Literature cited

Adams, F. 1965. Manganese. In: Black, C.A. (ed). *Methods of Soil Analysis: Chemical Procedures.* American Society of Agronomy, Madison, USA. pp 1011-1018.

Adesina, A.A. 1996. Factors affecting the adoption of fertilizers by rice farmers in Côte d' Ivoire. *Nutrient Cycling in Agroecosystems* 46:29-39.

Adesina, A.A. and Chianu, J.N. 2002. Determinants of farmers' adoption and adaptation of alley farming technology in Nigeria. *Agroforestry Systems* 55:99-112.

Adjei-Nsiah, S., Kuyper, T.W., Leeuwis, C., Abekoe, M.K. and Giller, K.E. 2006. Cassava improves soil fertility management practices in the forest/savanna transitional agroecological zone of Ghana. *Field Crops Research* 103:87-97.

Africa Fertilizer Summit. 2006. *Africa Fertilizer Summit Proceedings.* IFDC, Muscle Shoals. pp 182.

Africa Rice Center (WARDA). 2005. *Toward New Horizons: Africa Rice Center (WARDA) Annual Report 2003-2004*. WARDA, Cotonou, Benin.

African Agricultural Technology Foundation (AATF). 2006. *Empowering African Farmers to Eradicate Striga from Maize Croplands.* AATF, Nairobi. pp 17.

Alexandratos, N. 1997. Agricultural development in the economy wide context: Approaches to policies and strategies. In: *World Agriculture towards 2010*, Food and Agriculture Organization of the United Nations study. John Wiley and Sons, Chichester, UK. pp 257-293.

Amoding, A., Muzira, R., Bekunda, M.A. and Woomer, P.L. 1999. Bioproductivity and decomposition of water hyacinth in Uganda. *African Crop Science Journal* 7:433-440.

Anderson, J.M. and Ingram, J.S.I. 1989. *Tropical Soil Biology and Fertility: A Handbook of Methods.* CAB International, Wallingford, UK.

Annan, K.A. 2008. *Forging a Uniquely African Green Revolution.* Address by Mr. Kofi A. Annan, Chairman of African Green Revolution Association (AGRA), Salzburg Global Seminars, Austria.

Annor-Frempong, C. 1994. A survey of cassava cultivation practices in Ghana. *Acta Horticulturae* 380:216-221.

Appelhof, M., Webster, K. and Buckerfield, J. 1996. Vermicomposting in Australia and New Zealand. *Biocycle* 3:63-66.

Araki, S. 1993. Effect on soil organic matter and soil fertility of the Chitemene slash-and-burn practice used in Northern Zambia. In: Mulongoy, K. and Merckx, R. (eds). *Soil Organic Matter Dynamics and Sustainability of Tropical Agriculture.* Wiley-Sayce, Chichester, UK. pp 367-375.

Ashby, J., Harti, M., Lambrou, Y., Larson, G., Lubbock, A., Pehu, E. and Ragasa, C. 2008. *Investing in Women as Drivers of Agricultural Growth.* World Bank, Washington DC.

Ashby, J.A., Braun, A.R., Garcia, T.M.P., Guerrero, L., Hernandez, A.C., Quiro, A. and Roa, J.I. 2000. *Investing in Farmers as Researchers: Experiences with Local Agricultural Research Committees in Latin America.* CIAT, Cali, Colombia.

Ashokan, P.K., Nair, R.V., Geethakumari, V.L. and Lalithabai, E.K. 1988. Response of local and hybrid varieties of cassava to nitrogen and potassium fertilizers. *Journal of Root Crops* 14:17- 22.

Avery, T.D. 2002. *Is Global Warming Causing Africa's Famines?* Center for Global Food Issues, USA. http://www.unisdafrica.org/droughtnet/countrykenyacca.htm.

Babana, A.H. and Antoun, H. 2006. Effect of Tilemsi phosphate rock-solubilizing microorganisms on phosphorous uptake and yield of field grown wheat *Triticum aestivum L.* in Mali. *Plant and Soil* 287:51-58.

Bado, B.V., Sedogo, M.P., Cescas, M.P., Lomnpo, F. and Bationo, A. 1997. Effet a' long terme des fumures sur le sol et les rendements du mais au Burkina Faso. *Cahiers Agricultures* 6:571-575.

Bagyaraj, D.J. and Varma, A. 1995. Interaction between arbuscular mycorrhizal fungi and plants: Their importance in sustainable agriculture and in arid and semi-arid tropics. *Advances in Microbial Ecology* 14:119-142.

Bahl, G.S. and Pasricha, N.S. 1998. Efficiency of P utilization by pigeonpea and wheat grown in a rotation. *Nutrient Cycling in Agroecosystems* 51:225-229.

Baijukya, F.P., de Ridder, N. and Giller, K.E. 2005. Managing legume cover crops and their residues to enhance productivity of degraded soils in the humid tropics: A case study in Bukoba district, Tanzania. *Nutrient Cycling in Agroforestry* 73:75-87.

Bananuka, J.A. and Rubaihayo, P.R. 1994. Banana management practices and performance in Uganda. *African Crop Science Conference Proceedings* 1:177-182.

Barrios, E., Kwesiga, F., Buresh, R.J. and Sprent, J.I. 1997. Light fraction soil organic matter and available nitrogen following trees and maize. *Soil Science Society of America Journal* 61:826-831

Bationo, A. 2008. *Integrated Soil Fertility Management Options for Agricultural Intensification in the Sudano-Sahelian Zone of West Africa*. Academy of Science Publishers, Nairobi, Kenya. pp 204.

Bationo, A. and Buerkert, A. 2001. Soil organic carbon management for sustainable land use in sudano-sahelian West-Africa. *Nutrient Cycling in Agroecosystems* 61:131-142.

