

SUSTAINABLE ORGANIC FARMING IN AFRICA

Hennie C Eksteen

Managing Director of Affmech cc and Director of Research

Bonnet Herb Farm, Graskop, Mpumalanga, Republic of South Africa

Introduction

The poor results obtained with organic farming in South Africa together with the lack of credible research and information, were crucial in the decision behind initiating research into organic farming as a discipline. By looking back at the history of African farming and observing nature, we were able to research a workable agriculture method suitable to African conditions. This resulted in a holistic approach, as no single method was effective.

The conventional method of replacing chemical fertilizer with compost was not feasible, as 50 to 100 tons of compost per hectare created problems with high levels of Phosphate and heavy metals in the soil. The yields were poor and the high cost of making compost together with poor disease control forced us to look for a different approach.

Affmech cc has, over a number of years, been involved with waste management with earthworms. These processes produced vermicompost as a by-product. With high vermicompost application a vegetable production unit was started. Initially the results achieved were roughly in line with conventional production but by experimenting with different cultivation practices, practices based on historical agriculture in Africa and by including what was observed in nature, a very cost effective and simple method was developed. The research work and subsequent papers were presented in 2004 at the 2nd International Conference on Earthworms and Organic Farming in Vladimir Russia. Here follows a summary of the research.

Results and discussion

Land preparation and cultivation

The extreme climate variations that are experienced in Africa, with large variations between wet and dry seasons, both in temperature and other climatic conditions, demanded a different approach to that employed elsewhere in the world. The first factor that was researched was the variations in soil temperature. On bare soil in summer the soil temperature reaches between 50° and 70 °C, down to a depth of 10 cm. The rate of evaporation of water reached on windy days climbed to 25mm per day and up to 80% of water after rain was lost by evaporation. This observation led to the practice of heavy mulch and as little disturbance of the soil as possible.

The following results were obtained:

Soil condition	Evaporation	Run-off	Effective
Bare soil	83%	10%	7%
Covered with mulch	10%	10%	80%

The only way this cover could be maintained was by introducing a strict no-till regime. Cultivation was limited to a narrow tine ripper moving very slowly to break up compaction and even that only when necessary. For marking planting lines a spring tine cultivator was used to open a little furrow into which vermicompost was fed by way of preparation. As the soil improved the need for a ripper disappeared. This cultivation change was successful and led to a trial done on a variety of crops where half the plot was ploughed and half not.

The following results were obtained;

Crop	Ploughed with mulch	No-till with mulch
Sweet Potatoes	37t/h	200t/h
French Beans	6t/h	24t/h
Swiss Chard	4t/h	15t/h

(Yields were rounded off to the nearest ton)

The marked differences in yield indicated that the mulch made a substantial difference. Subsequent results in open fields showed the same results.

Fertilizing

The only fertilizer used was Vermicompost at 2m³/h and bone-meal at 50kg/h which as only needed initially, as the soil in South Africa has very low phosphate content. The 2m³/h at planting was found to be sufficient for successful cultivation, and no other fertilizer was needed.

Different application rates were tried and the following results obtained:

Crop	2m ³	5m ³	10m ³
French Beans	17t/h	20.5t/h	22t/h
Cabbage	97t/h	101t/h	104t/h

The small variation in results surprised us and led us to the realization that there were other factors that influenced the result.

Micro-organisms

As vermicompost is rich in micro-organisms, we realised that this could be a major contributing factor. After research and further trails we found that this was indeed the case. The discovery of the importance of micro-organisms explained why the baring of soil and removing soil cover had such a great impact on soil and yields under African conditions. In Europe, with its relatively moderate climate, cooler, moist summers and snow and cold weather in winter, micro-organisms have better survival rates and ploughing

and green manure in organic farming are more successful. What we found was that the practice of bare soils and ploughing are not conducive to successful organic agriculture in Africa. Cover crops are successful in an African context for mulch production. The cover crops, mostly legumes, are grown and cut down to form mulch where in Europe cover crops are routinely ploughed in. The European farming methods used here help to explain why Africa has a problem feeding itself.

The following trial was done to substantiate this:

Crop	Only mulch	EM (effective micro-organisms)	Vermicompost with Mulch
French Beans	5t/h	11t/h	22t/h
Swiss Chard	3t/h	7t/h	17t/h

Using vermicompost in conjunction with a no-till regime and mulch proved to be a very cost effective way of farming. My own farming operations prove that 10 cattle together with plant waste can supply enough vermicompost for 50 hectares of vegetable and herb production.

An added bonus of this farming method is that disease and pests all but disappeared. As soon as we started the practice of no-till, mulch and vermicompost the occurrence of disease and pests disappeared. This resulted in a new field of research. As cutworm damage used to be a major pest we were surprised that it also disappeared. By trial we found that with no-till and all the organic material and especially the decaying rootstock in the soil, which is the natural food supply of most soil borne insects, no damage was done to seedlings.

A trial was completed with Swiss Chard seedlings and the following results obtained:

All plant material removed	Plants pulled and left as mulch	Plants cut and left as mulch
68% seedlings destroyed	21% destroyed	>1% destroyed

This trial was repeated with very similar results. All the seedlings were lost within 48 hours of planting. This was not surprising as the major food source for cutworms, according to entomologists, is decaying plant material. By ploughing or removing all the material, the only food source remaining was the seedlings.

The other question that needed answering was why in 11 years of perfecting this system, no destruction from aphids, red spiders, white flies, thrips, bollworms or any caterpillars ever resulted.

An explanation was found in research by Francis Chaboussou, a researcher from INRA in Les plantes malades des Pesticides – bases nouvelles d'une prevention contre maladies et parasites (Plants made sick by pesticides – new basis for the prevention of diseases and pests)

The basis of his research was that any pest or disease was caused by water-soluble chemical substances in the soil or the spraying of such substances onto the plant. According to his research these substances cause an excessive production of amino acids, which these insects and pests use for food. The mechanism of how this works is not known at present, but it was found to be the only logical explanation for the lack of insects attack on the plants. Nitrate fertilizers, herbicides and insecticides all cause this unbalance. When the pH of plants is monitored, this extra amino acid production can be measured.

Summary

Armed with this information, one can understand why Africa cannot grow enough food to feed itself. This NEPAD conference shows that they are looking at chemical fertilizer as the solution. The reasoning behind this is the success enjoyed by relatively wealthy farmers in Africa (predominantly of European origin), who have enough money to buy fertilizer. It is not feasible to expect a poor African farmer to spend €400 to €500 per hectare to grow a crop if he can live on €1 per day as many do. For the money he has to spend on one hectare - he can live for a year. This is the core message that has to be communicated to Africa as a whole, but with all the funding that chemical giants are prepared to donate to governments for so called 'upliftment' programs, there is very little chance of this happening.