Research and Development in sub-Saharan Africa

Publisher

A publication of SUPPORT AFRICA INTERNATIONAL, Association for the Support of Higher Schools for Applied Sciences, Colleges and Universities, Inc.

Elisenhütte 5
D-56377 Nassau, Germany
Tel. 0049-6772-1480
Fax 0049-6772-8680
e-mail: info@support-africa.de
web: www.support-africa.de

Research and Development in Africa is published annually. Circulation is 1000. It is freely available to members of SAI and to African Schools of Higher Learning.

Award Calls 2009

SUPPORT AFRICA INTERNATIONAL
is offering the

Research Award
for Sustainable Agriculture, Ecology and Biotechnology

Reserach topic: African traditional ways of food preservations

Send applications to:	
Via eMail:	info@support-africa.de
Via ordinary mail:	SUPPORT AFRICA INTERNATIONAL Elisenhütte 5 56733 Nassau/Germany
Date of application:	Dec. 31. 2009
Length of paper:	double space, 20 pages, word document, Times New Roman 12
Language:	English

SUPPORT AFRICA INTERNATIONAL
is offering the

Research Award for Ecology

Reserach topic: Political and public awareness of climate change in sub-Saharan Africa.

Send applications to:	
Via eMail:	info@support-africa.de
Via ordinary mail:	SUPPORT AFRICA INTERNATIONAL Elisenhütte 5 56733 Nassau/Germany
Date of application:	Dec. 31. 2009
Length of paper:	double space, 20 pages, word document, Times New Roman 12
Language:	English

SUPPORT AFRICA INTERNATIONAL
is offering the

Research Award for Inclusive Education

Reserach topic: Inclusive education for woman in sexclusion.

Send applications to:	
Via eMail:	info@support-africa.de
Via ordinary mail:	SUPPORT AFRICA INTERNATIONAL Elisenhütte 5 56733 Nassau/Germany
Date of application:	Dec. 31. 2009
Length of paper:	double space, 20 pages, word document, Times New Roman 12
Language:	English

Eligible are only university staff members of the respective sciences!

RESEARCH AND DEVELOPMENT

IN SUB-SAHARAN AFRICA

2009/1

UT SCIENTIIS ILLUMINENTUR GENTES AFRICAE ®

LOW-INPUT AGRICULTURAL TECHNOLOGIES FOR SUB-SAHARAN AFRICA

F. L. MKANDAWIRE, M.Sc.*
(University of Eastern Africa, Baraton)

Introduction

Sub-Saharan Africa is a region of contrasts. It is endowed with resources at various levels of exploitation. Perhaps one of the most important resources is its people, most of who are struggling to get out of the cycle of poverty by adopting some new low in-put technologies in order to increase food production. The cycle of hunger in sub-Saharan Africa begins and ends with poverty. The inability to grow or purchase food causes malnutrition and poor health, which in turn leads to the inability of individuals to earn income leading to deeper poverty. It is estimated that one in three people in Africa are currently undernourished. To break this cycle, African leaders have recognised that increased economic growth driven by agriculture is essential. It has been said that Africa's challenges are numerous and complex, but there is also much potential and opportunity for growth and development throughout the continent. Investing in people through agriculture is perhaps the single most important factor in economic growth. Because agriculture is the foundation of most African economies, increasing the productivity of agriculture is critical to reducing poverty and increasing food security. The initiative to end hunger focuses on programs to improve the use of modern low input technologies and increase agricultural productivity and income for small-scale farmers who are the majority in sub-Saharan Africa.

Fig. 1

Fig. 2

Contents

SUPPORT AFRICA INTERNATIONAL
Studies in sub-Saharan Africa
Publisher: Peter Lang, Internationaler Verlag der Wissenschaften, Frankfurt a. M.

Vol. I — Uche C. Amalu and Franz-Theo Gottwald (eds.) Studies of Sustainable Agriculture and Animal Science in sub-Saharan Africa. Frankfurt a. M., 2001.

Vol. II — Franz-Theo Gottwald, Susan Kein and Timothy Rotimi Fayey (eds.) Fostering Subsistence Agriculture, Food Supplies and Health in sub-Saharan Africa. Frankfurt a. M., 2002.

Vol. III — George Ouma, Franz-Theo Gottwald and Isabel Boergen (eds.) Agrarian Science for Sustainable Resource Management in sub-Saharan Africa. Frankfurt a. M., 2009.

Vol. IV — F. L. Mkanadawire and Mkpado Mmaduabuchukwu (eds.) Low-input Agriculture Technologies for sub-Saharan Africa (in preparation)

Vol. V — Sunday Paul Bako, Non-animal protein in sub-Saharan Africa (in preparation)

LOW-INPUT AGRICULTURAL TECHNOLOGIES FOR SUB-SAHARAN AFRICA

Productivity is still very low in African agriculture. Productivity in agriculture can be enhanced through research that includes many innovations which are geared towards increasing agricultural productivity in many parts of sub-Saharan Africa. Adaptive research is, therefore, needed to bring these low in-put technologies to African farming systems so as to increase production. Rapid advances in agricultural sciences are giving scientists new tools. Economic growth requires much food. When poor people prosper, they use much of the incremental income on food. Africa's rapid population growth alone increases food needs by 2.5 percent per year, but if incomes grow fast, demand for food could increase by 4 percent per year. Thus there is need to produce more.

