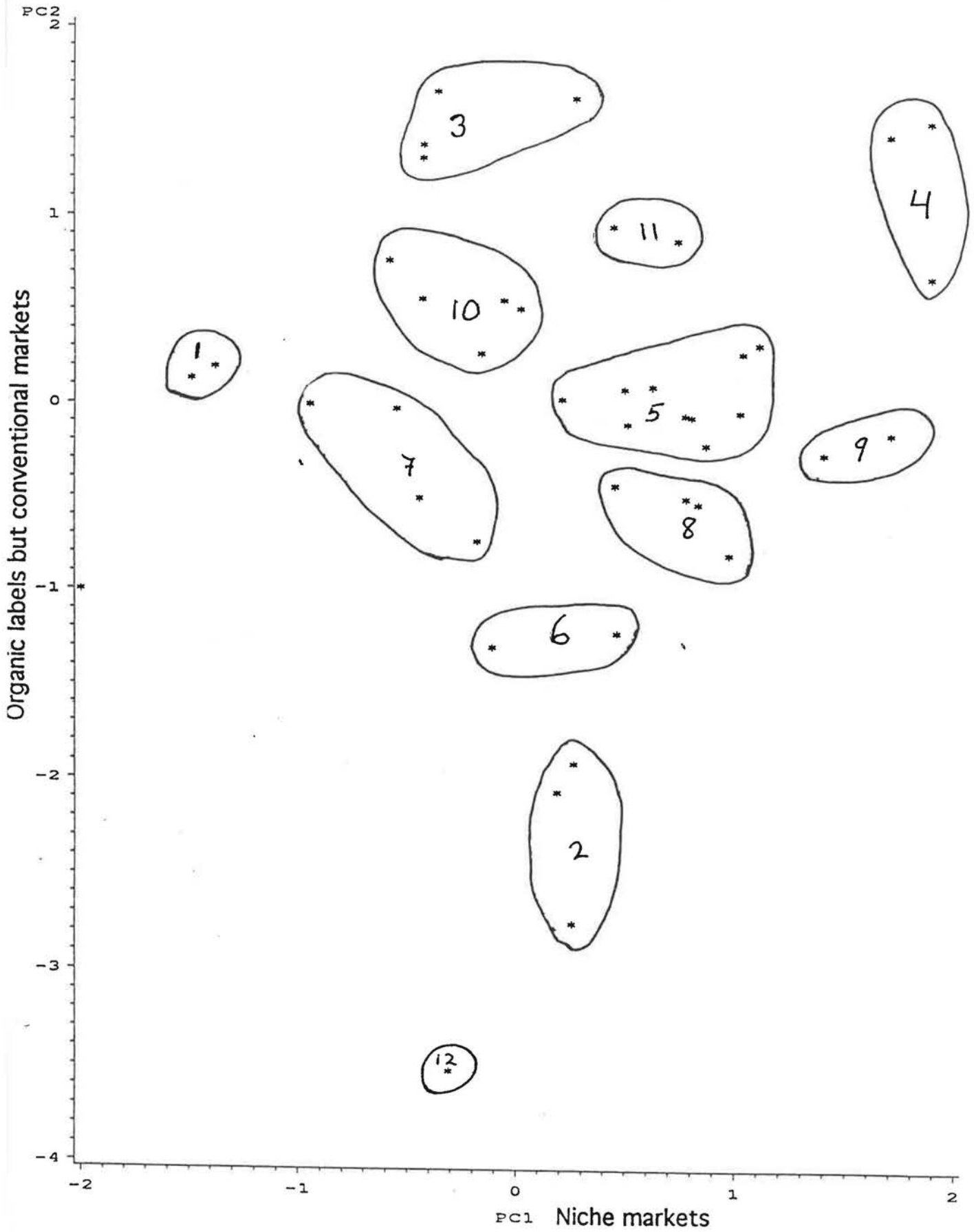
	organic mean	conv. mean	t test	P
source of advice/info. *	27.72	17.33	0.746	ns
general advice**	2.42	4.39	7.493	P<0.001
-- within Biodynamic organisation**	3.94			
general information**	2.44	4.06	9.886	P<0.001
-- within Biodynamic organisation**	3.90			
response from general advisor**	2.13	3.22	2.797	P<0.01

\*scores ranged up to 63

\*\*scores were:1=little 5=plenty

Organic farmers on a general scale felt that advice and information was not readily available (Table 4.24). A reasonable amount of information could be found within the Biodynamic organisation. This was to be expected as the organisation only deals with organic farming. Conventional farmers in contrast found it easier to get answers to their questions. This reflects the much lower number of publications available that are aimed at the more specialised topics and problems that occur in organic

Figure 4.22 PC 2 versus PC 1 for marketing data



farming from general outlets. General advisors were felt by organic farmers to have little interest in their problems. Conventional farmers also felt that a sympathetic response from the general advisor was not always forthcoming in reply to their problems.

There was a high correlation between availability of advice and of information, and a low one with the response of a general advisor (Table 4.25). Not unexpectedly, there was a high correlation between biodynamic advice and information.

**Table 4.25**  
**Correlations of advice and information data**

<b>variable</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
1-source of advice/information	1.000	-0.130	-0.013	0.068
2-general advice		1.000	0.809	0.246
3-general information			1.000	-0.072
4-response from a general advisor				1.000

<b>variable</b>	<b>biodynamic information</b>
biodynamic advice	0.861

In the principal component (PC) analyses for both the general and specific biodynamic advice/information, the data was well structured. Only two factors were required to account for over seventy percent of the variation for the general subset and one factor in the biodynamic group. In the general PC analysis (Table 4.26), the first factor gave high scores for scores in availability of general advice and information, and factor two for the technical level of information and the response of a general advisor.

**Table 4.26**

**Results of PC on advice and information data**

-----  
overall advice/information

<b>D<sub>z</sub> accounted for:</b>	<b>1</b>	<b>2</b>
proportion	0.5130	0.2483
cumulative proportion	0.5130	0.7613
<b>standardised scoring coefficients</b>		
source of advice/information	-0.1849	0.7796
general advice	0.4548	0.0211
general information	0.4405	-0.0222
response from a general advisor	0.2288	0.6310

biodynamic advice/information

<b>D<sub>z</sub> accounted for:</b>	
proportion	0.9306
<b>standardised scoring coefficients</b>	
biodynamic advice	0.51832
biodynamic information	0.51832

-----

The plot of factors one and two in the general PC is shown in Figure 4.23. The plotting of all the conventional farmers to the right on the plot is due to their feeling advice and information was easier to find (PC 1). The technical level of information and the response of a general advisor ranged as much for both sets of farmers (PC 2).

