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**AN EVALUATION OF WHEY, COMPOST AND MINERAL
FERTILIZERS USED IN AN ORGANIC FARMING SYSTEM**

**A thesis presented in partial fulfilment
of the requirements for the degree of
MASTER OF AGRICULTURAL SCIENCE
in Soil Science, Massey University
Palmerston North, New Zealand**

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ABSTRACT

An evaluation of whey, compost and mineral materials as fertilizers for an organic farming system, was undertaken in an ongoing 3 year old field trial at the MAFTech Levin Horticultural Research Centre. Sweetcorn (var. Honey and Pearl) was grown as a summer crop (1989-1990) and responses to the three fertilizer forms were measured using fresh cob, plant dry matter and dried grain yield as production criteria. Plant uptake of N and K was measured along with soil inorganic and total N and mineralizable N.

The whey fertilizer gave the highest sweetcorn cob yield averaging 12 t/ha. All fertilizer forms at low and medium levels increased fresh cob yield above the control in the order of whey > mineral > compost. The increase in yield averaged over all levels was 26% for whey and 21% for compost. The mineral treatment at the high level gave a significant depression (-20%). Whey fertilizer also increased sweetcorn N and K uptake to a higher level than compost and mineral fertilizers. Nitrogen and K weed uptake, which was measured only on the control and high level of fertilizer addition, was considerable (26-46 kg N/ha and 83-143 kg K/ha).

Apparent plant N recovery from whey and compost treatment levels were low, 3-13% for compost and 12-22% for whey. Apparent plant K recovery ranged from 4-15% for whey rates, 10-43% for compost rates and 0-27% for the mineral rates.

Soil inorganic N levels, 20 DAS, relate well to plant N uptake which also showed a good relationship with plant K uptake. The mineralizable N potential of the soil associated with various treatments was measured by 3 methods. The anaerobic incubation appeared to relate well to N uptake by sweetcorn. At all levels, the whey treatment mineralized at a faster rate than either the compost or mineral treatments. It appeared that the N component of whey and compost was mainly responsible where yield increases were measured although, the P and K component of the fertilizers may have

contributed in some situations.

Some suggestions are made regarding the design and conduct of future trials i.e. use of plant nutrient analysis to monitor nutrient status and a treatment eliminating annual fertilizer application from part of the main treatment to allow measurement of the residual effects from previous applications.

Some guidelines for organic growers using whey, compost and mineral fertilizers were suggested. These include the continual/annual monitoring of the soil's nutrient status, the measurement of nutrient losses in produce, the construction of a simple nutrient balance for each crop and the suggestion that the fertilizer forms used could be altered when some soil nutrients are considered to be in excess of requirements.

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INTRODUCTION

The present trend in intensive agricultural and horticultural systems, where high yielding and fertilizer responsive cultivars are used, will eventually exhaust the fertility of the soil unless proper soil and fertilizer management is practiced. Additional inputs of plant nutrients in the form of fertilizers, synthetic/chemical or natural, has over the years proved to be necessary to achieve and maintain high yields. Numerous trials have shown that no less than 30 per cent increase in yields can be attained by the proper use of chemical fertilizers (Flaig, *et al.*, 1977).

Today, the spiralling cost of synthetic fertilizers and pesticides, brought about in part by the disruption in oil supply, is having a marked influence on the profitability in agriculture and horticultural enterprises. Consequently, there is increasing interest in more efficient fertilizer application rates, timing and methods of application along with the use of N fixing legumes in rotations. In addition, people are becoming more conscious of their health and are demanding "organically grown" foods. Organic farmers are turning their attention to the better utilization of rural wastes, farmyard manures and other agricultural wastes as sources of plant nutrients.

Organic farming systems have been practiced in New Zealand by a handful of farmers for some years now. The interest in bio-dynamic farming is also fast increasing. Both organic and bio-dynamic systems aim for a "balanced" and "sustainable" production system.

In many overseas grassland organic farms, where fertilizer N input is low, leguminous herbage together with excreta from housed livestock are the prime source of N. However, under intensive cropping (arable farming) where N is almost always limiting, brought-in organic farm supplements are necessary.

Many claims have been made concerning the advantages of organic fertilizers over inorganic sources. For instance, organic sources are claimed to slowly release nutrients at rates that match the uptake of the crop (Smith & Hadley, 1988). Thus, there are less nutrient losses and the residual pool slowly increases. Organic fertilizers can also help improve soil structure as well as provide a source of trace elements.

There has been little experimental work done to evaluate the relative ability of different fertilizer sources used in organic production to supply plant nutrients. Variability in the composition of organic material often causes inconsistent crop and soil responses to organic materials (MacRae & Mehuys, 1985). Furthermore, the availability and cost of organic materials are important considerations in the choice of these materials.

The general aim of the research reported in this thesis is to evaluate the effects of whey, compost and mineral fertilizers, such as phosphate rock/dolomite and potassium sulphate, on the production of sweetcorn in an organic farming system.

More specifically the aims are to;

1. determine at various stages of growth the nitrogen and potassium uptake of sweet corn.
2. relate plant N and K uptake to the chemical composition of fertilizer and soil properties including soil inorganic N (NO_3^- and NH_4^+), mineralizable nitrogen and K levels.
3. determine the effect of the fertilizer sources on the final yield of sweet corn.
4. provide guidelines on the use of fertilizer materials for organic growers.