Bationo, A. and Mokwunye, A.U. 1987. *Soil Fertility Management of the Millet Producing Sandy Soils of Sahelian West Africa: The Niger Experience*. Paper presented at the workshop on soil and crop management systems for rainfed agriculture in the sudano-sahelian zone. International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Niamey, Niger.

Bationo, A., Ayuk, E., Ballo, D. and Kon'e, M. 1997. Agronomic and economic evaluation of Tilemsi phosphate rock in different agroecological zones of Mali. *Nutrient Cycling in Agroecosystems* 48:179-189.

Bationo, A., Kimetu, J., Ikerra, S., Kimani, S., Mugenda, D., Odendo, M., Silver, M., Swift, M.J. and Sanginga, N. 2004. The African Network for Soil Biology and Fertility (AFNet): New challenges and opportunities. In: Bationo, A. (ed). *Managing Nutrient Cycles to Sustain Soil Fertility in sub-Saharan Africa*. Academy Science Publishers, Nairobi, Kenya. pp 1-23.

Bationo, A., Mughogho, S.K. and Mokwunye, A.U. 1990. Agronomic evaluation of phosphate fertilizer in tropical Africa. In: Mokwunye, A.U. (ed). *Management of Nitrogen and Phosphorous Fertilizers of sub-Saharan Africa*. Martinus, Nijhoff, Dordrecht, Netherlands. pp 283-318.

Bationo, A., Waswa, B., Kihara, J. and Kimetu, J. (eds). 2006. Advances in integrated soil fertility management in sub-Saharan Africa: Challenges and opportunities. *Nutrient Cycling in Agroecosystems* Volume 76/2-3.

Baylies, C. 2002. The impact of AIDS on rural households in Africa: A shock like any other? *Development and Change* 33:611-632.

Becker, M. and Johnson, D.E. 1998. Legumes as dry season fallow in upland rice-based systems of West Africa. *Soil Biology and Fertility* 27:358-367.

Bekunda, M.A. and Woomer, P.L. 1996. Organic resource management in banana based cropping systems of the lake Victoria basin, Uganda. *Agriculture, Ecosystems and Environment* 59:171-180.

Benites, J.R. 2008. Effect of no-till on conservation of soil and soil fertility. In: Goddard, T., Zoebisch, M.A., Gan, Y.T., Ellis, W., Watson, A. and Sombatpanit, S. (eds). *No-Till Farming Systems*. World Association of Soil and Water Conservation, Bangkok. pp 59-72.

Bhan, S. and Bharti, V.K. 2008. Conservation tillage in Indian agriculture. In: Goddard, T., Zoebisch, M.A., Gan, Y.T., Ellis, W., Watson, A. and Sombatpanit, S. (eds). *No-Till Farming Systems*. World Association of Soil and Water Conservation, Bangkok. pp 197-206.

Bignell, D.E., Constantino, R., Csuzdi, C., Karyonto, A., Konaré, S., Louzada, J., Susilo, F.X., Tondoh, J.E. and Zanetti, R. 2008. Macrofauna. In: Moreia, F.M.S., Huising, E.J. and Bignell, D.E. (eds). *A Handbook of Tropical Soil Biology: Sampling and Characterization of Below-Ground Biodiversity*. Earthscan, London. pp 43-76.

Bingen, J., Serrano, A. and Howard, J. 2003. Linking farmers to markets: Different approaches to human capital development. *Food Policy* 28:405-419.

Blackie, M. and Albright, K. 2005. A lesson learning study of the farm inputs promotions project in Kenya with a special emphasis on public-private partnerships for input provision and possibilities for regional upscaling. Farm Inputs Promotions Project, Nairobi, Kenya.

Blackie, M. and Mann, C.K. 2005. The origin and concept of the starter pack. In: Levy, S. (ed). *Starter Packs: A Strategy to Fight Hunger in Developing Countries. Lessons from the Malawi Experience 1998- 2003*. CAB International, Wallingford, UK.

Blank, D. 2008. A fresh look at life below the surface. In: Goddard, T., Zoebisch. M., Gan, Y., Ellis, W., Watson, A. and Sombatpanit, S. (eds). *No–Till Farming Systems*. World Association of Soil and Water Conservation, Bangkok. pp 73-81.

Bohlool, B.B., Kosslak, R.M. and Woolfenden, R. 1984. The ecology of rhizobium in the rhizosphere: Survival, growth and competition. In: Veeger, C. and Netwon, W.E. (eds). *Advances in Nitrogen Fixation Research*. Martinus, Nijhoff, The Hague, Netherlands.

Boonman, J.G. 1993. *East Africa's Grasses and Fodders: Their Ecology and Husbandry*. Kluwer Academic Publishers, Netherlands. pp 343.

Borlaugh, N.E. 2003. *Feeding a World of 10 Billion People*. The TVA/ International Centre for Soil Fertility and Agricultural Development Legacy. Muscle Shoals, Alabama.

Bouis, H.E., Graham, R.D. and Welch, R.M. 1999. *The Consultative Group on International Agricultural Research Micronutrient Project: Justification, History, Objectives and Summary of Findings*. Paper presented at a Workshop on Improving Human Nutrition through Agriculture: The Role of International Agricultural Research. IRRI, Philippines.

Bouwman, A.F. 1990. *Soils and the Greenhouse Effect*. John Wiley and Sons, Chichester, England. pp 575.

Bouwman, A.F. 1997. Long-term scenarios of livestock, crop and land use interactions in developing countries. *Land and Water Bulletin No. 6*. Food and Agriculture Organization of the United Nations, Rome.

Brady, N. 1990. *The Nature of Soils*. Tenth edition. Macmillan Publishers, New York.