Land pressure caused by increased human population and declining natural resources in sub-Saharan Africa has resulted into the need for crop production systems that require small space. There is a general outcry for organically produced foods the world over. Bio-intensive farming low in-put technologies come in hand and are suitable in areas where land is limiting and yet farmers still want to produce crops, especially vegetables. Such systems are environmentally friendly and sustainable. Low-input alternative systems for fresh vegetable production are available in sub-Saharan Africa in the form of different technologies which are not extensively in use. These alternative systems are based on the realization that sustainability is maintained through production practices that reduce soil losses, maintain high soil fertility, lower production cost, conserve non-renewable resources and maintain yield and quality.

This research discusses the implementation of such low in-put technologies. The low in-put technologies presented function very well for the home garden, kitchen garden or homestead garden terms which are commonly used in agro-forestry, where rural farmers especially women have small vegetable gardens very close to the homestead which utilize recycled water from the kitchen. While the low in-put technologies discussed in this paper are aimed at providing fresh vegetables to the rural women in order to improve the nutritional status of their families through the supply of vitamins and minerals, they can also be used for commercial vegetable production. This research also provides the scientific basis of such low in-put technologies by giving results from some experiments conducted at the University of Eastern Africa, Baraton. Such low in-put technologies are environmentally friendly because of limited use of inorganic fertilizers and pesticides, utilize less space as opposed to conventional systems, saves on water, since the soil retains water for a long time and weeding costs are minimized.

Vertical, multi-storage bag or multi-storey garden here referred to as the multi-storey garden is a useful technology for urban dwellers that are surrounded by concrete jungles. They can produce fresh vegetables in a limited area. A multi-store garden contains soil and compost mixture in the ratio of 1:1. The mixture is put in a receptacle or manila bag resting vertically on the ground. Vegetables are planted around the bag. There are several modifications of the technology all of which are explained here. These are the traditional multi-storey garden (Fig 1), multi-storey garden Model A (tin and manila bag type) (Fig 2 and 3), and Model B (Auto-watering manuring system) (Fig 4).

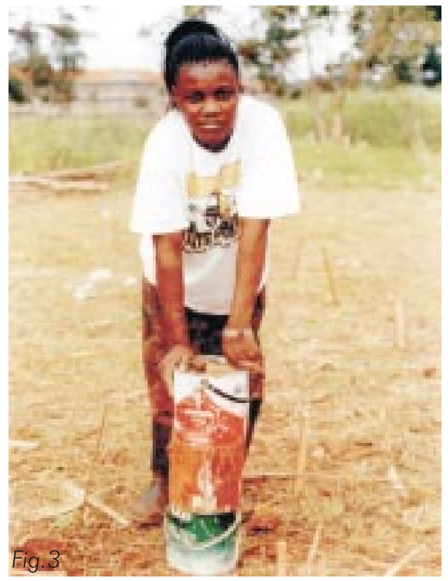


Fig 3

The traditional multi-storey garden uses a sack supported by 4 x 1.5 m vertical sticks pushed into the ground. The soil compost mixture is put in the bag with an inner core of quarry stones for watering. The disadvantage of this is that stones are transported to the field when the multi-storey bags are dismantled. Model A is made like the traditional multi-storey garden but the inner core consists of stones packed in used containers such as used paint tins with holes punched through them to allow water to drain vertically and horizontally within the bag. The technique of putting stones in a container reduces the chances of transferring stones into the garden. Sites can be changed without transferring a single stone into the garden. Model B is the most sophisticated and is fit for busy vegetable producers. A completed model B (Fig 4) made at UEAB produced an equivalent of 35 tonnes/ha of Spinach in a mixture of 35:65 manure to soil ratio and 15 tonnes/ha of sukuma wiki (Kales) at 20:80 manure to soil ratio.

Fig.4

Nine-plants-per-hole technology is also an intensive cropping system in which nine plants are planted in a hole 60 x 60 x 60 cm that has been filled with compost and soil in the ratio of 1:1 (Fig. 5). The technique was developed for marginal areas which have water management problems. Nine-plants-per-hole technology improves water infiltration and retention, breaks the soil hard pan and allows higher plant population per unit area thereby increasing yields.

Another technology is double digging (Fig 6). This is a process whereby the top-and sub-soil is dug to a depth of 60 cm for the production of more crop yield on a given plot. While length may be unlimited, the width must be such as to allow cultivation when one is on either side of the bed. Once dug, the hole is covered with a mixture of 1:1 compost to soil ratio.


Fig.5


Fig.6

Box and pot planting provides a perfect solution to apartment dwellers whose planting space is limited. It is also suited to home dwellers who desire flexibility of changing and rearranging their planting to please their moods. Box planting can also be used to plant rooted cuttings, buds, tubers, corms and rhizomes.

A mandala bed is ideal in situations where a large amount of effluent is provided as is the case in a zero grazing unit or a dairy. Conventional farming technologies follow the usual methods of land preparation but utilize organic fertilizers and pesticides to control pests. Bio intensive methods utilize compost, manure and manure teas as fertilizers. Compost is organic residue of plant or animal origin which is sometimes mixed with soil moistened and allowed to decompose and is used to increase soil fertility (Fig 7). Composting changes organic waste into a dark crumbly material called humus. Manure tea is a liquid fertilizer made by soaking manure in water. Manure tea is usually made from cow dung and chicken manure and is high in nutrients especially nitrogen. Botanical pesticides are those pesticides made from plant material. They include hot pepper, garlic, pyrethrum, neem, stinging nettle, cherries, tobacco, *Chrysanthemum mazimum*, lavender cotton, castor bean and ash. These have the advantage of low persistency on crops or in the soil and yet they have been found to suppress various insect pests such as nematodes.