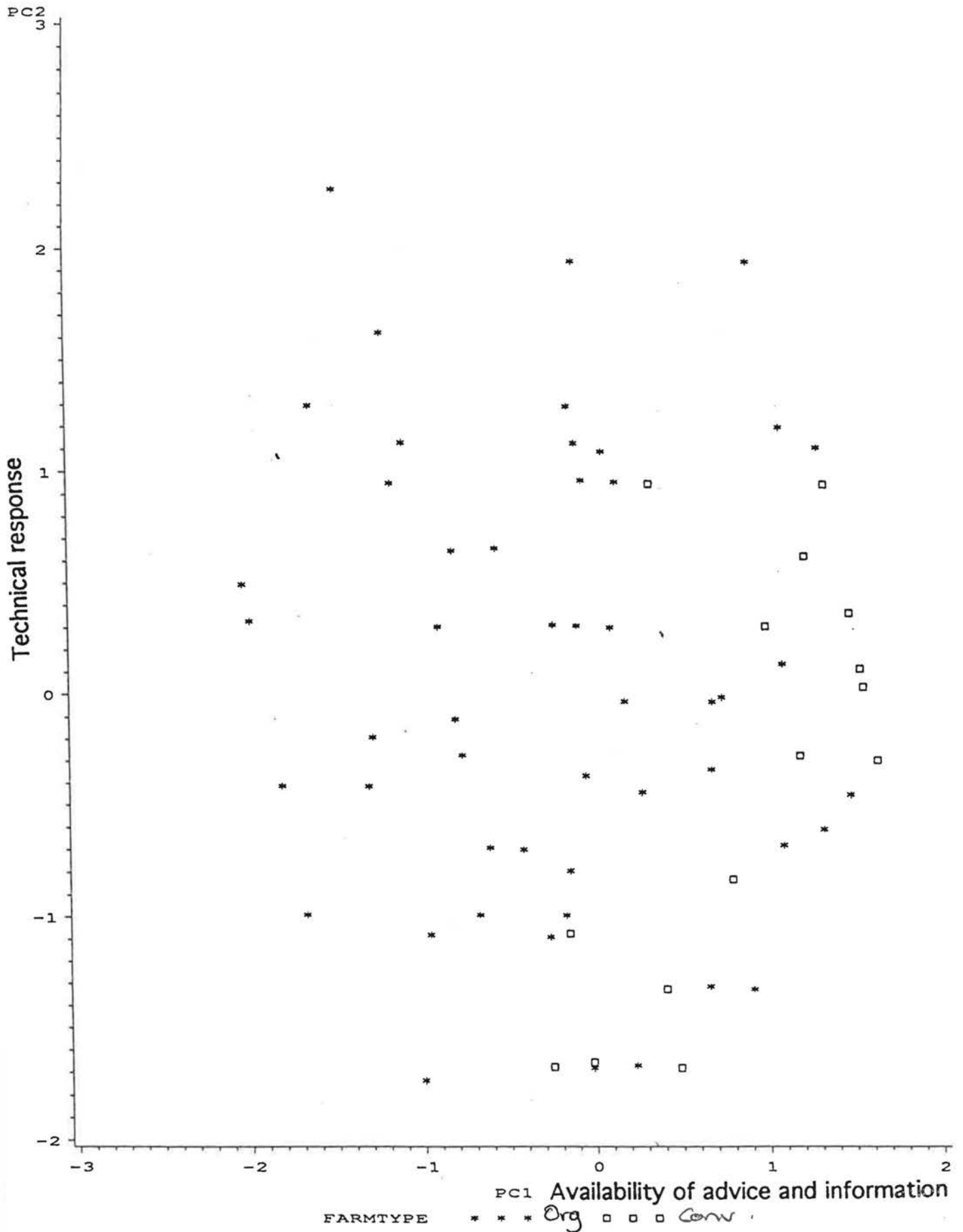
## **4.6 Financial Data**

### **4.6.1 Income items**

The highest ranking income items (Table 4.27) in the organic group were meat, fruit, and vegetables. These were followed by animal fibres, milk & milk products and other livestock. Conventional farmers also had meat as their biggest income earner, but had animal fibres second. This was followed by cull for age stock, other livestock and milk & milk products.

Overall, the conventional farmers ranked animal products as significantly higher income earners than the organic farmers, with the exception of dairy and poultry. In contrast, the organic farmers had higher proportions of fruit and vegetables.

Figure 4.23 PC 2 versus PC 1 for advice and information



**Table 4.27**  
**Ranking of income items by farmers**

item	organic	conventional	t test value
meat	2.29	6.33	4.557 P<0.001
fruit	1.63	0	3.985 P<0.001
vegetables	1.52	0.22	9.009 P<0.001
animal fibres	1.19	3.11	7.981 P<0.001
milk & milk products	1.02	1.06	0.119 ns
livestock	0.67	1.28	1.773 P<0.1
nuts	0.42	0.05	9.718 P<0.001
herbs	0.27	0	1.770 P<0.1
cull for age stock	0.19	1.44	5.934 P<0.001
chickens	0.19	0	1.412 ns
grain & grain products	0.17	0	1.679 P<0.1
flowers	0.08	0	1.049 ns
velvet	0.06	0.11	3.039 P<0.01
eggs	0.06	0	1.030 ns
honey	0.04	0	1.030 ns
farm holidays	0.04	0	1.030 ns

Meat was found to be strongly negatively correlated (Table 4.28) with fruit, vegetables and milk products, whilst vegetable production was negatively correlated with meat, fruit and milk production. Milk production was also negatively correlated with fruit production. Herb growing was positively correlated with flower production and farm holiday ventures, but the latter was negatively correlated with flower growing.

**Table 4.28**  
**Correlations of income data**

variable	1	2	3	4	5	6
1-meat	1.000	-0.327	-0.077	-0.474	-0.560	0.272
2-livestock		1.000	-0.130	-0.381	-0.348	0.174
3-cull for age stock			1.000	0.142	-0.348	0.174
4-milk & milk products				1.000	-0.467	-0.092
5-fruit					1.000	-0.057
variable		7	8	9	10	11
1-meat		-0.131	0.180	-0.014	0.062	-0.551
2-livestock		-0.241	-0.060	0.045	0.021	-0.344
3-cull for age stock		-0.190	-0.108	-0.112	0.040	-0.192
4-milk & milk products		-0.112	-0.019	0.251	0.019	-0.418
5-fruit		-0.123	-0.012	0.080	0.173	-0.515
6-animal fibres		0.344	-0.051	0.073	-0.005	-0.143
7-grain & grain products		1.000	-0.064	-0.027	-0.007	-0.045
8-velvet			1.000	0.010	0.003	-0.030
9-chickens				1.000	-0.054	0.116
10-eggs					1.000	0.222
variable		12	13	14	15	16
1-meat		-0.187	-0.305	0.205	-0.000	0.200
2-livestock		-0.166	-0.207	0.096	-0.000	0.120
3-cull for age stock		-0.022	-0.079	-0.057	-0.000	0.048
4-milk & milk products		-0.213	-0.267	0.311	-0.000	0.197
5-fruit		0.044	-0.294	0.129	-0.000	0.377
6-animal fibres		-0.097	-0.078	-0.040	0.000	0.016
7-grain & grain products		-0.043	-0.056	0.020	-0.000	0.047
8-velvet		-0.016	-0.012	-0.023	0.000	0.004
9-chickens		-0.038	0.016	-0.113	0.000	-0.044
10-eggs		-0.086	0.031	-0.060	0.000	-0.065
11-vegetables		-0.124	-0.317	0.250	-0.000	0.179
12-nuts		1.000	-0.123	0.025	-0.000	-0.025
13-herbs			1.000	0.076	0.643	0.630
14-honey				1.000	0.000	-0.057
15-flowers					1.000	-0.409
16-farm holidays						1.000

The data was weakly structured (Table 4.29) as is shown by the fact that 8 eigenvalues (from 16 variables) are required to account for seventy percent of the variation. The scores tended to pick out particular farming enterprises. Factor one discriminated for fruit growers and was strongly negative on livestock. Factor two selected the cottage industries of herb and flower growers and farm holiday places. Factor three was a dairy and fruit & nut contrast, the fourth selecting arable farms and five specifically sorting out the grain growers. Factor six was strong for deer farms with the seventh score as a nut & flower producer and poultry, livestock & farm holiday contrast. The eighth score was an interesting chicken/egg producer contrast.

**Table 4.29**  
**Results of PC on income items**

D <sub>z</sub> accounted for:	1	2	3	4	5	6	7	8
proportion	0.17	0.12	0.10	0.08	0.07	0.07	0.07	0.07
cum. proportion	0.17	0.28	0.38	0.46	0.53	0.60	0.67	0.73
<b>standardised scoring coefficients</b>								
meat	-0.30	0.08	-0.05	-0.06	0.02	0.25	0.04	0.05
livestock	-0.14	0.05	-0.11	-0.00	-0.44	-0.36	0.31	-0.06
culled stock	-0.14	-0.02	0.26	-0.35	-0.02	-0.11	-0.22	0.35
milk & milk prod.	0.04	-0.19	0.47	-0.19	0.10	0.08	0.02	-0.02
fruit	0.21	0.09	-0.26	-0.33	0.15	0.03	0.11	0.03
animal fibre	-0.29	0.07	-0.04	-0.00	0.22	-0.16	0.03	-0.01
grain & gr. prod.	-0.09	0.02	-0.10	0.25	0.68	-0.15	-0.15	-0.14
velvet	-0.08	0.05	-0.08	0.11	-0.13	0.66	0.22	-0.16
chickens	0.06	-0.14	0.19	-0.03	0.06	-0.19	0.35	-0.59
eggs	0.08	-0.08	-0.12	0.20	0.01	-0.14	0.24	0.58
vegetables	0.18	-0.26	-0.04	0.37	0.01	-0.07	0.05	0.08
nuts	0.13	-0.04	-0.27	-0.23	-0.05	0.12	-0.48	-0.17
herbs	0.14	0.43	0.20	0.13	0.01	-0.02	0.01	0.02
honey	0.04	-0.14	0.20	0.17	0.05	0.35	-0.00	0.19
flowers	0.08	0.32	0.21	0.31	-0.19	-0.09	-0.32	-0.09
farm holidays	0.12	0.28	0.04	-0.21	0.29	0.09	0.43	0.14

#### 4.6.2 Cost Items

The highest ranking cost items on organic farms were labour, repairs & maintenance (R&M) and fuel, followed by fertiliser, replacements, interest, plant & stock health (health), freight & cartage (F&C), irrigation and packaging (see Table 4.30). Low on the list were administration, stockfeed and fruit processing, advice & information (A&I), fencing and trees, rates & rent and insurance.

Both organic and conventional farmers ranked labour, R&M and replacement stock/seed similarly. Conventional farmers ranked fertiliser, animal and plant health significantly higher than the organic farmers. This would in part be due to the organic farmers making their own fertilisers such as compost (see figure 4.11), as well as often using homeopathic preventatives and remedies. Conventional farmers also ranked interest, rates and rent significantly higher. Organic farmers ranked fuel, F&C, irrigation, packaging, fruit processing and administration significantly higher. These reflect the number of organic farmers involved with fruit and vegetable crops.