Brady, N. 1996. Alternatives to slash-and-burn: A global imperative. *Agriculture, Ecosystems and Environment* 58:3-11.

Braun, A.R.G., Thiele, G. and Fernandez, M. 2000. Farmer field schools and local agricultural research committees: Complementary platforms for integrated decision-making in sustainable agriculture. *Agricultural Research and Extension Network Paper No 105*. Department for International Development, UK.

Bray, R.H. and Kurtz, L.T. 1945. Determination of total organic and available forms of phosphorous in soils. *Soil Science* 59:39-45.

Breman, H., Fofana, B. and Mando, A. 2005. *The Lesson of Drente's 'Essen': Soil Nutrient Depletion in sub-Saharan Africa and Management Strategies for Soil Replenishment*. Paper presented at the International Human Dimensions Programme Open Meeting, Session on Impact of Land Use Change on Soil Resources. Bonn, Germany.

Bremmer, J.M. and Keeney, D.R. 1965. Steam distillation methods for determination of ammonium, nitrate and nitrite. *Analytical Chemistry* 32:215-163.

Brockwell, J., Gault, R.R., Chase, D.L., Turner, G.L. and Bergersen, F.J. 1985. Establishment and expression of soybean symbiosis in a soil previously free of *Rhizobium japonicum*. *Australian Journal of Agricultural Research* 40:753-762.

Brockwell, J., Gault, R.R., Morthorpe, L., Peoples, M.B., Turner, G.L. and Bergersen, F.J. 1989. Effect of soil nitrogen status and rate of inoculation on the establishment of populations of *Brdyrhizobium japonicum* and on the nodulation of soybeans. *Australian Journal of Agricultural Research* 40:753-762.

Browne, A.W., Harris, P.J.C., Hofny, A.H., Posieczenic, N.M. and Wallace, R.R. 2000. Organic trade and ethical trade: Definition practice and links. *Food Policy* 25:69-89.

Brundrett, M.C. 1991. Mycorrhizas in natural ecosystems. *Advances in Ecological Research* 21:171-213.

Buerkert, A., Bationo, A. and Piepho, H.P. 2001. Efficient phosphorous application strategies for increased crop production in sub-Saharan West Africa. *Field Crops Research* 72:1-15.

Buresh, R.J., Sanchez, P.A. and Calhoon, F. 1997. *Replenishing Soil Fertility in Africa.* Soil Science Society of America Special Publication No 51. Madison, USA. pp 251.

Bwamiki, D.P., Zake, J.Y.K., Bekunda, M.A. and Woomer, P.L. 1998. Use of coffee husks as an organic amendment to improve soil fertility in Ugandan banana production. In: Bergström, L. and Kirchmann, H. (eds). *Carbon and Nutrient Dynamics in Natural and Agricultural Tropical Ecosystems.* CAB International, Wallingford, U.K.

Cabral, L., Farrington, J. and Ludi, E. 2006. The Millennium Villages Project: A new approach to ending rural poverty in Africa. *Natural Resource Perspectives 101*, Overseas Development Institute, London.

Cadisch, G. and Giller, K.E. 1997. (eds). *Driven by Nature: Plant Litter Quality and Decomposition.* CAB International, Wallingford, UK.

Carr, T.H., Sloger, C., Rourke, J.W. and Tembo, H. 1998. Agronomic and economic impact of legume inoculant use in Zambia. In: Mpepereki, S.M. and Makonese, F.T. (eds). *Harnessing Biological Nitrogen Fixation in Agriculture.* University of Zimbabwe, Harare. pp 91-98.

Carsky, R.J. and Iwuafor, E.N.O. 1995. Contribution of soil fertility research and maintenance to improved maize production and productivity in sub-Saharan Africa. *Proceedings of Regional Maize Workshop, International Institute of Tropical Agriculture* (IITA), Cotonuo, Benin.

Carsky, R.J., Jagtap, S.S., Tian, G., Sanginga, N. and Vanlauwe, B. 1998. Maintenance of soil organic matter and N supply in the moist savanna zone of West Africa. In: Lal, R. (ed). *Soil Quality and Agricultural Sustainability.* Ann Arbor Press, Michigan, USA. pp 223-236.

Cassman, K.G., Dobermann, A., Sta Cruz, P.C., Gines, G.C., Samson, M.I., Descalsota, J.P., Alcantara, J.M., Dizon, M.A. and Olk, D.C. 1996. Soil organic matter and the indigenous nitrogen supply of intensive irrigated rice systems in the tropics. *Plant and Soil* 182:267-278.

Chabi-Olaye, A., Nolte, C., Schulthess, F. and Borge Meister, C. 2005. Abundance, dispersion and parasitism of the stem borer *Busseola fusca* (*Lepidoptera: noctuidae*) in maize in the humid forest zone of Southern Cameroon. *Bull. Entomology Research* 95:169-177.

Chambers, R., Pacey, A. and Thrupp, L.A. (eds). 1989. *Farmer First: Farmer innovation and agricultural research.* Intermediate Technology Publications, London.

Chandi, P.N. 2003. EM: A microbial product for sustainable agriculture. In: Savala, C., Omare, M. and Woomer, P. (eds). *Organic Resource Management in Kenya: Perspectives and Guidelines.* Forum for Organic Resource Management and Agricultural Technologies. Nairobi. pp 116-125.

Chianu, J.N., Tsujii, H. and Awange, J. 2006. Environment impact of agricultural production practices in the savannas of the Northern Nigeria. *Food Agriculture and Environment* 4:255-260.

Chien, S.H. and Menon, R.G. 1995a. Agronomic evaluation of modified phosphate rock products. *Fertilizer Research* 41:197-209.