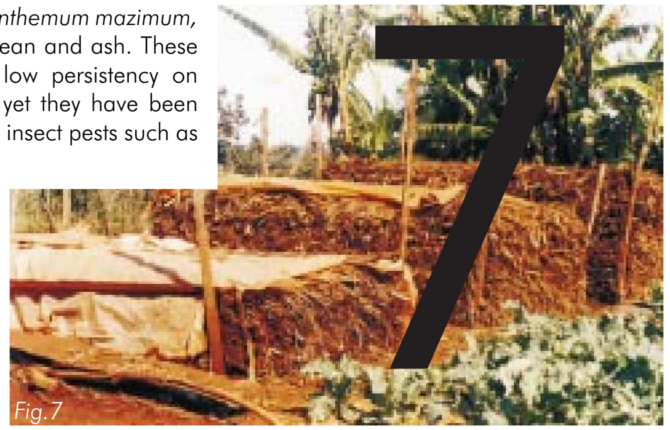


Fig.7

Literature review

Soils poor in nitrogen and organic matter adversely affect quality of vegetables (Nath and Mohen, 1995). Livestock manures are thus an important source of organic manure for sustainable vegetable production. Since cow compost is an excellent source of organic manure for crop production, its use as a fertilizer has become traditional in sustainable soil management (George, 1989). Studies have shown that composting manure from livestock with straw and other degradable plant materials is necessary to obtain organic matter which is stable and uniform. Such material is essential for slow and steady release of nitrogen and other nutrients to the crops. Studies have also shown that manures enhance availability of water, air and nutrients, a characteristic of importance in soils of poor fertility (Lombardo, 2000). The multi-storey garden is an integrated system which enables small scale farmers to realize maximum yields and fully utilize the available aerial space.

Nine-plants-per-hole technology is an intensive cropping practice in which nine heads of plants are planted in a hole 60 x 60 x 60 cm that has been filled with cattle compost. This technology was originally developed by planting nine maize seeds per hole in Kirinyaga District, a semiarid area in Kenya (Kenya: International Institute of Rural Reconstruction, 1998). The system has an advantage over conventional farming in that it increases yield, helps to break the soil hard pan, allows higher plant population in a given area and requires less organic matter in the following season.

The use of double digging technology in areas where soils have been compacted coupled with an effective composting process converts animal wastes, bedding and other raw materials into humus, leading to positive results (Haapla, 1997). It also enables nutrient application in the right ratios at the right time when plants need them most (Anderson and Ingram, 1993). Research has shown that well composted farmyard manure when incorporated into the soil improves soil structure, aeration and water retention capacity (Donahue et al, 1990). In areas where soils have been compacted, double digging technology has proven to be a worthwhile practice in that it enhances root penetration. Furthermore, the technology helps loosen the soil in areas where hard pans have developed due to soil compaction and thus increases soil aeration.

These low in-put technologies can be visualised and compared to a large wheel with a hub and the methods as spokes indicating the inter-dependence of these methods on each other (Fig 8). This study discusses the implementation of three bio-intensive low in-put technologies that can be of use in sub-Saharan Africa in the quest of increasing food production and maintaining high nutritional quality. The three bio-intensive technologies discussed are multi-storey garden, nine-plants-per-hole and double digging. It also provides the scientific basis of such technologies by giving results from some experiments conducted at the University of Eastern Africa, Baraton. The objectives of the study were: 1. To test the response of vegetables (cabbages, cauliflower and spinach) to varying ratios of compost to soil under multi-storey garden, nine-plants-per-hole and double digging. 2. Quantify yield. 3. Establish optimal soil to compost mixing ratios.

Materials methods

General Materials and Methods

The studies were conducted at the Research and Demonstration Farm of the University of Eastern Africa, Baraton (UEAB). UEAB is situated in Nandi district, Kenya, at an altitude of 1981 m a s 1, latitude 0° 20' N, longitude 35° 06' E. The area is classified as lower highland zone three (LH3) with well drained reddish, brown friable clay Mollic Nitosols and has a soil pH of between 4.3-4.5. In all the different technologies, compost manure made from cow dung, maize stalks, dry banana leaves and grass were used. The compost heap was built above the ground on an area 1.5 x 2m. The ground on which compost was made was loosened 30 cm deep. The area was watered and a layer of substrate 50 cm deep was laid upon it with alternate layers of manure and watering. This build up continued up to a height of 2 metres. Soil was added on top as the last layer. A strong stick was placed in the middle and pulled out every week to measure the temperature in the compost heap. The process of decomposition raises the temperature to about 70°C. The material was turned every two weeks until decomposition was complete.

Experiment 1: Multi-storey Garden (Spinach growing at UEAB)

The experiment was laid out in a randomised complete block design (RCBD) with four levels of soil to compost (100:0, 85:15, 70:30, 55:45 and 50:50) and replicated three times. The multi-storey garden was erected from four posts, manila bags, empty paint tins and quarry stones. Four poles were erected at 90 cm apart to form a square. Manila bags were cut longitudinally using a pen knife. Two bags were joined together and wrapped around the four poles. Manila bags were then folded to the base of the poles. A used paint tin with holes on the side and bottom was packed with stones and placed in the centre of the bag. The bag was filled with soil and compost manure up to the level of the first tin. The process was repeated until the bag was full. Each multi-storey garden used five paint tins.