**Table 4.30**  
**Ranking of costs by farmers**

item	organic	conventional	t test value
labour	2.15	2.76	1.621 ns
R&M	2.04	1.82	1.208 ns
fuel	1.96	1.18	5.647 P<0.001
fertilisers	1.37	3.12	6.114 P<0.001
replacement stock/seed	1.10	1.41	1.032 ns
interest	0.73	1.65	2.463 P<0.02
health	0.62	1.47	5.550 P<0.001
F&C	0.60	0	2.904 P<0.01
irrigation	0.46	0	2.064 P<0.01
packaging	0.37	0	2.541 P<0.02
administration	0.27	0	2.238 P<0.05
fruit processing	0.21	0	1.741 P<0.1
stock feed	0.21	0.29	1.412 ns
A&I	0.15	0	1.442 ns
fencing	0.15	0.12	1.354 ns
trees	0.15	0	1.387 ns
rates/rent	0.13	0.53	3.840 P<0.001
insurance	0.02	0	1.030 ns
contracting	0	0.06	1.061 ns

A medium to large correlation (Table 4.31) was present between freight/cartage and packaging. This corresponds with the large number of fruit and vegetable growers that use these inputs. A smaller correlation existed between administration and insurance, and fuel with administration and with fencing.

**Table 4.31**  
**Correlations of cost items**

variable	2	3	4	5	6	7
1-interest	-0.081	-0.182	0.165	-0.110	0.048	0.048
2-fertiliser	1.000	-0.034	-0.081	-0.265	-0.240	0.020
3-irrigation		1.000	-0.019	0.027	-0.039	-0.200
4-freight/cartage(F&C)			1.000	0.019	-0.021	-0.120
5-repairs & maintenance(R&M)				1.000	-0.204	-0.018
6-fruit processing					1.000	-0.102
variable	8	9	10	11	12	13
1-interest	-0.180	-0.106	-0.125	-0.284	-0.111	-0.162
2-fertiliser	-0.174	0.054	0.010	-0.033	-0.169	-0.017
3-irrigation	0.014	0.117	-0.011	-0.144	-0.089	-0.114
4-F & C	-0.034	-0.007	-0.054	-0.064	-0.010	-0.021
5-R & M	0.064	-0.202	0.297	-0.054	-0.121	-0.085
6-fruit processing	-0.078	-0.057	0.132	0.107	-0.080	0.268
7-stock/pl health	-0.055	-0.065	-0.013	-0.076	-0.130	-0.014
8-replacement stock/seed		-0.042	-0.152	-0.173	-0.018	0.165
9-advice/information		1.000	0.159	-0.075	-0.093	-0.039
10-fuel			1.000	-0.039	0.330	-0.127
11-labour				1.000	-0.221	-0.139
12-administration					1.000	-0.045
variable	14	15	16	17	18	19
1-interest	-0.128	0.212	0.033	-0.093	-0.270	-0.040
2-fertiliser	-0.087	-0.057	-0.075	0.012	-0.148	-0.091
3-irrigation	-0.064	0.011	0.195	-0.112	0.022	-0.030
4-F & C	-0.035	-0.054	-0.031	0.144	0.633	-0.006
5-R & M	-0.135	-0.194	-0.236	0.088	-0.202	0.054
6-processing	-0.089	-0.075	-0.088	-0.036	-0.076	-0.015
7-health	-0.008	-0.034	-0.063	-0.137	0.058	0.099
8-replacement	-0.007	0.095	-0.098	-0.126	-0.093	0.167
9-advice/info	-0.118	-0.031	-0.093	-0.018	-0.046	0.035
10-fuel	0.393	0.149	0.002	-0.160	-0.135	-0.136
11-labour	-0.195	0.040	0.075	0.035	0.011	0.153
12-admin	-0.189	0.374	0.203	-0.036	0.192	0.049
13-stock feed	0.021	0.012	-0.005	-0.065	-0.031	-0.076
14-fencing	1.000	-0.057	0.098	0.161	0.008	0.046
15-insurance		1.000	-0.161	0.062	-0.065	0.013
16-trees			1.000	-0.028	-0.119	0.010
17-rates/rent				1.000	-0.067	-0.037
18-packaging					1.000	-0.045
19-contracting						1.000

Again the data was weakly structured (Table 4.32) with nine eigenvalues (from 19 variables) required to account for seventy percent of the variation. Factor one was highly positive for fuel and negative for freight/cartage and packaging, implying the selection of farmers that transport their produce to markets themselves and do not use packaging. Factor two is positive for

administration and insurance and negative for fertiliser, factor three positive for repairs/maintenance and replacements but negative for fertiliser. Factor four negative on fruit processing costs, stockfeed and interest, factor five positive to irrigation and negative on health costs and interest and factor six was highly negative on labour. Factor seven selected for horticultural units with high costs in labour, contracting and trees. Factor eight also selected those investing in trees whilst factor nine accounted for the freehold properties. Factor ten showed up those units leasing land.

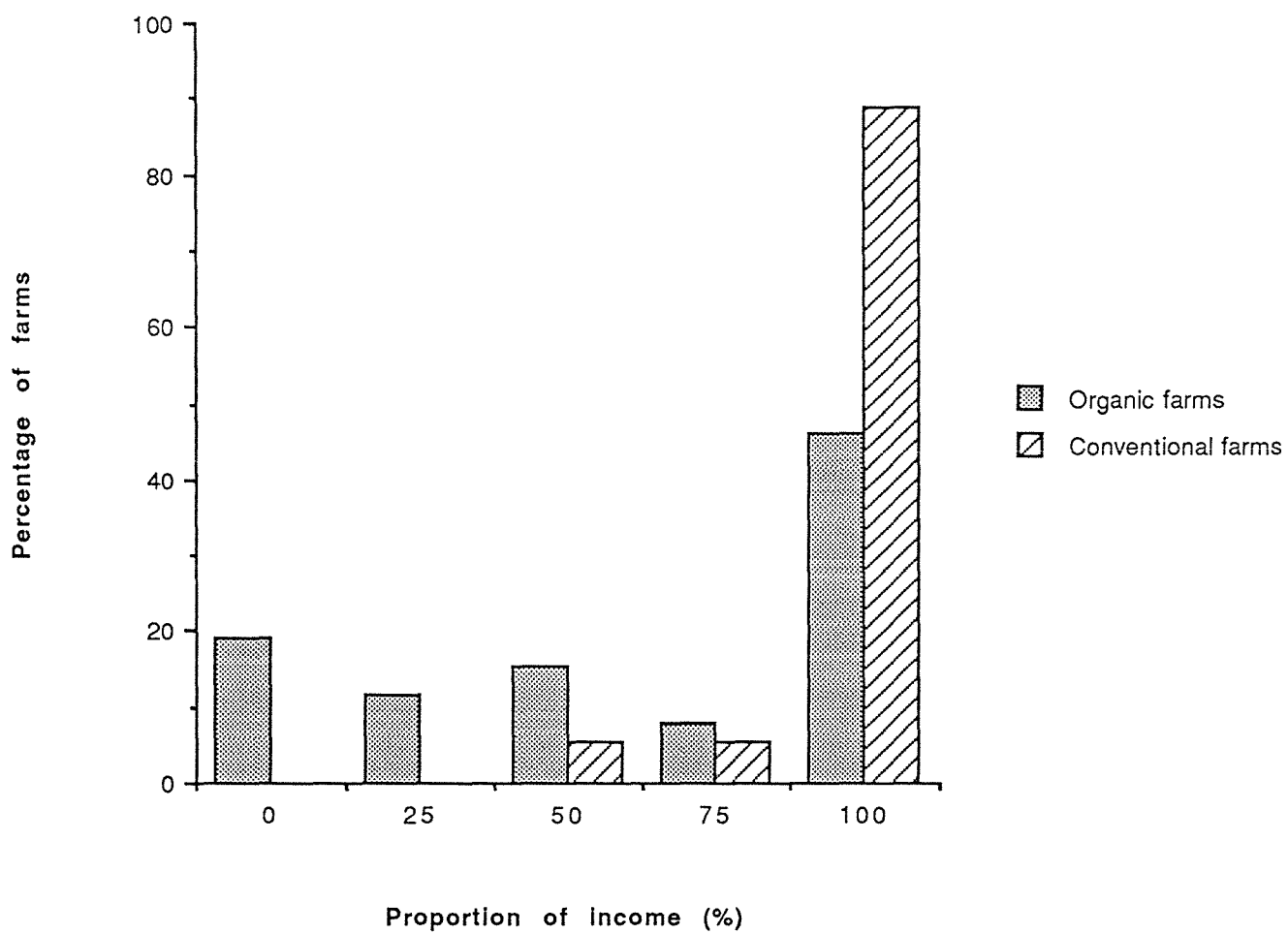
**Table 4.32**  
**Results of PC on cost items**