Chien, S.H. and Menon, R.G. 1995b. Factors affecting the agronomic effectiveness of phosphate rock for direct application. *Fertilizer Research* 41:227-234.

Chien, S.H., Sompongse, D., Henao, J. and Hellums, D.T. 1987. Greenhouse evaluation of phosphorus availability from compacted phosphate rocks with urea and triple super phosphate. *Fertilizer Research* 14:245-256.

Chirwa, E., Dorward, A., Kachule, R., Kumwenda, I., Kydd, J., Poole, N., Poulton, C. and Stockbridge, M. 2005. Walking tightropes: Supporting farmer organizations for market access. *Natural Resource Perspectives* No 99. London. pp 6.

Citizen Network for Foreign Affairs (CNFA). 2002. *Citizen Network for Foreign Affairs 2001 Annual Report.* CNFA, Washington, D.C., USA.

Clark, N., Hall, A. and Sulaiman, R. 2003. Research as capacity building: The case of a non-governmental organization facilitated post-harvest innovation system for the Himalayan hills. *World Development* 31:1845-1863.

Cofie, O., Boubacar, B. and Bossio, D. 2004. Human resources as a driver of bright spots: The case of rainwater harvesting in West Africa. *Agricultural Successes in the Greater Horn of Africa.* Conference paper No 19. The Partnership for Africa's Development/IGAD, Nairobi.

Collaborative Study of Cassava in Africa (COSCA). 1998. Soil properties and climate, elevation, soil depth and cropping. *Working Paper No 18*. COSCA, IITA, Ibadan. pp 23-59.

Collion, M. and Rondot, P. 2001. *Investing in Rural Producer Organizations for Sustainable Agriculture.* World Bank, Washington.

Conservation Technology Information Center (CTIC) Partners. 2000. *Conservation Technology Information Center*. Purdue University, Indiana, USA.

Consultative Group on International Agricultural Research (CGIAR). 2006. *Natural Resources Management Research Impacts: Evidence from the Consultative Group on International Agricultural Research, Standing Panel on Impact Assessment.* CGIAR, Science Council, Rome.

Conway, G. and Toenniessen, G. 2003. Science for African food security. *Science* 299:1187-1189.

Cooper, K.M. and Tinker, P.B. 1978. Translocation and transfer of nutrients in vesicular-arbuscular mycorrhizas. II. Uptake and translocation of phosphorus zinc and sulphur. *New Phytologist* 81:43-52.

Cottenie, A. 1980. Soil and plant testing as a basis of fertilizer recommendations. *Soils Bulletin* 38(2). Food and Agriculture Organization of the United Nations (FAO), Rome.

Crawford, E., Kelly, V., Jayne, T.S. and Howard, J. 2003. Input use and market development in sub-Saharan Africa: An overview. *Food Policy* 28:277-292.

Crowley, E. and Carter, S. 2000. Agrarian change and the changing relationships between toil and soil in Marigoli, Western Kenya. *Human Ecology* 28:383-414.

Dangerfield, J.M. 1990. Abundance, biomass and diversity of soil macrofauna in savanna woodland and other associated managed habitats. *Pedobiologica* 19:141-150.

Dangerfield, J.M. and Telford, S.R. 1991. Seasonal activities of julid millipedes in Zimbabwe. *Journal of Tropical Ecology* 7.

Date, R.A. 1991. Nodulation success and persistence of recommended inoculum strains for subtropical and tropical forage legumes in Northern Australia. *Soil Biology and Biochemistry* 23:533-541.

Davis, E.L., Hussey, R.S. and Baum, T.J. 2004. Getting to the roots of parasitism by nematodes. *Trends* in *Parasitology* 20:134–141.

Day, J.C. and Aillery, M.P. 1988. Soil and moisture management in Mali: A case study for West Africa. *Agricultural Economics* 2:209-222.

De Bertoldi, M., Vallini, G. and Pera, A. 1985. Technological aspects of composting, including modelling and microbiology. In: Gasser, J.K.R. (ed). *Composting of Agricultural and Other Wastes*. Elsevier Applied Science Publishers, Essex, England. pp 27-41.

De Ridder, N. and Van Keulen, S.J. 1990. Some aspects of the role of organic matter in sustainable intensified arable farming systems of the West African semi-arid tropics. *Fertilizer Research* 26:299-310.

De Wit, C.T. 1992. Resource use efficiency in agriculture. *Agricultural Systems* 40:125-151.

Decaëns, T., Lavelle, P., Jimenez, J.J., Escobar, G. and Rippstein, G. 1994. Impact of land management on soil macrofauna in the oriental Llanos Colombia. *European Journal of Soil Biology* 30:157-168.

Defoer, T. 2002. Learning about methodology development for integrated soil fertility management. *Agricultural Systems* 73:57-81.

Defoer, T., Hilhorst, T., Kante, S. and Diarra, S. 1995. Analysing the diversity of farmers' strategies. *Centre for Information on External Input and Sustainable Agriculture Newsletter* 11:9

Defoer, T., Wopereis, M.C.S., Jones, M.P., Lancon, F. and Erenstein, O. 2003. Challenges, innovation and change towards a rice-based food security in sub-Saharan Africa. In: *Sustainable Rice Production for Food Security. Proceedings of the 20th Session of the International Rice Commission.* Food and Agriculture Organization of the United Nations (FAO), Rome.

Delve, R. and Ramisch, J.J. 2002. Impacts of land management options in Eastern Uganda and Western Kenya. In: Benin, S., Pender, J. and Ehui, S. (eds). *Policies for Sustainable Land Management in the Highlands of East Africa.* International Food Policy Research Institute (IFPRI), International livestock Research Institute (ILRI) Conference, Addis Ababa. pp 155-162.