Planting holes were cut on the side of the multi-storage bag at a spacing of 15 x 15 cm. Watering was done through the core of perforated tins three times a day until seedlings were fully established. Weeding was done by pulling the weeds by hand once in a while. Transplanting was done in September 2001 in holes made on the side of the multi-storey garden. Seedlings were planted and firmed and watered. Dead seedlings were replaced 14 days after transplanting (DAT). First harvesting was done at 63 DAT and there after once every week for five weeks. Leaves harvested from each treatment were weighed fresh and samples were oven dried to determine dry matter (DM) content. Data was analysed by using MSTATC computer package. Means were separated by Duncan multiple range test to detect differences between treatment means.

Experiment 2: Nine-plants-per-hole (Cabbages)

The study was conducted between March and July 2002. The experiment was laid out in a randomised complete block design with five treatments (T1=0:100, T2=25:75, T3=50:50, T4=75:25 and T5=100:0) of soil to compost ratio and replicated four times. The size of the hole in each plot was 60 x 60 x 60 cm. Compost manure was incorporated with top soil according to the various treatment combinations. The holes were then filled by the soil/compost mixture. Certified cabbage seeds were sown in the nursery and 9 seedlings transplanted in each hole three weeks later. Botanical pesticides were used to control pests and diseases. Watering and weeding were done as necessary. Data were collected for growth and harvest. Data was analysed by using MSTATC computer package. Duncan multiple range test was used to separate treatment means.

Experiment 3: Double digging technology (Cauliflower)

Land preparation was done by slashing vegetation cover around the area where plots were to be established. Plots measured 2 x 0.90 m. Double digging was achieved by digging and removing 30 cm of top soil and placing it on one side. Then dug 30 cm of sub soil and left it in the trench. Then moved to the next section where the top soil was removed and placed it in the first trench. Then loosened the sub soil and left it in the trench. The process continued until the last trench. The top 30 cm of the trench was mixed with the different rates of compost in the following treatments T1=0:100, T2=25:75, T3=50:50, T4=75:25 and T5=100:0 compost to soil ratio. Cauliflower seedlings were then transplanted on the double dug plot at a spacing of 25 x 30 cm.

Results and discussion

Experiment 1: Multi-storey garden

Seedling survival percentage were significantly ($P<0.05$) affected by the various treatments (Table 1). During the early stages of growth survival percentage was highest for the control, and 15% compost from 7-21 DAT. Seedling survival percentage was, however, reversed from 28-63 DAT. Multi-storey garden with 30, 45 and 50% compost manure recorded the highest survival percentage.

However, lower rates of manure for the control and 15% were detrimental to the survival of plants with time. This might have been due to poor aeration, low nutrient availability and soil caking. The overall survival percentage at 63 days after transplanting was 43.92% for the control and 68.28% for treatment with 15% compost. Survival % was stable for treatments with 30, 45 and 50% compost. In general, survival percentage increased as compost was increased from 0% to 50% throughout the growing period. This is attributed to enhanced soil conditions provided by the presence of organic manure such as available nutrients, water holding capacity and aeration.

Leaf length was also significantly affected ($P<0.05$) by the various treatments through out the period of growth (Table 1). Leaf length increase as the number of days increased from 7 to 63 DAT. The length of leaf was lowest at 7 and 14 DAT for all treatments. These results are agreement with Cooper et al. (1996) who reported immobilisation of nitrogen by micro-organisms during the first week after transplanting. The root system was also not properly developed at this stage. The highest leaf length was recorded for 50% and was lowest for the control. These results also concur with Smalling (1993) who reported of numerous advantages from manure such as progressive release of nutrients which have a positive long term effect on the vegetables.

Fresh leaf weight was also significantly affected (P<0.05) by the various treatments (Table 1). In general fresh leaf weight increased with increase in manure rates. The same trend was observed for total fresh weight and dry matter (Table 1). Throughout the growing season, 50% compost produced the highest leaf weight in kg/ha and the control had the lowest.

Treatment Manure: Soil ratio	Average % plant Survival	Average leaf length (cm)	Fresh yield tons/ha	Total kg/ ha
Control	43.92 c	2.18 d	2.53	253.3 c
15 : 85	68.28 b	4.09 c	12.87	1287.0
30 : 70	94.36 a	7.02 ab	35.00	3500.0 b
45 : 55	91.60 a	8.98 ab	43.60	4360.0 a
50 : 50	95.28 a	10.14 a	58.40	5173.0 a
CV %	12.98	19.89	41.16	40.17
S.E.	11.69	0.67	51.98	692.60

Table 1: Average % survival, leaf length and leaf weight/ha (multi-storey garden)

Experiment 2: Nine-plants-per-hole
Results and Discussion

Survival % was significantly (P≤0.05) affected by the different rates of cattle manure compost. Treatments with 0% (control), 25% and 50% of cattle manure compost ratios resulted into the highest percentage of survival. There was a tendency of decreasing survival rate as the amount of cattle compost was increased from 50 to 100% (Table 2). Throughout the period a combination of 50% manure compost to soil ratio produced the highest number of leaves. The combination of 75% manure compost and 25% soil recorded the lowest number of leaves. There was no definite trend observed on the number of leaves per plant, but as the number of weeks increased the number of leaves per plant also increased in all the treatments.