Dz accounted for:	1	2	3	4	5	6	7	8	9
proportion	0.11	0.11	0.09	0.08	0.08	0.07	0.06	0.06	0.05
cum. propn.	0.11	0.22	0.30	0.38	0.46	0.53	0.59	0.64	0.70
<b>standardised scoring coefficients</b>									
interest	0.00	0.01	0.04	-0.45	-0.20	-0.03	0.01	0.01	-0.41
fertiliser	-0.20	-0.02	-0.33	-0.18	0.02	-0.08	-0.17	-0.02	0.17
irrigation	0.07	0.08	-0.18	0.22	0.30	-0.26	-0.08	0.02	-0.35
freight	0.31	-0.28	-0.02	-0.07	-0.11	0.02	-0.13	0.00	-0.01
R & M	-0.12	0.13	0.13	0.33	-0.30	-0.01	-0.01	-0.20	-0.27
processing	-0.04	-0.03	0.20	-0.11	0.31	0.42	0.13	-0.18	-0.02
health	-0.17	-0.05	0.08	-0.16	-0.25	-0.12	-0.09	0.34	0.35
replacements	-0.04	0.04	0.38	0.17	0.11	-0.27	-0.17	0.05	-0.04
advice/info	-0.03	0.05	-0.23	0.01	0.22	-0.20	-0.20	-0.36	0.33
fuel	0.08	0.38	-0.05	0.09	-0.08	0.17	0.01	-0.11	0.22
labour	-0.13	-0.17	-0.09	0.11	0.09	0.09	0.56	-0.15	0.19
administration	0.34	0.19	0.08	-0.07	0.01	-0.08	0.14	-0.02	0.16
stock feed	-0.06	-0.06	0.29	-0.05	0.32	0.24	-0.28	0.08	0.10
fencing	0.02	0.20	-0.07	0.18	-0.12	0.34	-0.17	0.37	0.22
insurance	0.20	0.19	0.13	-0.26	-0.05	-0.11	0.16	-0.24	0.14
trees	0.09	0.10	-0.19	-0.03	0.24	0.02	0.28	0.55	-0.21
rates/rent	0.04	-0.11	-0.13	0.14	-0.23	0.29	0.06	-0.16	-0.11
packaging	0.32	-0.27	-0.02	0.11	-0.03	-0.02	-0.11	0.07	0.20
contracting	-0.08	-0.05	0.20	0.14	-0.03	-0.29	0.37	0.16	0.24

#### 4.6.3 Income Status Of Farm

For the majority of the conventional farmers, the farm provided most or all of their total income (Figure 4.24). This was also the case for over half (53.8%) of the organic farmers, but there were also ten properties (19.2%) in this group that provided none or very little in the way of income for their owners. Another six farms (11.5%) provided only a quarter of their farmers total income. A chi-square test value of 6.412 showed no significant difference between the two groups of farmers ( $0.50 > P > 0.10$ ).

Figure 4.24 Proportion of total income derived from farming



## 4.7 Comparison And Evaluation

Organic farmers were asked to assess the change, if any, in yield when they moved from conventional to organic farming techniques. Yields did not change significantly, both in the first year of using organic methods, and present yields compared with those prior to converting (Table 4.33). Income per hectare and labour requirements changed by the shift to organic farming. Both had increased, although the increase in labour requirements had a low probability.

**Table 4.33**  
**Farmer evaluation**

assessment factor	mean	t test value
change in yield, first year *	1.98	0.34 ns
present yields compared with before changing*	2.04	0.51 ns
change in income per hectare since changing*	2.21	2.46 P<0.02
change in labour requirements since changing**	3.25	1.92 P<0.1
satisfaction of organic farmers (1-10)	8.81	
satisfaction of conventional farmers (1-10)	8.06	

\*1=less 2=same 3=more

\*\*1=less 3=same 5=more

Asked to assess their satisfaction with their present farming system, organic farmers on average declared themselves to be "satisfied, with very few problems" (scored as 8 out of 10). Conventional farmers had also responded that they were "satisfied, with very few problems". Although conventional farmers scored slightly lower, this difference was not significant at  $P<0.1$  when  $t=1.31$ . Organic farmers did have a much wider range in responses to this question than the conventional group, ranging from two farmers (3.8%) saying that they were "not at all happy, definitely changing over" (scored as 1), to more than half (55.8%) answering 10 (very satisfied, keen to continue). Among the conventional farmers, the majority answered 8 (66.7%) or 10 (22.2%), one gave himself 9 and the other 1.

There was a high degree of correlation between present yield levels compared with those before changing over and the change in income per hectare since changing (see Table 4.34). Low correlations also existed between present yield compared with before changing and the change in yield in the first year, and the

change in labour. Farmer satisfaction was also poorly correlated with the change in income per hectare.

**Table 4.34**  
**Correlations of assessment data**

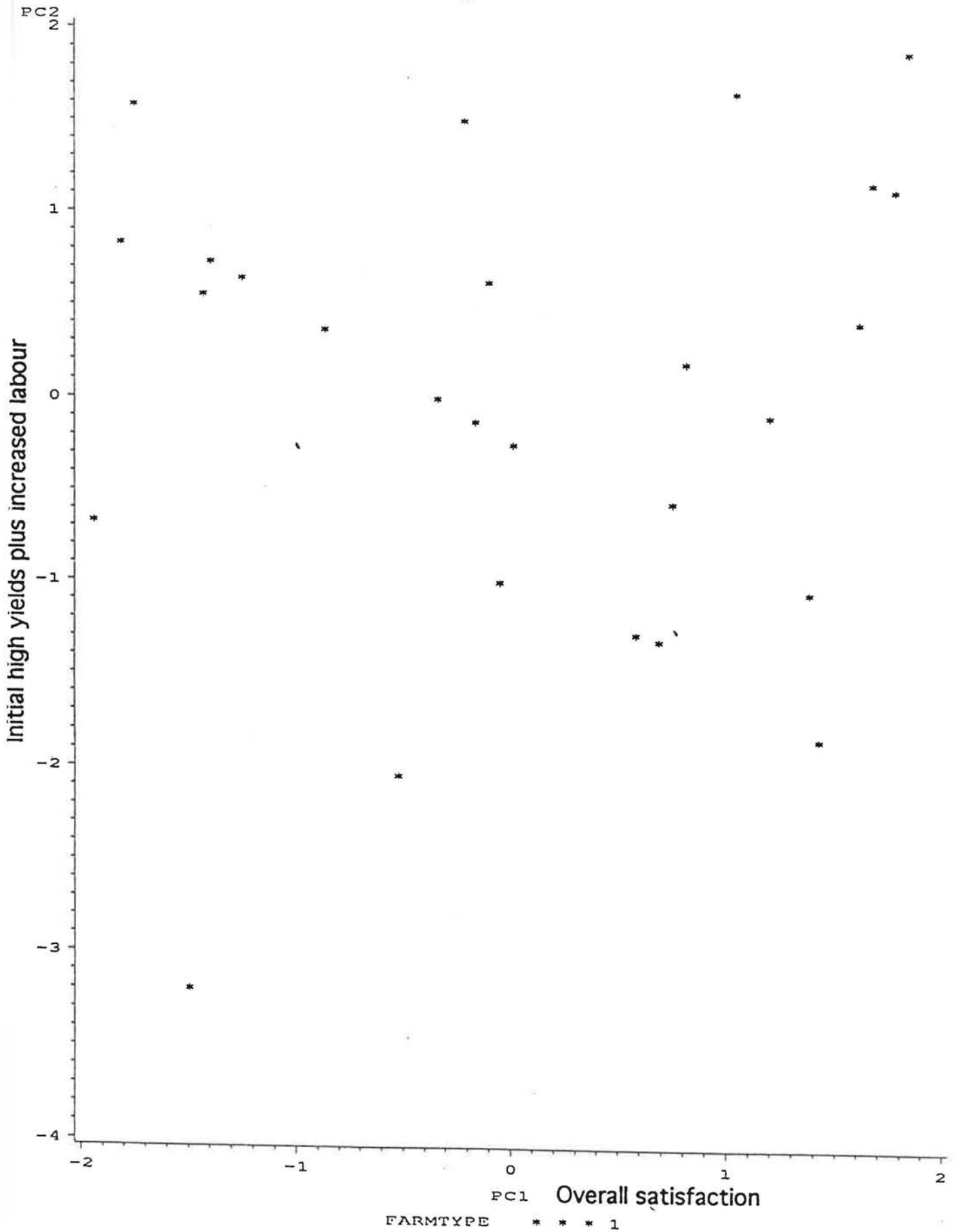
variable	1	2	3	4	5
1-change in yield (1st year)	1.000	0.217	-0.134	-0.032	0.002
2-change in yield (present)		1.000	0.652	0.203	0.058
3-change in income			1.000	-0.159	0.247
4-change in labour requirement				1.000	0.017
5-satisfaction of farmer					1.000

The first factor (Table 4.35) of the principal component analysis was a general factor that especially emphasised the present yield and income levels and the degree of satisfaction, i.e. identifying farms that are doing well or poorly. Factor two selected for farms with high yields in the first year after changing and increased labour requirements, and factor three farms with low first year yields and increased labour requirements. The first two factors gave a fairly high degree of parsimony (59.5%), with the third adding another 19.7%. The plot (Figure 4.25) of factor two against factor one divided the organic farms into those which are doing well and are satisfied with their system (8 properties), farms that have increased yields and labour requirements and low farmer satisfaction (12), properties that are doing well with respect to their yields but have had a large increase in labour requirements (7). and four farmers which have a low level of satisfaction combined with low yields and decreased labour requirements.