Denning, G., Kabambe, P., Sanchez, P., Malik, A., Flor, R., Harawa, R., Nkhoma, P., Zamba, C., Banda, C., Magombo, C., Keating, M., Wangila, J. and Sachs, J. 2009. Input subsidies to improve smallholder maize productivity in Malawi toward an African green revolution. *PLOS Biology* 7.

Derpsch, R. 2008. No-tillage and Conservation Agriculture: A progress report. In: Goddard, T., Zoebisch, M.A., Gan, Y.T., Ellis, W., Watson, A. and Sombatpanit, S. (eds). *No-Till Farming Systems.* World Association of Soil and Water Conservation, Bangkok. pp 7-39.

Devries, J. and Toenniessen, G. 2001. *Securing the Harvest: Biotechnology, Breeding and Seed Systems for African Crops.* CAB International, Wallingford, UK. pp 208.

Diao, X. and Hazell, P. 2004. Exploring market opportunities for African smallholders. *Africa Conference Brief No 6*. International Food Policy Research Institute (IFPRI), Washington, D.C.

Dixon, J., Gulliver, A. and Gibbon, D. 2001. *Farming Systems and Poverty. Improving Farmers' Livelihoods in a Changing World.* FAO/World Bank, Rome, Washington, D.C.

Dobermann, A. and Fairhurst, T. 2000. Rice. Nutrient disorders and nutrient management. Handbook series. Potash and Potash Institute (PPI), Potash and Phosphate Institute of Canada (PPIC) and International Research Institute. pp 191

Dobermann, A., Witt, C., Abdulrachman, S., Gines, H.C., Nagarajan, R., Son, T.T., Tan, P.S., Wang, G.H., Chien, N.V., Thoa, V.T.K., Phung, C.V., Stalin, P., Muthukrishnan, P., Ravi, V., Babu, M., Simbahan, G.C. and Adviento, M. 2003a. Soil fertilizer and indigenous nutrient supply in irrigated rice domains of Asia. *Agronomy Journal* 95:913-923.

Dobermann, A., Witt, C., Abdulrachman, S., Gines, H.C., Nagarajan, R., Son, T.T., Tan, P.S., Wang, G.H., Chien, N.V., Thoa, V.T.K., Phung, C.V., Stalin, P., Muthukrishnan, P., Ravi, V., Babu, M., Simbahan, G.C., Adviento, M. and Bartolome, V. 2003b. Estimating indigenous nutrient supplies for site-specific nutrient management in irrigated rice. *Agronomy Journal* 95:924-935.

Doering, D.S. 2005. *Public-Private Partnership to Develop and Deliver Drought Tolerant Crops to Food Insecure Farmers*. Winrock International, Washington, D.C., USA.

Donovan, C., Wopereis, M.C.S., Guindo, D. and Nebie, B. 1999. Soil fertility management in irrigated rice system in the Sahel and Savanna regions of West Africa: Profitability and risk analysis. *Field Crops Research* 61:147-162.

Dorward, A., Kydd, J. and Poulton, C. 1998. *Smallholder Cash Crop Production under Market Liberalization: A New Institutional Economics Perspective.* CAB Publishing, Wallingford, UK.

Doss, C.R. 2002. Men's crops? Women's crops? The gender patterns of cropping in Ghana. *World Development* 30:1987-2000.

Duke, J.A. 1981. *Handbook of Legumes of World Economic Importance*. Plenum Press, NewYork.

Dumanski, J., Peiretti, R., Benetis, J., Mcgarry, D. and Pieri, C. 2006. The paradigm of conservation tillage. *Proceedings of World Association of Soil and Water Conservation*. pp 58-64.

Eaglesham, A.R.J. 1989. Global importance of rhizobium as an inoculant. In: Campbell, R. and Macdonald, R.M. (eds). *Microbial Inoculants of Crop Plants. Society of General Microbiology* 25:29-48.

Eaglesham, A.R.J., Ayanaba, A., Ranga Rao, V. and Eskew, D.L. 1982. Mineral N effects on cowpea and soybean crops in a Nigerian soil. Part II. Amount of N fixed and accrual to the soil. *Plant and Soil* 68:183-192.

Edwards, C.A. 1988. Breakdown of animal, vegetable and industrial organic wastes by earthworms. *Agriculture Ecosystems and Environment* 24:21-31.

Edwards, D.G. 1971. *Plant Nutrition. http//www.fao.org/ag/agp/agpc/doc/publicat/faobul4*.

Eicher, C.K. 1999. *Institutions and the African Farmer*. Economics Program Third Distinguished Economist Lecture. CIMMYT, Mexico.

Eilittä, M., Mureithi, J. and Derpsch, R. (eds). 2004. *Green Manure/Cover Crop Systems of Smallholder Farmers*. Kluwer Academic Publishers, Netherlands.

Elbasha, E., Thornton, P.K. and Tarawali, G. 1999. An ex-post economic impact assessment of planted forages in West Africa. *International Livestock Research Institute (ILRI) Impact Assessment Series No 2*. Nairobi, Kenya. pp 61.

Ellis, F. 2005. *Small Farm, Livelihood Diversification, and Rural-Urban Transitions: Strategic Issues in Sub-Saharan Africa*. Paper prepared for the research workshop on "The future of small farms". Organized by International Food Policy Research Insitute (IFRP), Overseas Development Insitute (ODI), and Imperial College, London. Withersdane Conference Centre, Wye, Kent. UK. pp 135-149.

Elwell, H.A. 1995. *An assessment of the performance of minimum tillage practices in Zimbabwe in terms of drought risk alleviation, yields and cost-effectiveness*. Consultancy report. World Bank, Harare

Erenstein, O., Sayre, K., Wall, P., Dixon, J. and Hellin, J. 2008. Adapting no-tillage agriculture to the conditions of smallholder maize and wheat farmers in the tropics and sub-tropics. In: Goddard, T., Zoebisch, M.A., Gan, Y.T., Ellis, W., Watson, A. and Sombatpanit, S. (eds). *No-Till Farming Systems*. World Association of Soil and Water Conservation, Bangkok. pp 253.