There were significant (P≤0.05) differences in leaf length between the different rates of cattle compost at 5 and 7 weeks. The highest leaf length per plant was recorded at 25 and 75% of manure to soil ratio. In general, cabbages planted in 25% cattle compost manure and 75% soil produced the longest with the control producing the shortest leaves (Table 2). Time to head formation was not affected by different rates of manure compost to soil. The combination of 1:1 cattle compost manure ratio enhanced head formation. Average head size, average head weight, fresh yield in tones/ha and dry matter percentage increased with increases with cattle manure compost to soil ratios. The highest increase was recorded at 50:50% cattle manure ratios to soil. These results are in agreement with Robin and Andrew (2001) who reported that yield of cabbage, head size, head weight were superior in compost treated plots than from equivalent areas treated with commercial fertilisers. In general, head size, fresh leaf yield in tonnes/ha and dry were highest at 50% compost. Line (2001) also reported of decreasing mean leaf length of lettuce as the ratio of manure to soil was increased beyond 50%. In this study this can be attributed to the fact that compost like any other organic matter releases nutrients slowly (Brady, 1990). These results are also in agreement with www.ext.col.state.edu (2000) where increases in the yield of tomatoes and cabbages were reported as manure rates were increased. The control recorded the lowest.

Treatment Manure: Soil ratio	Average % plant Survival	Average leaf length (cm)	Days to head formations	Head size (cm)	DM %	Yield tons/ha
Control	100.00 a	10.33 b	85	11.95 b	25.77	140.3 d
25 : 75	100.00 a	16.74 a	74	13.95 ab	22.16	221.5 b
50 : 50	100.00 a	13.69 b	71	14.92 a	19.95	275.0 a
75 : 25	97.22 a	9.52 c	78	-12.45	23.59	193.8
100 : 0	88.89 b	10.66 b	74	12.33 b	22.12	154.9
CV %	4.89	23.56	9.50	10.81	22.53	14.26
S.E.	2.38	1.45	3.62	0.71	2.57	14.00

Table 2: Summary of yield and yield components (nine-plants-per-hole)

Experiment 3: Cauliflower (Double digging)

Average plant height and leaf length were significantly (P≤0.05) affected by different rates of manure compost to soil ratios. Plant height increased with increases of soil to manure ratio. Average plant height was highest at 100% manure compost while the control recorded the lowest. The same trend was observed for leaf length. Treatments without manure recorded the lowest leaf length through out the period. There was a steady increase in yield from 75 to 100% manure compost treatments. Optimum yield was obtained at 75% manure rate. Fresh curd weight in tones/ha also increased with increases in manure rates with the control producing the lowest. Dry matter yield was highest at 50 and lowest for the control. These results concur with the findings of Warren (1992) and Nicholas (1989), who reported that the rates of organic manure as high as 7.5 tonnes/ha gave very high yields. This could be attributed to higher nitrogen rates that enhance vegetative growth. There was positive correlation between the yield at harvest and establishment percentage. This implies that the earlier the plants are established, the higher the yield if conditions remain favourable.

Manure: Soli ratio	Average plant height (cm)	Average leaf length (cm)	% Establish-ment	Fresh curd tons/ha	DM yield tons/ha
Control	10.87 d	6.37 c	97.77	0.70	0.71
25 : 75	21.20 c	15.71 b	88.28	12.65	11.47
50 : 50	26.03 a	18.62 b	91.65	15.03	12.00
75 : 25	28.99 ab	21.64 a	91.63	15.53	10.84
100 : 0	30.57 a	22.64 a	79.95	22.53	12.32
CV %	16.32	18.46	8.46	11.83	11.78
S.E.	1.49	1.27	3.60	0.79	0.57

Table 3: Summary of yield and yield components (double digging)

Conclusions and recommendation from summary of results

The following conclusions and recommendations can be drawn from the study:

1. The results of these experiments have revealed that the technologies discussed in this paper are viable and can be used to increase food production in sub-Saharan Africa where nutritional imbalance in terms of minerals and vitamins results into high mortality rates in children. These minerals and vitamins can easily be obtained from vegetables.
2. Spinach, head cabbage and cauliflower yields were enhanced through the application of manure compost in different ratios. The positive effect of cattle compost manure on the yield of these vegetables is a promising technology for intensive vegetable producers in sub-Saharan Africa. The technologies can be of great help to the land less urban dwellers who can gainfully produce these vegetables for home consumption and a surplus for sale.
3. The equivalent yields/ha obtained through these studies surpass those of conventional farming by almost half.
4. Although 30, 45 and 50 percent compost to soil ratio could all be recommended to different levels of farmers in sub-Saharan Africa, 50% would be the best overall.
5. The low in-put technologies presented in this research can help alleviate problems faced by sub-Saharan African women in the quest for fending for food for their families and in turn leave energy for other chores the women face. This is because the vegetables needed for the preparation of almost every meal will be readily available within the vicinity of the home compound.