**Table 4.35**  
**Results of PC on assessment data**

<b>D<sub>z</sub> accounted for:</b>	<b>1</b>	<b>2</b>	<b>3</b>
proportion	0.3880	0.2074	0.1974
cumulative proportion	0.3880	0.5953	0.7928
<b>standardised scoring coefficients</b>			
change in yield (1st year)	0.09658	0.61570	-0.73349
change in yield (present)	0.44635	0.12674	-0.00691
change in income	0.44721	-0.18824	0.01103
change in labour requirements	0.05774	0.69558	0.68304
satisfaction of farmer	0.32187	-0.22374	0.09181

Figure 4.25 PC 2 versus PC 1 for assessment analysis



## **CHAPTER FIVE - DISCUSSION**

The results will be discussed with respect to the objectives of this survey. These were:

a/ the identification of the characteristics of organic farms and their operators.

b/ to determine the management factors of organic farms

c/ to assess the effects of changing from a conventional farming system to an organic one.

### **5.1 Characteristics of organic farms and their operators**

Of the survey forms returned, conventional, organic and biodynamic farming systems were evenly covered (Figure 4.1). Most of the organic farms had started using organic methods in the early to mid eighties. The respondents who were farming organically were more often doing so for pragmatic rather than spiritual or esoteric reasons (Table 4.1). Pollution, declining soil fertility and economics were popular incentives. Of the esoteric reasons, lifestyle and a disillusionment with modern farm practices were often chosen. The United States Department of Agriculture survey (1983), Lockeretz (1978, 1982), and Blobaum (1983) had also found farmers adopted organic farming methods more for pragmatic reasons, although Blobaum had found that encouragement from friends or relatives was the most commonly quoted reason.

Organic farmers come from a diverse range of occupational backgrounds, with only a third having been farmers all their working lives. In contrast, a large proportion of the conventional farmers had always been farmers. Prior occupations of organic farmers often included some degree of tertiary training (Table 4.4). This may have made them more aware of health or ecological issues, and led them to choose an alternative and more fulfilling lifestyle for themselves by adopting organic farming.

A number of the properties were not certified or only in Transitional Bio-Gro. As the incentives for the adoption of organic farming principles were scientific rather than spiritual, there may be a less pressing desire for the farmer to be certified to gain personal satisfaction. This also showed in the negative correlation between scientific incentives and level of certification (Table 4.2). As

farmers continued using organic techniques over time, there was a tendency for them to become more involved in the certification of their property (Table 4.2). Recent organic farms tended to be set up by farmers who had either strong spiritual or personal beliefs in the system, or those with high levels of pragmatic interests (Table 4.3). The former may be those seeking an alternative lifestyle, whereas the latter could well be farmers that were having problems financially and feel that farming organically will reduce their input costs and so allow them to continue farming.

## **5.2 Management factors of organic farms**

Organic farms come in all sizes, with an average size of 123 hectares. A mode of 30 ha. reflected that there were however a number of small properties present in the survey with 17 properties having around five hectares. Poincelot (1986) had noted that the organic farms in the United States ranged in size up to 567 ha. for a pure organic farm and 2429 ha. for a combined conventional/organic farm.

Most properties had two or more farm enterprises (Figure 4.8). The traditional beef, wool and sheep production systems were most popular on the conventional farms. Organic properties were more diverse with beef, vegetable and fruit production being the most popular choices on these properties. Wool, dairy and sheep production formed the next most popular choices. The diversity on organic farms may be as a result of the aim to get away from monoculture type systems. As well, mixed stocking/planting may be used as a therapeutic effect, such as using goats for weed control, or making use of the reputed repelling properties of some plants against insect pests. Obtaining a premium on organic produce may be easier on vegetables and fruit rather than on traditional produce such as sheep, beef and dairy produce. The latter would require further processing into dairy products or specialised cuts before being suitable to sell on to the consumer. This requires a much larger investment in capital and time if the farmer wants to retain the organic status of the produce.

There was a significant trend for organic cropping systems to make fewer passes with machinery. The grazing systems of organic farms did not use significantly more soil conservation techniques than the conventional properties (Table 4.6). Organic farmers that used sabbatical farming techniques (see glossary) showed up as a distinctive group in Figure 4.9 for the little if any soil tillage

carried out on their properties.

Although organic farming emphasises the importance of soil health and a number of organic farmers felt that declining soil fertility was an incentive for them to farm organically, significantly more conventional farmers carried out soil tests than organic farmers. However, conversely, the organic farmers that did test were more interested in the minor or trace element status of their soil compared with the conventional group who tested only for pH and the major elements phosphate, sulphur and potassium. The majority of organic farmers used fertilisers with only a few using materials that would not be acceptable to the BPC if the farm was certified. There was a definite shift away from chemically produced compounds with compost and fish fertiliser commonly used in this group, and reactive phosphate rock being popular as an acceptable phosphate source. This contrasted strongly with the use of traditional fertilisers by the conventional group, albeit a few conventional farmers used reactive phosphate rock and blood and bone.

The animal health problems as perceived by the organic farmers were quite different to those of the conventional farmers. Although both conventional and organic farmers felt internal parasites and flystrike were the most common problems, on organic properties flystrike was less than half as common than internal parasites. However conventional farmers felt the two were nearly equally troublesome. The internal and external parasites often mentioned by organic farmers may be a result of the unavailability of modern anthelmintics to them. In contrast, conventional farmers noted grass staggers, facial eczema and flystrike as well as internal parasites as causing problems. Whether these, especially the first two, are due to differing management or feeding systems would involve further research. Haystead (1987) noted that stock appeared less healthy under conventional management.

Only flystrike was felt to have improved significantly after changing to organic farming methods (Table 4.9). Organic farmers were more concerned with controlling bloat than the conventional group, whereas the conventional farmers were far more intense in controlling external parasites and mineral deficiencies (Table 4.18). The concentration on external parasites is probably due to the availability of dips and pour-on chemicals to these farmers. Organic farmers also use fertilisers containing a larger range of elements,

which may negate the need for extra trace element supplementation.

As there was a wider range of farm enterprises present on the organic farms surveyed, especially fruit and vegetable production systems, it was to be expected that a wider range of plant pests would be mentioned. In comparison though, the same three insect orders were mentioned as the most troublesome pests but in reverse order. None of the plant health problems changed after the farmer started using organic methods. Conventional farmers were more interested in containing fungal diseases whereas the organic farmers were far more intense in controlling Lepidopterous and Coleopterous problems. This was due again to the types of enterprises present on the organic farms.

Both groups of farmers also felt that the worst weeds were thistles and other Asteraceae, which included ragwort. On organic properties thistles stood out as being nearly double the problem of any other type of weed. This could be a reflection of the illegality of chemical sprays under an organic regime. There was however a significant improvement noted in the thistle populations of farms after switching over to organic farming. This was also reflected in that the organic farmers were more intense in their control methods against thistles. Grass weeds (Poaceae) were felt to have worsened slightly, although the organic farmers again concentrated on controlling these, crop weeds and other Asteraceae far more than conventional farmers.

Over twenty percent of organic farmers admitted using chemicals not allowed under the BPC standard. Of these, two thirds used anthelmintics against internal parasites and a further sixth used chemicals against external parasites. The reason for the latter may be due to the statutory requirements that sheep and cattle have to be dipped every year with an approved chemical. Lack of a suitable and effective alternative may also be the reason.

Labour use on organic farms did not differ significantly from that on conventional farms. This agrees with the findings of Vine and Bateman (1981) but is in contrast to the findings of other workers (Oelhaf 1978,1982, USDA 1980 and Blobaum 1983) who found labour requirements to be higher on organic properties. As the amount of permanent labour was related to the size of the property, and a number of organic farms were less than 30 ha., this would bias the results. Further work would have to be done comparing properties with similar enterprises and sizes to get a more reliable

assessment.

Over a quarter of the organic farms did some processing of their produce on their property (Figure 4.20). This was expected to provide added value to the product and lead to a higher profit margin. None of the conventional farmers were involved in any on-farm processing, selling all their produce to conventional processing plants. Over forty percent of organic produce was also sold to conventional outlets with less than a third being sold via 'known' organic outlets such as health food shops or organic co-operatives. Organic farmers did, on average, identify their produce as organic with some form of labelling, often displaying the Bio-Gro symbol. Haystead (1987) commented that skilful marketing was required for the organic farmer to achieve a premium for what is perceived by many people as a better product. In Europe a 1987 survey (Davis *et al* 1990) had indicated that 77% of customers there were willing to pay a premium for organically produced food. Principal component scores identified these different marketing strategies (Figure 4.22) of the farmers.

All the farmers surveyed obtained their advice and information from fairly technical sources, with many using the services of advisors and/or inspectors. Discussion groups, clubs and a range of literature also provided information for the farmers. Organic farmers did feel that advice and information was not as easy to find via the regular means as compared to within their organisations (Table 4.24). General advisers were felt to have little interest in organic techniques. This could be due to some degree of cynicism within the conventional farming fraternity, where some feel organic farming is just a passing fancy. Conventional farmers also felt that the response from a general adviser was not always very good. The current user-pays system could be the cause of this drop in popularity.