Evers, B. and Walters, B. 2000. Extra-household factors and women farmers' supply response in sub-Saharan Africa. *World Development* 28:1341-1345.

Ezumah, N.N. and Domenico, C.M.D. 1995. Enhancing the role of women in crop production: A case study of Igbo women in Nigeria. *World Development* 23:1731-1744.

Farrington, J. 1995. The changing public role in agricultural extension. *Food Policy* 20:537-544.

Faulkner, E.H. 1943. *Plowman's Folly*. University of Oklahoma Press, Norman, USA.

Feder, G., Murgai, R. and Quizon, J.B. 2004. Sending farmers back to school: The impact of farmer field schools in Indonesia. *Review of Agricultural Economics* 26:45-62.

Feller, C., Chopaty, J.L. and Dancette, F. 1987. Effet de divers modes de restitution de pailles de mil sur le niveau et al nature du stock organic dans deux sols sableux tropicaux. *Cachiers Orstom, Séries Pédologie* 24:237-252.

Fermont, A.M., Obiero, H.M., Van Asten, P.J.A., Baguma, Y. and Okwuosa, E. 2004. Improved cassava varieties increase the risk of soil nutrient mining: An ex-ante analysis for Western Kenya and Uganda. In: Bationo, A., Waswa, B., Kihara, J. and Kimetu, J. (eds). *Advances in Integrated Soil Fertility Management in Sub-Saharan Africa: Challenges and Opportunities*. Springer, Dordrecht, The Netherlands. pp 511-519.

Fofana, B., Breman, H., Carsky, R.J., Reuler, H., van Tamelokpo, A.F. and Gnakpenou, K.D. 2004. Using mucuna and P fertilizer to increase maize grain yield and N fertilizer use efficiency in the coastal savanna of Togo. *Nutrient Cycling in Agroecosystems* 68:213-222.

Food and Agriculture Organization of the United Nations (FAO). 1977. *Soil Map of the World. Volume VI Africa*. UNESCO, Paris.

Food and Agriculture Organization of the United Nations (FAO). 1995. *A Synthesis Report of the Africa Region-Women, Agriculture and Rural Development*. FAO, Rome.

Food and Agriculture Organization of the United Nations (FAO). 1995. *Fertilizer and Plant Nutrition Bulletin No. 12*. FAO, Rome.

Food and Agriculture Organization of the United Nations (FAO). 1989a. *Fertilizers and Food Production*. FAO, Rome.

Food and Agriculture Organization of the United Nations (FAO). 1989b. *Prevention of Post-Harvest Food Losses: Fruits, Vegetables and Root Crops*. FAO, Rome.

Food and Agriculture Organization of the United Nations (FAO). 2001a. *Farming Systems and Poverty. Improving Farmers' Livelihoods in a Changing World*. FAO, Rome.

Food and Agriculture Organization of the United Nations (FAO). 2001b. Integrated soil management for sustainable agriculture and food security. Case studies from four countries in Africa. FAO Regional Office for Africa. Accra, Ghana.

Food and Agriculture Organization of the United Nations (FAO). 2002a. *Fertilizer Use by Crops*. Fifth edition. FAO, Rome.

Food and Agriculture Organization of the United Nations (FAO). 2002b. *Land Degradation Assessment in Drylands*. FAO, Rome.

Food and Agriculture Organization of the United Nations (FAO). 2004a. *Food and Agriculture Organization of the United Nations Statistics Database (FAOSTAT*), Rome.

Food and Agriculture Organization of the United Nations (FAO). 2004b. The global cassava development strategy and implementation plan. *Proceedings of the Validation Forum on the Global Cassava Development Strategy*. FAO, Rome.

Food and Agriculture Organization of the United Nations (FAO). 2005. The state of food and agriculture. *FAO Series No 36*. FAO, Rome.

Food and Agriculture Organization of the United Nations (FAO). 2008. *Investing in Sustainable Agricultural Intensification: The Role of Conservation Agriculture*. Rome, Italy. pp 21.

Food and Agriculture Organization of the United Nations/International Institute for Applied System Analysis (FAO/IIASA). 2000. Global agroecological zones 2000. Online database at. http://www.Fao.org/ag/agl/Agll/Gaez/Index.Htm.

Food and Agriculture Organization of the United Nations (FAO)/International Institute for Applied System Analysis (IIASA). 2002. *Global Agroecological Assessment for Agriculture in the 21st Century*. International Institute for Applied System Analysis (IIASA). Luxembourg.

Food and Agriculture Organization of the United Nations (FAO)/United Nations Education Scientific and Cultural Organization (UNESCO). 1995. *The Digital Soil Map of the World, Version 3.6*. FAO, Rome.

Fortmann, I. 1981. The plight of invisible farmer: The effect of national agricultural policy on women. In: Dauber, R. and Cain, M. (eds). *Women and Technological Change in Developing Countries*. Westview Press, Boulder, USA. pp 205-204.

Fox, R.L. 1974. Examples of anion and cation adsorption by soils in Tropical America. *Tropical Agriculture (Trinidad)* 51:200-210.

Fragoso, C., Brown, G.G., Parton, J.C., Blanchart, E., Lavelle, P., Pashanasi, B., Senapati, B. and Kumar, T. 1997. Agricultural intensification, soil biodiversity and agroecosystem function in the tropics: The role of earthworms. *Applied Soil Ecology* 6:17-35.