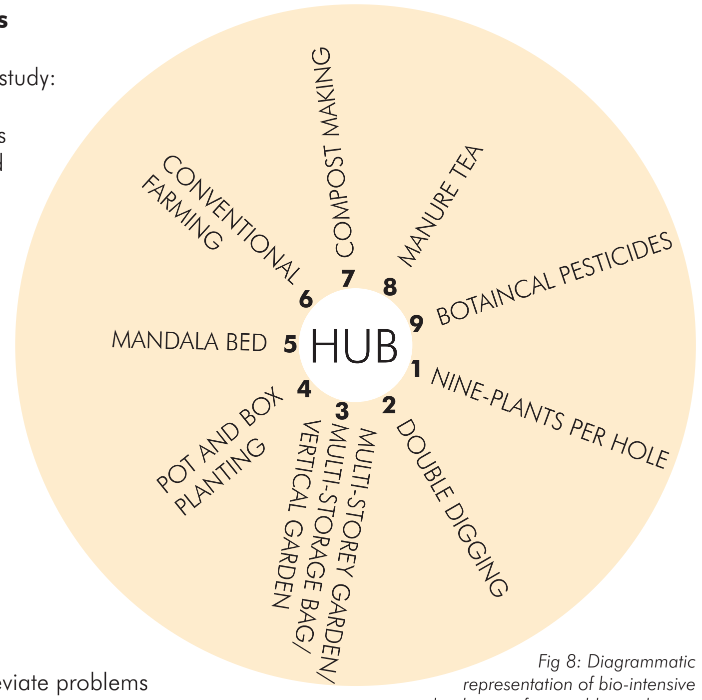


Fig 8: Diagrammatic representation of bio-intensive technologies of vegetable production

References

*Winner of the Research Award of Sustainable Agriculture 2007

Anderson, J. M. and J. S. Ingram (1993). *Tropical Soil Biology and Fertility: A Handbook of Methods.* CAB International, Wallingford England, pp 221.

Cooper, R. J. M., Leaky, R.B. B. and L. Reynolds (1996). Agroforestry and mitigation of land degradation in humid and sub-humid tropics of Africa. *Experimental Agriculture 32:253-290.*

Brady, N. C. (1990). *The Nature and Properties of Soil.* 10th ed. Macmillan Publishing Company, London, pp 481.

Donahue. L., Miller, R. W. and J. C. Shicklunar (1990). *Soils: An Introduction to Soils and Plant Growth.* Prentice Hall of India Private Limited, New Delhi, p 57.

George, R. (1989). *Vegetable Production.* Longman Group, New York, pp 3-4.

Haapla, J. (1997). *Risk Chicken Manure Fertilizer in Good Tilth.* http://abcnews

http://www ext.colostate.edu/pubs/crops/00560.html (2000). *Cattle Marnure Application Rates.*

http: //www.usaid.gov/locations/sub-saharanafrica (2000). What is the impact of agriculture research in Africa.

Line, M A. (2001). *Comparative analysis of organic manure.* Department of Agriculture, University Tasmania, Australia. www.premaorganics.com.research.html.

Lombardo, P. J. (2000). Comparative Manure Management for Improved Nutrient Utilization. http://abcnews.

Nath, M. I. and M. C. Mohan (1995). Canberra Organic Farming. Society index html.

Nicholas, T. (1989). Effect of nitrogen sources and rates on yield and hollow stem development in Broccoli. *Journal of Plant Science* 34:536.

Robin, A. and W. Andrew (2001). Use of compost in agriculture. Scottish Agricultural College. http://www.remade.org. UK/Documents.

Smalling, E. (1993). *An agro forestry framework for integrated nutrient management with special reference to Kenya.* Doctoral Thesis, Agricultural University Wagningen, 50 pp.

Warren, C. (1992). Fertilizer phosphorous; absorption and residual value in tropical Africa. *Soils Bulletin 37.* Natural Resources Institute (NRI). Britain, pp 16-18.

www.aec.msu.edu/agecon/fs2/polsyn/no20.html (2000) Policy synthesis for USAID).

Universities in times of social uprisings and civil wars: the realities in sub-Saharan Africa

Prof. Dr. B. Ed.Pfeiffer

Universities in-between ethnic strives

The development of sub-Saharan African universities is oftentimes interrupted due to social uprisings and civil wars. As if economic and political insecurities were not enough, additional ethnic tensions hinder even more developments and delay the implementation of perspectives. In this respect, one can point to numerous armed conflicts in recent East African history, which are causing great concern.

Against this background the ongoing violence in Darfur also eliminates all educational institutions and as such destroys hope for future developments of universities. Schools of higher learning have no chance to emerge under such conditions. There will come about a tremendous loss of academic generations - the most important promoters in society and culture. The situation in Somalia is likewise precarious, where the country is split into medieval tribal states hindering communication and contacts with the academic world. This makes academic life practically non-existent. The deprivations of access to the rest of the academic world are a tremendous loss to modern university development and state-making.

In comparison to this situation, universities in Kenya, in connection with the parliamentary election in 2007, were in the fortunate position that the political uprisings were short-lived and passed without considerable destructions at their campuses. Though major disturbances were avoided, the academic life was overshadowed substantially by the political and ethnic stigmatization. So many organizations, including SUPPORT AFRICA INTERNATIONAL (SAI) were affected thereof by the hindrance in supplying equipment, which was urgently needed by universities in Kenya and Uganda. Thus development procedures were delayed for several months.

Likewise the civil war in the eastern part of the Democratic Republic of the Congo is presently delaying the shipment of medical equipment for a university clinic near Goma. Negotiations with that university had been going on for several years and now the negotiations have come to a sudden standstill. By the time normality returns, decisive years for development would have been wasted. Probably all plans to build up medical services and health sciences may even be scuttled altogether.