Income items were a reflection of the farm enterprises present on the properties (Table 4.27), and as such, the organic farms had a much wider range. Both groups had meat as their top income earner, but fruit was second in the organic group, whilst animal fibres followed in the conventional group. Overall, income items followed similar rankings in both groups, although the magnitude did vary.

Rankings of cost items by the two groups of farmers were also similar, although the organic group placed labour first and fertilisers topped the conventional farmers' list. Fertilisers were

ranked fourth (Table 4.30) by the organic farmers. This will in part be due to a number making their own compost and preparations. Animal and plant health costs were also lower on these farms and may be due to their either having healthier stock or using home-grown remedies. Interest, rates and rent were also ranked lower on organic farms which may mean that these farms are more likely to be free-hold or co-operative holdings. The strong correlation between freight/cartage and packaging is probably due to fruit and vegetables that are packed and sent to their markets on behalf of the producers.

For fifty percent of the organic farmers their property provided most or all their total income (Figure 4.24). This compares with nearly all the conventional farmers receiving the majority of their income from their farm. Although this difference was not significant here, it was a strong trend. Further investigation is required to define if this is due to a lag phase during development or changing over when production may be low, or if the farms are run as a sideline to another profession. The ten organic properties that were not providing any financial returns at present in this survey were either in a developmental stage or a hobby farm.

### **5.3 Effects of changing over to organic farming**

There was no change in yield in the first year after converting (Table 4.33), nor were present yields different to those prior to changing. Other workers have found that organic farming resulted in lower yields (Oelhaf 1978, Lockeretz 1978,1981,1982, Haystead 1987, Spiertz 1989).

Income per hectare was felt to have improved somewhat. Lockeretz (1978,1982) had found the income had not changed where farmers had changed to organic farming. Other workers had found that organic farmers had lower incomes than their conventional counterparts. The low income during the transition period that was felt to occur by the farmers surveyed by Fisher (1989) was not apparent here.

Labour requirements increased slightly on organic farms after changing to an organic system (Table 4.33). Other surveys (Oelhaf 1978,1982 USDA 1980) had found the labour requirements to increase after changeover. The actual labour use on organic farms did not differ significantly from that on conventional farms (Table 4.19).

In conclusion, the majority of the farmers surveyed felt satisfied with their present farming system, but complained nevertheless about the odd minor problem. It is noteworthy that two of the organic farmers commented that they were not at all happy and definitely changing systems, and one conventional farmer was definitely thinking of changing over to an organic farming system. Farmer satisfaction was not related to yield or labour requirements per hectare and only poorly with the change in income per hectare.

Finally, from this survey, organic farming appears to be successful to some degree in New Zealand, although certain problems have been identified here. As more resources are allocated for research into organic farming, these problems may be addressed and some solutions found.

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## Appendices

# Massey University

PALMERSTON NORTH, NEW ZEALAND

TELEPHONES: 69-079, 69-089, 69-099  
DATEX: NZ 30974, Mas Uni

In reply please quote:

Dear

I have been given your name as a farmer or grower of organic produce. I am a student at Massey University doing a Masterate of Agricultural Science degree. For my thesis I am involved in doing a survey on organic farming in New Zealand. ➔

This survey is aimed at assessing the current status of organic/Biodynamic farming in New Zealand. The survey reflects an increasing interest in the farming and university/student community in the area of low/nil input and organic/Biodynamic farming.

Information on these methods of farming is at present scarce in New Zealand. This survey will aim to improve this situation as well as aim to assess the viability of such farming techniques. The information collected in this survey will also influence course content with the teaching staff at University, so full feedback is desirable. In this way, the farming community has a real and lasting influence on both the range and the direction of topics taught. New ideas in the field will also lead to new ideas in the teaching area.

Your assistance in responding to this survey will go a long way towards fulfilling these aims. I would be very grateful if you could spare a little of your precious time to complete the enclosed questionnaire.

If you are no longer farming organically or biodynamically, could you please still fill in as much of the questionnaire as applies to you. This will be of great use to me.

Please understand that all information supplied will be strictly confidential. I will send out a brief summary of results to those who have returned a survey. Thank you.

Yours sincerely

Rosalie J. Bakker  
**AGRONOMY DEPARTMENT**  
RJB/cg

# Appendix B: Survey form

All names and addresses will remain confidential:

## Personal Background Information.

Please tick chosen answer(s) when given a choice.

1. In which of the following categories would you place your farm?

- 1 : conventional - please go to question 5
- 2 : biodynamic
- 3 : organic
- 4 : other (\_\_\_\_\_)

2a Have you adopted all or part of the methods and principles used in organic/biodynamic farming?

- 100% - all
- 75% -
- 50% - about half
- 25%
- 0% - none (or nearly none)

2b If your answer was less than 100% could you explain briefly why you have not adopted all the methods and principles?

-----  
-----

3a Approximately in what year did you make the first major step towards using your current system?

-----

3b What certification does your farm hold?

- 1 : Demeter (biodynamic standard)
- 2 : Bio-gro (Biological Producers Council standard)
- 3 : transitional Bio-gro
- 4 : none

3c What incentives were there for you to change?

- tick any that apply:

- |   |   |
|---|---|
| <input type="checkbox"/> 1 : economics                            | <input type="checkbox"/> 2 : better quality food      |
| <input type="checkbox"/> 3 : lifestyle                            | <input type="checkbox"/> 4 : declining soil fertility |
| <input type="checkbox"/> 5 : ecology                              | <input type="checkbox"/> 6 : religion                 |
| <input type="checkbox"/> 7 : pollution                            | <input type="checkbox"/> 8 : conservation             |
| <input type="checkbox"/> 9 : disillusion of modern farm practices |   |
| <input type="checkbox"/> 10 : other (_____)                       | <input type="checkbox"/> 11 : other (_____)           |

4. Have you always been a farmer?

- 1 : yes
- 2 : no - What was your previous occupation(s)?

-----

Please tick chosen answer(s) when given a choice

Statistics and Marketing:

5 Have you previously used organic/biodynamic methods more extensively than at present?

- 1 : No  
 2 : Yes - Why have you decreased the use of these methods?

-----  
-----  
-----

6a What is the total area of your property?

\_\_\_\_\_hectares \_\_\_\_\_acres

6b What area is used for organic/biodynamic production?

\_\_\_\_\_hectares \_\_\_\_\_acres

7 What products do you grow/produce on your property?

- please tick any that apply.

- 1 : grains/cereals  
 2 : vegetables  
 3 : fruit  
 4 : dairy  
 5 : beef  
 6 : sheep  
 7 : wool  
 8 : goats  
 9 : deer  
 10 : other (\_\_\_\_\_)  
 11 : other (\_\_\_\_\_)

8 Of what origin is any replacement stock/seed you may buy in?

- 1 : organic  
 2 : biodynamic  
 3 : conventional  
 4 : other (\_\_\_\_\_)  
 5 : unknown

9a Do you process any of your raw products? (e.g. : milk to cheese)

- 1 : no - (please go to question 10)  
 2 : yes

9b What processed products do you produce?

-----  
-----

9c Is the processing done:

- 1 : on your farm  
 2 : as a collective  
 3 : at conventional processing plants  
 4 : other (\_\_\_\_\_)

Please tick chosen answers when given a choice

10a Are you products labelled (identified):

- 1 : biodynamic (Demeter)
- 2 : organic (Bio-gro)
- 3 : other (\_\_\_\_\_)
- 4 : not specifically labelled

10b What markets are most of your products targeted at?

Could you give approximate percentages sent to each market?

- 1 : health food shops \_\_\_\_\_%
- 2 : road side stalls \_\_\_\_\_%
- 3 : Wellington food co-op \_\_\_\_\_%
- 4 : Ceres wholefoods \_\_\_\_\_%
- 5 : conventional outlets \_\_\_\_\_%
- 6 : other (\_\_\_\_\_)

11a Do you receive a price difference for any of your produce compared with conventionally produced goods?

- 1 : no - go to question 12
- 2 : yes
- 3 : do not know - go to question 12

11b Which product(s) receives this price difference?

\_\_\_\_\_

11c Approximately what is this price difference? (\$ or %)

% \_\_\_\_\_

\$ \_\_\_\_\_

12 What demand is there for your organic/biodynamic labelled produce compared with conventional produce?

- 1 : higher
- 2 : lower
- 3 : same
- 4 : do not know

Please tick chosen answers when given a choice

- 13a List the five largest costs on your farm : Choose from following list.  
(e.g.) irrigation/fertiliser/repairs & maintenance/animal or plant)  
health/labour/replacement seed or stock/advice and information/fuel  
(energy)/other (\_\_\_\_\_)

ITEM	COST PER YEAR
------	---------------

-----	-----
1	
2	
3	
4	
5	

- 13b List the five largest income items from the farm?  
e.g.: xxxx lambs at \$XX per head = \$yyy

ITEM	INCOME PER YEAR
------	-----------------

-----	-----
1	
2	
3	
4	
5	

- 14 The following question is to estimate the number of people obtaining most of their income from their farm.