Fragoso, C., Lavelle, P., Blanchart, E., Senapati, B.K., Jiménez, J.J., Martinez, M.A., Decaëns, T. and Tondoh, J. 1999. Earthworm communities of tropical agroecosystems: Origin, structure and influence of management practices. In: Lavelle, P., Brussard, L. and Hendrix, P.F. (eds). *Earthworm Management in Tropical Agroecosystems*. CAB International, Wallingford, UK.

Franke, A.C., Schulz, S., Oyewole, B.D. and Bako, S. 2004. Incorporating short-season legumes and green manure crops into maize-based systems in the moist Guinea savanna of West Africa. *Experimental Agriculture* 40:463-479.

Franson, R.L. and Bethlenfalvay, G.J. 1989. Infection unit method of vesicular-arbuscular mycorrhizal propagule determination. *Soil Science Society of America Journal* 53:754-756.

Franzel, S. and Scherr, S.J. (eds). 2002. *Trees on the Farm: Assessing the Adoption Potential of Agroforestry Practices in Africa*. CAB International, Wallingford, UK.

Friedrich, T. 2000. Perspective: Shedding light on Conservation Agriculture. *New Agriculturalist* (on-line). WREN Media, UK. pp 3.

Friis, H. and Michaelsen, K.F. 1998. Micronutrients and HIV infection: A review. *European Journal of Clinical Nutrition* 52:157-163.

Fujisaka, S. 1994. Learning from six reasons why farmers do not adopt innovations intended to improve sustainability of upland agriculture. *Agricultural Systems* 46:409-425.

Gachene, C.K.K. and Kimaru, G. (eds). Soil fertility and land productivity: Guide for extension workers in the Eastern Africa region. *RELMA Technical Handbook Series 30*. Nairobi, Kenya.

Gachengo, C.N., Palm, C.A., Jama, B. and Otieno, C. 1999. Tithonia and senna green manures and inorganic fertilizers as phosphorous sources for maize in Western Kenya. *Agroforestry Systems* 44:21-36.

Garrity, D.P. and Liboon, S.P. 1995. A non-conventional methods for establishing upland crops following lowland rice in saturated soils. *Field Crops Research* 43:31-42.

Gathumbi, S.M., Cadisch, G., Buresh, R.J. and Giller, K.E. 2003. Subsoil nitrogen capture in mixed legume stands as assessed by deep nitrogen-15 placement. *Soil Science Society of America Journal* 67:573-582.

Gerdeman, J.W. 1975. Vesicular-arbuscolar mycorrhiza. In: Torrey, J.G. and Clarkson, D.T. (eds). *The Development and Function of Roots. Academic Press*. pp 575–591.

Giller, K.E. 2000. Translating science into action for agricultural development in the tropics: An example from decomposition studies. *Applied Soil Ecology* 14:1-3

Giller, K.E. 2001. *Nitrogen Fixation in Tropical Cropping Systems. Second Edition*. CAB International, Wallingford, UK.

Giller, K.E. 2002. Targeting management of organic resources and mineral fertilizers: Can we match scientists' fantasies with farmers' realities? In: Vanlauwe, B., Sanginga, N., Diels, J. and Merckx, R. (eds). *Balanced Nutrient Management Systems for the Moist Savanna and Humid Forest Zones of Africa*. CAB International, Wallingford, UK. pp 155-171.

Giller, K.E. and Wilson, K.J. 1991. *Nitrogen Fixation in Tropical Cropping Systems*. CAB International, Wallingford, UK.

Giller, K.E., Beare, M.H., Lavelle, P., Izac, A.M.N. and Swift, M.J. 1997. Agricultural intensification, soil biodiversity and ecosystem function. *Applied Soil Ecology* 6:3-16.

Giller, K.E., Cadisch, G. and Mugwira, L.M. 1998a. Potential benefits from interactions between mineral and organic nutrient sources. In: Waddington, S.R., Murwira, H.K., Kumwenda, J.D.T., Hikwa, D. and Tagwira, F. (eds). *Soil Fertility Research for Maize-Based Farming Systems in Malawi and Zimbabwe*. Soil Fertility Network and CIMMYT, Harare, Zimbabwe. pp 155-158.

Giller, K.E., Gilbert, R., Mugwira, L.M., Muza, L., Patel, B.K. and Waddington, S. 1998b. Practical approaches to soil organic matter management for smallholder maize production in Southern Africa. In: Waddington, S.R., Murwira, H.K., Kumwenda, J.D.T., Hikwa, D. and Tagwira, F. (eds). *Soil Fertility Research for Maize-Based Farming Systems in Malawi and Zimbabwe*. Soil Fertility Network and CIMMYT, Harare, Zimbabwe. pp 139-153.

Giller, K.E., Rowe, E., de Ridder, N. and Van Keulen, H. 2006. Resource use dynamics and interactions in the tropics: Scaling up in space and time. *Agricultural Systems* 88:8-27.

Giller, K.E., Witter, E., Corbeels, M. and Tittonell, P. 2009. Conservation Agriculture and smallholder farming in Africa: The heretics' view. *Field Crops Research* (in press)

Gladwin, C.H., Buhr, K.L., Hiebsch, A.G.C.H., Hilderbrand, P.E., Kidder, G., Langham, M., Lee, D., Nkendi-Kizza, P. and Wiliams, D. 1997. Gender and soil fertility in Africa. In: Buresh, R.J., Sanchez, P.A. and Calhoun, F. (eds). *Replenishing Soil Fertility in Africa*. Soil Science Society of America Special Publication 51, Madison, USA. pp 219-236.

Gockowski, J., Tonye, J., Baker, D., Legg, C., Weise, S., Ndoumbé, M., Tiki-Manga, T. and Fouaguègué, A. 2004. Characterization and diagnosis of farming systems in the forest margins benchmark of Southern Cameroon. *Social Science Working Paper Series No 1*. International Institute of Tropical Agriculture (IITA). Ibadan, Nigeria. pp 154-156.