As long as the economic problems of Eastern Africa are not overcome and political stability is not guaranteed, disturbances described above will occur over and over again. Such disturbances are liable for the tremendous setbacks in the development of academic life in particular and as such to the countries at large.

The causes of ethnic strife

Whenever political and economic instabilities appear, Africans seek their hopes and securities under the umbrella of ethnic affinity. As a pattern it happened during the conflicts in Burundi, Rwanda, Darfur, Ethiopia, Kenya, Somalia and Uganda and cannot only be observed in Eastern Africa, since it also appears across the entire continent. The tribe becomes the last resort of refuge while a neighboring tribe is stigmatized as scapegoat. There is great danger that universities composed of a multi-tribal community are drawn into ethnic strife. Looking closely at the roots of the problems, the real cause can be detected in overpopulation.

The underlying theory of this discussion propagated here is concerned with the causes and consequences coming forth from overpopulation. It is the source for economic, social, political and environmental problems leading to poverty and hunger and all other problems derived thereof. Africans are confronted by it daily. Many people find no jobs, lack secure income and sufficient food and water. When problems culminate to the peak, violence and war cannot be avoided. By the time normality has returned, years have gone by during which academic life and development were impaired decisively.

As long as the problem of overpopulation is not coped with, political and economic stability cannot be established and guaranteed and disturbances will continue to occur periodically. And as long as academic life is hindered or discouraged, these problems cannot be sufficiently discussed and consequently not politically solved. Within the realms of possibilities, universities are best suited for the provision of a common platform for interdisciplinary discussions. Herein the universities must accept their responsibility of accepting this leading role.

The university in times of social uprisings and civil wars

It is well understood that universities transmit and promote research and science and generate intellectual manpower contributing to the development of a peaceful society, nation and mankind. Social upheaval preparedness and civil war risk reduction must be understood by all universities. Wars do not erupt suddenly. They rather have undercurrents long before they come to the surface. Universities could make a great contribution to society by concentrating on conflict predicting and thus assist in avoiding their eruption. To achieve this aim is a challenge to all scholars, a task already called for in the universities' mission statements about the duty of servicing mankind, science and the well being of humanity.

But in times of crisis faculty members have to take care of their own safety and therefore cannot come to the aid to their university. Normally they are not trained for handling outbreaks of violence but rather plan step by step as the crisis develops. There are no common standardized guidelines, no special training is provided. Social unrests or civil wars release unpredicted chain reactions which cannot easily be predicted nor understood. Therefore, it cannot be expected that faculty members can look through the confusions and, least of all, defend a university campus.

As the situation on the campus is escalating by inserted pressures, lectures and academic programs have to be closed down. In the sequence of the tensions, academic programs may have to be adjusted thus to enable remaining students for finishing their studies, because by leaving the country they might have no chance of return. At the worst, research projects may have to be abandoned forever.

Under such conditions discussions are constantly going on within the university administration, the faculties and the student body: To close or not to close the university is the question of greatest concern. Knowing by experience, discussions will constantly be going on; one emergency meeting follows the other. Decisions of one day are no longer binding on the following. Situations change more rapidly than decision making is possible.

In this situation the university administration may have to be reorganized, when some administrators have left their post. The authority still remains with the Vice-Chancellor and a few unelected and un-appointed brave that stepped in and filled the gap, thus a new non-elected and non-authorized authority made up of courageous individuals developed for the interim. Vice-Chancellors have now to rely on faculty members, administrative staff and students who had never before been part of the university decision-making body.

Finally, the defending of the campus in the absence of a police security remains the major task. In such situations universities are very often left on their own. Non-combatant strategies radiating neutrality, such as lightening the campus at night and providing aid and shelter to the neighboring communities, have to be developed. By all means, the fighting parties have to be prevented from entering the campus in order to avoid destruction and the loss of lives.

The university's role in civil war prevention

In order to prevent the scenario described above, all scholars are invited to participate through risk reduction, monitoring and planning. Through their research, discussions, dialogue and community outreach, the respective scholars could always be one step ahead in understanding such developments. Conflict research should detect seismic and all social volcanic activities that are ready to erupt. Though parliaments have the duty of decision making and steering developments, the university has the prerogative of pointing to possible developments. It would also be helpful for this purpose if scholars and politicians provide a peace-seeking platform for dialoging and voicing common concern. In this respect universities should always be a step ahead in taking initiatives. All scholars can contribute towards this discussion!

The boot is full

Now, back to the main topic? If it is true that the world population is increasing annually by 80 - 90 million people, then it is equally true that the population in sub-Saharan Africa will rise likewise or grow even faster than the world population. And it is likewise an established fact that the available agricultural lands, water resources, food and energy cannot be increased in proportion to serve all men equally. And in phase of the predicted environmental scenario of climate change, the problems of upholding an ecological equilibrium and balance of nature, protecting biodiversity, which includes man and nature, and considering the different interests of biodiversity and economy, the future problems of Africa are challenging.

And looking at these problems also from the perspectives of human rights, the right of the family, of health and food, of economy and work, Africa is facing challenges ahead which must be solved if ethnic strife for food, water resources and rights has to be prevented.

In this connotation, certainly all scholars have to concern themselves with the problems of human overpopulation. It is not possible that some scholars preach "…multiply and fill the earth" while others specialize in healing the damages of its consequences. More important is an interdisciplinary dialogue that considers the causes and effects of overpopulation and finds answers and solutions. Blessed is the country that has universities that can understand and handle the causes of such problems and avoid ethnic strife and civil wars. This will not only avoid tensions within the country but allows also universities to prosper and fulfill their calling.