Approx. What proportion of your income does your farm represent?

- 100% - all or nearly all
- 75% -
- 50% - about half
- 25% -
- 0% - none or very little



Please tick chosen answer(s) when given a choice

17a What are your two major problems in:

1: animal health (eg : worm burdens or fly strike)

a: \_\_\_\_\_

b: \_\_\_\_\_

2: plant health (eg: aphids/scale insects)

c: \_\_\_\_\_

d: \_\_\_\_\_

3: weeds (eg: thistles)

e: \_\_\_\_\_

f: \_\_\_\_\_

Conventional farmers go to Part C

17b When you became organic/biodynamic, did these problem(s) get worse or improve?

Score each problem on a scale of:

5 \_\_\_\_\_ 4 \_\_\_\_\_ 3 \_\_\_\_\_ 2 \_\_\_\_\_ 1

improved  
greatly

same

worsened  
badly

PROBLEM (situation)

SCORE FROM SCALE

- 
- a.
  - b.
  - c.
  - d.
  - e.
  - f.

17c What methods do you use to control each of these problems?  
eg : change stock density or class/use tolerant or resistant strains/spray/dip drench/breed for tolerance or resistance/nothing/other (\_\_\_\_\_). You may use more than one method of course.

PROBLEM (situation)

CONTROL METHOD(S)

- 
- a.
  - b.
  - c.
  - d.
  - e.
  - f.

18a Have you ever had to resort to using a chemical not allowed by BPC to control a problem?

- 1 : no go to question 19
- 2 : yes

18b What was the problem?

-----

18c What did you use?

-----

18d Did it help?

- 1 : yes
- 2 : no
- 3 : unsure

19 What is the labour force on your farm? (including yourself and partner?)

Permanent fulltime: \_\_\_\_\_ persons  
Permanent part-time: \_\_\_\_\_ persons  
casual : \_\_\_\_\_ persons -  
which months are they employed \_\_\_\_\_

20a Where do you get your advice and information from?  
- please tick any that apply:

- |  |  |
|--|--|
| <input type="checkbox"/> 1 : general adviser   | <input type="checkbox"/> 2 : biodynamic adviser                    |
| <input type="checkbox"/> 3 : organic adviser   | <input type="checkbox"/> 4 : BPC inspector                         |
| <input type="checkbox"/> 5 : Demeter inspector | <input type="checkbox"/> 6 : magazines (specify_____)              |
| <input type="checkbox"/> 7 : Discussion group  | <input type="checkbox"/> 8 : clubs/organisations<br>(specify_____) |
| <input type="checkbox"/> 9 : organic farmers   | <input type="checkbox"/> 10 : biodynamic farmers                   |
| <input type="checkbox"/> 11 : other farmers    | <input type="checkbox"/> 12 : libraries/books                      |
| <input type="checkbox"/> 13: other (_____)     |  |

20b Is advice readily available?  
- please tick choice.

general:

within BD Association:

- |   |                              |
|---|------------------------------|
| <input type="checkbox"/> 5 : plentiful        | <input type="checkbox"/> 5 : |
| <input type="checkbox"/> 4 :                  | <input type="checkbox"/> 4 : |
| <input type="checkbox"/> 3 : variable         | <input type="checkbox"/> 3 : |
| <input type="checkbox"/> 2 :                  | <input type="checkbox"/> 2   |
| <input type="checkbox"/> 1 : extremely scarce | <input type="checkbox"/> 1   |

20c Is information easy to find?  
- please tick choice.

general:

within BD Association:

- |  |                            |
|--|----------------------------|
| <input type="checkbox"/> 5 : very easy         | <input type="checkbox"/> 5 |
| <input type="checkbox"/> 4 :                   | <input type="checkbox"/> 4 |
| <input type="checkbox"/> 3 : so-so             | <input type="checkbox"/> 3 |
| <input type="checkbox"/> 2 :                   | <input type="checkbox"/> 2 |
| <input type="checkbox"/> 1 : very hard to find | <input type="checkbox"/> 1 |

20d Do you get a sympathetic response from a general adviser?

- 5 : very open and keen
- 4 :
- 3 : lukewarm, some interest
- 2 :
- 1 : not interested

Please tick chosen answer(s) when given a choice

Evaluation:

21 What are your present yields? eg: T/ha, su/ha,  
%lambing/calving, Kg. wool/su or /ha, kg.milk solids/cow  
or/ha.

T/ha (name crops) \_\_\_\_\_  
su/ha \_\_\_\_\_  
%lambing/calving \_\_\_\_\_  
kg.wool/su or /ha \_\_\_\_\_  
kg.milk solids/  
cow or /h a \_\_\_\_\_  
other \_\_\_\_\_

CONVENTIONAL FARMERS PLEASE CONTINUE WITH QUESTION 25

22a During the first year of conversion, to organic/biodynamics,  
did yields:

- a : increase
- b : decrease
- c : stay the same
- d : not known

- If you answered (a) or (b), quantify this by how much +/- per ha?

\_\_\_\_\_  
\_\_\_\_\_

22b Compared with before you changed, are present yields:

- a : more
- b : less
- c : the same
- d : not known

- If you answered (a) or (b), say by how much per ha?

\_\_\_\_\_  
\_\_\_\_\_

22c Compared with before converting, has the income/ha

- a : increased
- b : decreased
- c : stayed the same
- d : not known

- If you answered (a) or (b), would you be willing to say by how much +/-  
\$ per ha?

\_\_\_\_\_  
\_\_\_\_\_

23 How much has the labour changed since conversion?

- 5 : increased greatly
- 4 : moderate increase
- 3 : about the same
- 2-5 : about the same
- 2 : slightly less
- 1 : moderate decrease

Please tick chosen answer(s) when given a choice

24 From personal experience can you describe any evidence on the following:

- changed soil fertility - eg : increased topsoil depth:

-----  
- changes in stock production

-----  
- changes in product quality

-----  
- changes in weed/pest/disease problems

-----  
- other  
-----  
-----

25 How satisfied are you with your present farming system?

5 : very satisfied, keen to continue

4 : satisfied, getting occasional problems

3 : not so sure, not really getting results expected or  
wanted.

2 : not sure, have occasionally thought about changing  
system.

1 : not at all happy, definitely changing over

Please feel free to add any comments you feel are relevant to  
this survey.

-----  
-----  
-----  
-----  
-----  
-----

My sincere thanks for taking the time to answer this survey.

# Appendix C: Coded Survey Form

All names and addresses will remain confidential:

## Personal Background Information.

Please tick chosen answer(s) when given a choice.

1. In which of the following categories would you place your farm?

- 1 : conventional - please go to question 5
- 3 : 2 : biodynamic
- 2 : 3 : organic
- 4 : 4 : other (\_\_\_\_\_)

2a Have you adopted all or part of the methods and principles used in organic/biodynamic farming?

- 10 : 100% - all
- 8 : 75% -
- 6 : 50% - about half
- 4 : 25%
- 2 : 0% - none (or nearly none)

2b If your answer was less than 100% could you explain briefly why you have not adopted all the methods and principles?

-----  
-----

3a Approximately in what year did you make the first major step towards using your current system?

number of years-----

3b What certification does your farm hold?

- 4 - both 1 & 2
- 3 : 1 : Demeter (biodynamic standard)
- 2 : 2 : Bio-gro (Biological Producers Council standard)
- 1 : 3 : transitional Bio-gro
- 0 : 4 : none

3c What incentives were there for you to change?

- tick any that apply:

- |   |  |                |
|---|--|----------------|
| <input checked="" type="checkbox"/> 3 : 1 : economics                 | <input type="checkbox"/> 2 : 2 : better quality food | * - scientific |
| <input type="checkbox"/> 8 : 3 : lifestyle                            | * 8 : 4 : declining soil fertility                   | o - esoteric   |
| * 4 : 5 : ecology   | <input type="checkbox"/> 14 : 6 : religion           |                |
| * 16 : 7 : pollution  | * 2 : 8 : conservation                               |                |
| <input type="checkbox"/> 4 : 9 : disillusion of modern farm practices |  |                |
| <input type="checkbox"/> 10 : 10 : other (_____)                      | <input type="checkbox"/> 11 : 11 : other (_____)     |                |

4. Have you always been a farmer?

- 1 : 1 : yes
- 2 : 2 : no - What was your previous occupation(s)?

-----

Please tick chosen answer(s) when given a choice

Statistics and Marketing:

5 Have you previously used organic/biodynamic methods more extensively than at present?

1 : No

2 : Yes - Why have you decreased the use of these methods?

-----  
-----  
-----

6a What is the total area of your property?

\_\_\_\_\_ hectares \_\_\_\_\_ acres

6b What area is used for organic/biodynamic production?

\_\_\_\_\_ hectares \_\_\_\_\_ acres

7 What products do you grow/produce on your property?  
- please tick any that apply.

1 : grains/cereals

2 : vegetables

3 : fruit

4 : dairy

5 : beef

6 : sheep

7 : wool

8 : goats

9 : deer

10 : other (\_\_\_\_\_)

11 : other (\_\_\_\_\_)

8 Of what origin is any replacement stock/seed you may buy in?

1 : organic

2 : biodynamic

3 : conventional

4 : other (\_\_\_\_\_)

5 : unknown

9a Do you process any of your raw products? (e.g. : milk to cheese)

1 : no - (please go to question 10)

2 : yes

9b What processed products do you produce?