**Lecture held at the University of Eastern Africa Baraton and Moi University, Oct. 10 and 17, 2008.*

Award winners 2008

Research Award for Sustainable Agriculture

Dr. Sunday Paul Bako, Ahmadu Bello University, Nigeria

Research Award for Ecology

Dr. Achilee E. Assogbadjo, University of Abomey-Calavi, Benin

Dr. Emmanuel U. Onweremadu, Federal University of Technology, Owerri, Nigeria

Cyprian Osine a.o., Makerere University, Uganda

Research Award for Inclusive Education

Dr. C. Amadi-Eric, River State University of Science and Technology, Nigeria

Pr Niyongabo Jacques, University of Burundi, Burundi

Dr. S. W. Wodi and A. Dokubo, River State University of Science and Technology, Nigeria

New clinic for Valley View University, Ghana


Valley View University, Administration Building

Valley View University and SUPPORT AFRICA INTERNATIONAL have agreed on Nov. 19, 2008 to establish a new medical clinic that will serve its constituency and the surrounding Tema region. This project had been in discussion since 2002 and is now to be finished by the end of 2009. The university is putting up a new building and SUPPORT AFRICA is to furnish it with hospital and medical equipment. So far there exists a small clinic which is not large enough to provide medical facilities to the Tema community of 15.000 people. The 30 bed clinic will have sections for surgery, gynaecology, dentistry, general medicine and a laboratory. It is understood that this will serve to begin with the basic medical needs until a later expansion becomes necessary.

The new clinic will also give amble training opportunities to the nurses of the new Nursing School which had been established in 2007, a School of Public Health is also planned. With this action one more African university has taken a step forward in closing the medical gab in sub-Saharan Africa.

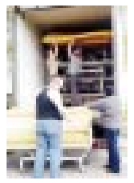
New Medical Health Centers

Young African universities are more and more interested in establishing health centers on their campuses. This enables them to serve medically their campus constituency but likewise their neighboring communities. Generally, the percentage of service is 5-10% for the university and 90% for the neighbouring communities. Besides offering basic medical services to begin with, it offers the universities also the chance of establishing or up-grading their health sciences by and by. The inauguration of a Nursing School is to begin with the natural consequence of this process followed by Public Health later on. And there is even an option for establishing the medical sciences in the future.

After the universities financed and erected the clinic building themselves, SUPPORT AFRICA is supplying the medical equipment that serves mainly the basic needs for general, surgical and dental medicine, gynaecology, diagnostics and laboratory equipment. It includes also up to 30 beds and the equipment that is needed to run a minor health center.
The **Maseno Community Health Center**, Kenya, had been in planning by Maseno University for a number of years until it came to completion in 2008.

SUPPORT AFRICA had sent two containers with equipment that arrived during the time of national crisis which made the delivery somewhat difficult.

SUPPORT AFRICA had been observing the planning and preparations by Bugema University of the **Bugema Community Health Center**, Uganda, since 2004. Finally construction was begun in 2008 with ist completion expected in 2009. SUPPORT AFRICA is planning to equip the center in early 2010.



SUPPORT AFRICA FOUNDATION
Established


Dolores Schneider-Pauly (Vicepresident ADD)
Dorothée Grebe Prof. Dr. B. Pfeiffer

The president and vice-president of SUPPORT AFRICA INTERNATIONAL, Prof. Dr. B. Pfeiffer and Dorothée Grebe, established the new SUPPORT AFRICA FOUNDATION on Nov. 11, 2008. A handsome donation was given by the vice-president providing the necessary capital to set up the foundation. This independent foundation will enable also other donors to come in with additional adjunct foundations that will serve various academic activities and needs at sub-Saharan African universities.

Thanks to the generous donation of the Karl Sondermann, a new center was added to the young foundation right after it had been established. Thus the foundation exists now of extensive ware houses and an office building, the latter being used as the headquarters of SUPPORT AFRICA INTERNATIONAL which is located in the city of Nassau, Germany.

It was the explicit wish of the Sondermann family that the center is to be used for the activities of SUPPORT AFRICA INTERNATIONAL in fostering the development of universities in sub-Saharan Africa. It appreciates that through these activities medical and other sciences can be developed.

The areal had served the Sondermann family in their industrial endeavors in producing household goods under the internationally known name *Kaiser Backformen* since 1850. After this industry was relocated to another city, the areal was made available to the SUPPORT AFRICA FOUNDATION.

New, used and reconditioned laboratory equipment and machinery for agricultural, medical and natural sciences.

Enquire: info@support-africa.de

Honorary degree awarded

Moi University (Kenya) honored Prof. Dr. B. Pfeiffer, president of SUPPORT AFRICA INTERNATIONAL, with the honorary Doctor of Literature h. c. during its 23d graduation service. As Prof. Dr. A. Nangulu, Dean of the School of Arts and Social Sciences, stated in her citation, Prof. Pfeiffer was awarded this doctorate "…. in recognition of his strategic positioning in Germany and in SUPPORT AFRICA INTERNATIONAL, which enabled him to contribute immensely to Moi University, the people of Kenya, and the humanity through networking, fundraising, research, publication and educational empowerment, … Moi University has the privilege and honor to confer Prof. Dr. B. Ed. Pfeiffer the Doctor of Literature (D. Litt), Honoris Causa."