-----  
-----

9c Is the processing done:

1 : on your farm

2 : as a collective

3 : at conventional processing plants

4 : other (\_\_\_\_\_)

Please tick chosen answers when given a choice

10a Are your products labelled (identified):

- 1 : biodynamic (Demeter)
- 2 : organic (Bio-gro)
- 3 : other (\_\_\_\_\_)
- 4 : not specifically labelled

10b What markets are most of your products targeted at?

Could you give approximate percentages sent to each market?

- 1 : health food shops \_\_\_\_\_%
- 2 : road side stalls \_\_\_\_\_%
- 3 : Wellington food co-op \_\_\_\_\_%
- 4 : Ceres wholefoods \_\_\_\_\_%
- 5 : conventional outlets \_\_\_\_\_%
- 6 : other (\_\_\_\_\_)

6 personal supply

11a Do you receive a price difference for any of your produce compared with conventionally produced goods?

- 1 : no - go to question 12
- 2 : yes
- 3 : do not know - go to question 12

11b Which product(s) receives this price difference?

-----

11c Approximately what is this price difference? (\$ or %)

% -----

\$ -----

12 What demand is there for your organic/biodynamic labelled produce compared with conventional produce?

- 1 : higher
- 2 : lower
- 3 : same
- 4 : do not know

Please tick chosen answers when given a choice

- 13a List the five largest costs on your farm : Choose from following list.  
(e.g.) irrigation/fertiliser/repairs & maintenance/animal or plant)  
health/labour/replacement seed or stock/advice and information/fuel  
(energy)/other (\_\_\_\_\_)

ITEM	COST PER YEAR
-----	-----
1	
2	
3	
4	
5	

- 13b List the five largest income items from the farm?  
e.g.: xxxx lambs at \$XX per head = \$yyy

ITEM	INCOME PER YEAR
-----	-----
1	
2	
3	
4	
5	

- 14 The following question is to estimate the number of people obtaining most of their income from their farm.

Approx. What proportion of your income does your farm represent?

- 100% - all or nearly all  
 75% -  
 50% - about half  
 25% -  
 0% - none or very little

Please tick chosen answer(s) when given a choice

agement:

Please tick the farming method(s) you use:

Cropping

Pastoral

- |                                     |                            |                                     |                          |
|-------------------------------------|----------------------------|-------------------------------------|--------------------------|
| <input checked="" type="checkbox"/> | 1 : minimum tillage        | <input checked="" type="checkbox"/> | 2 : set stocking         |
| <input checked="" type="checkbox"/> | 3 : Norfolk rotation       | <input checked="" type="checkbox"/> | 4 : companion planting   |
| <input checked="" type="checkbox"/> | 5 : multicropping          | <input checked="" type="checkbox"/> | 6 : rotational grazing   |
| <input checked="" type="checkbox"/> | 7 : summer/winter crops    | <input checked="" type="checkbox"/> | 8 : Sabbatical farming   |
| <input checked="" type="checkbox"/> | 9 : single crop/fallow     | <input checked="" type="checkbox"/> | 10 : mixed stock grazing |
| <input checked="" type="checkbox"/> | 11 : permanent trees/vines |                                     |                          |
| <input type="checkbox"/>            | 12 : other -----           |                                     |                          |

Do you have soil tests done?

- 1 : no  
 2 : yes - which of the following do you test for:

ELEMENT TESTED

VALUES OBTAINED ON YOUR PROPERTY

-----  
pH (acidity)  
P (Olsen)  
P (other, please say which test)  
K  
S  
Trace elements (specify) -  
-  
-

Do you use fertilisers?

- 1 : no  
 2 : yes - Please fill in the table below:

-----  
TYPE OF FERTILISER      WHERE PURCHASED FROM      APPLICATION RATE (per ha)  
-----

-  
-  
-  
-  
-  
-



18a Have you ever had to resort to using a chemical not allowed by BPC to control a problem?

- 1 : no go to question 19
- 2 : yes

18b What was the problem?

-----

18c What did you use?

-----

18d Did it help?

- 1 : yes
- 2 : no
- 3 : unsure

19 What is the labour force on your farm? (including yourself and partner?)

Permanent fulltime: \_\_\_\_\_ persons  
 Permanent part-time: \_\_\_\_\_ persons  
 casual : \_\_\_\_\_ persons -  
 which months are they employed \_\_\_\_\_

20a Where do you get your advice and information from?

- please tick any that apply:

- |  |   |
|--|---|
| <input type="checkbox"/> 1 : general adviser   | <input type="checkbox"/> 2 : biodynamic adviser                 |
| <input type="checkbox"/> 3 : organic adviser   | <input type="checkbox"/> 4 : BPC inspector                      |
| <input type="checkbox"/> 5 : Demeter inspector | <input type="checkbox"/> 6 : magazines (specify_____)           |
| <input type="checkbox"/> 7 : Discussion group  | <input type="checkbox"/> 8 : clubs/organisations (specify_____) |
| <input type="checkbox"/> 9 : organic farmers   | <input type="checkbox"/> 10 : biodynamic farmers                |
| <input type="checkbox"/> 11 : other farmers    | <input type="checkbox"/> 12 : libraries/books                   |
| <input type="checkbox"/> 13 : other (_____)    |   |

20b Is advice readily available?

- please tick choice.

general:

within BD Association:

- |   |                              |
|---|------------------------------|
| <input type="checkbox"/> 5 : plentiful        | <input type="checkbox"/> 5 : |
| <input type="checkbox"/> 4 :                  | <input type="checkbox"/> 4 : |
| <input type="checkbox"/> 3 : variable         | <input type="checkbox"/> 3 : |
| <input type="checkbox"/> 2 :                  | <input type="checkbox"/> 2 : |
| <input type="checkbox"/> 1 : extremely scarce | <input type="checkbox"/> 1 : |

20c Is information easy to find?

- please tick choice.

general:

within BD Association:

- |  |                            |
|--|----------------------------|
| <input type="checkbox"/> 5 : very easy         | <input type="checkbox"/> 5 |
| <input type="checkbox"/> 4 :                   | <input type="checkbox"/> 4 |
| <input type="checkbox"/> 3 : so-so             | <input type="checkbox"/> 3 |
| <input type="checkbox"/> 2 :                   | <input type="checkbox"/> 2 |
| <input type="checkbox"/> 1 : very hard to find | <input type="checkbox"/> 1 |

20d Do you get a sympathetic response from a general adviser?

- 5 : very open and keen
- 4 :
- 3 : lukewarm, some interest
- 2 :
- 1 : not interested

Please tick chosen answer(s) when given a choice

Evaluation:

21 What are your present yields? eg: T/ha, su/ha,  
%lambing/calving, Kg. wool/su or /ha, kg.milk solids/cow  
or/ha.

T/ha (name crops) \_\_\_\_\_  
su/ha \_\_\_\_\_  
%lambing/calving \_\_\_\_\_  
kg.wool/su or /ha \_\_\_\_\_  
kg.milk solids/  
cow or /h a \_\_\_\_\_  
other \_\_\_\_\_

CONVENTIONAL FARMERS PLEASE CONTINUE WITH QUESTION 25

22a During the first year of conversion, to organic/biodynamics,  
did yields:

a : increase  
 b : decrease  
 c : stay the same  
 d : not known

- If you answered (a) or (b), quantify this by how much +/- per ha?

\_\_\_\_\_  
\_\_\_\_\_

22b Compared with before you changed, are present yields:

a : more  
 b : less  
 c : the same  
 d : not known

- If you answered (a) or (b), say by how much per ha?

\_\_\_\_\_  
\_\_\_\_\_

22c Compared with before converting, has the income/ha

a : increased  
 b : decreased  
 c : stayed the same  
 d : not known

- If you answered (a) or (b), would you be willing to say by how much +/-  
\$ per ha?

\_\_\_\_\_  
\_\_\_\_\_

23 How much has the labour changed since conversion?

5 : increased greatly  
 4 : moderate increase  
 3 : about the same  
 2-5 : about the same  
 2 : slightly less  
 1 : moderate decrease

Please tick chosen answer(s) when given a choice

24 From personal experience can you describe any evidence on the following:  
- changed soil fertility - eg : increased topsoil depth:

-----  
- changes in stock production

-----  
- changes in product quality

-----  
- changes in weed/pest/disease problems

-----  
- other  
-----  
-----

25 How satisfied are you with your present farming system?

5 : very satisfied, keen to continue

4 : satisfied, getting occasional problems

3 : not so sure, not really getting results expected or wanted.

2 : not sure, have occasionally thought about changing system.

1 : not at all happy, definitely changing over

Please feel free to add any comments you feel are relevant to this survey.

-----  
-----  
-----  
-----  
-----  
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My sincere thanks for taking the time to answer this survey.