Goddard, T., Zoebisch, M.A., Gan, Y.T., Ellis, W., Watson, A. and Sombatpanit, S. (eds). 2008. *No-till Farming Systems*. World Association of Soil and Water Conservation, Bangkok. 540 pp.

Gold, G.S., Karamura, E.B., Kiggundu, A., Bagamba, F. and Abera, A.M.K. 1999. Geographic shifts in highland cooking banana (Musa Group AAA-EA) production in Uganda. *African Crop Science Journal* 7:223-298.

Gordon, A. 2000. Improving smallholder access to purchased inputs in sub-Saharan Africa. *Policy Series No 7*. Natural Resources Institute, Chatham, UK.

Graham, O. 1991. *Cereal Banks at your Service*. Ox-fam Publications, Oxford, UK. pp 7-11.

Graham, R.D. and Welch, R.M. 1999. A new paradigm for world agriculture: Meeting human needs, productive, sustainable and nutritious. *Field Crops Research* 60:1-10 .

Graham, R.D., Ascher, J.S. and Hynes, S.C. 1992. Selecting zinc efficient cereal genotypes for soil of low zinc status. *Plant and Soil* 146:241-250.

Grant, P.M. 1981. The fertility of sandy soil in peasant agriculture. *Zimbabwe Agriculture Journal* 78:169-175.

Graves, A., Mathews, R. and Waldie, K. 2004. Low external input technologies for livelihood improvement in subsistence agriculture. *Advances in Agronomy* 82:473-555.

Gypmantasiri, P., Limnirankul, B. and Phothachareon, C. 2004. Sesbania rostrata in rice-based farming systems of northern Thailand. In: Eilitä, M., Mureithi, J. and Derpsch, R. (eds). *Green Manure/Cover Crop Systems of Smallhold Farmers*. Kluwer Academic Publishers, Dorderecht, The Netherlands.

Haefele, S.M., Johnson, D.E., Diallo, S., Wopereis, M.C.S. and Janin, I. 2000. Improved soil fertility and weed management is profitable for irrigated rice farmers in Sahelian West Africa. *Field Crops Research* 66:101-113.

Haefele, S.M., Wopereis, M.C.S., Ndiaye, M.K, Barro, S.E. and Ould Isselmou, M. 2003. Internal nutrient efficiencies, fertilizer recovery rates and indigenous nutrient supply of irrigated lowland rice in Sahelian West Africa. *Field Crops Research* 80:19-32.

Haefele, S.M., Wopereis, M.C.S., Ndiaye, M.K. and Kropff, M.J. 2003. A framework to improve fertilizer recommendations for irrigated rice in West Africa. *Agricultural Systems* 76:313-335.

Haggblade, S. and Tembo, G. 2003. *Conservation Farming in Zambia*. Paper presented at the INWENT/The International Food Policy Research Institute (IFPRI)/The New Partnership for Africa's Development/Technical Centre for Agricultural and Rural Cooperation, Conference on Successes in African Agriculture. Pretoria, South Africa.

Haimi, J. and Huhta, V. 1990. Effect of earthworms on decomposition processes in raw humus forest soil: A microcosm study. *Biology and Fertility of Soils* 10:78-183.

Hallaer, R. and Baer, S. 1994. *From Wastelands to Paradise*. Hans H. Koschany Publishers, Germany.

Harinikumar, K.M. and Bagyaraj, D.J. 1988. Effects of crop rotation on native Vesicular arbuscular mycorrhizal propagules in soil. *Plant and Soil* 110:77-80.

Harris, P.J.C., Bowne, A.W., Barret, H.R. and Cadoret, K. 2002. Facilitating the inclusion of the resource-poor in organic production and trade: Opportunities and constraints posed by certification. Henry Doubleday Research Association, Coventry, UK.

Hartemink, A.E. 2003. *Soil Fertility Decline in the Tropics with Case Studies on Plantations*. International Soil Reference and Information Centre (ISRIC). Wageningen, Netherlands and CAB International, Wallingford, UK.

Harwood, R.R. 1994. Agronomic alternatives to slash-and-burn in the humid tropics. In: Sanchez, P.A. and Van Houten, H. (eds). *Alternatives to Slash and Burn Agriculture*. International Center for Research in Agroforestry (ICRAF). Nairobi. pp 92-105.

Hassane, A. 1996. Improved traditional planting pits in the Tahoua department, Niger: An example of rapid adoption by farmers. In: Reij, C, Scones, I. and Toulmin, C. (eds). *Sustaining the Soil: Indigenous Soil and Water Conservation in Africa*. Earthscan Publication, London.

Hassane, A., Martin, P. and Reij, C. 2000. Water harvesting, land rehabilitation and household food security in Niger: International Fund for Agricultural Development Soil and Water Conservation Project in Illela district. Vrije Universiteit, Amsterdam. pp 49.

Hauser, S., Nolte, C. and Carsky, R.J. 2006. What role can planted fallows play in the humid and sub-humid zone of West and Central Africa. In: Bationo, A., Waswa, B., Kihara, J. and Kimetu, J. (eds). *Nutrient Cycling in Agroecosystems* 76:297-318.

Hazell, P. 2005. *From Food Security to Market-Driven Growth in Indian Agriculture: Implications for Agricultural Policy*. Paper prepared for a special publication to celebrate the centenary year of the Agricultural College Research Institute, Coimbatore, Tamil Nadu, India.

Herlocker, D. (ed). 1999. *Rangeland Ecology and Resource Development in Eastern Africa. Rangeland Environment*, German Technical Cooperation Publication, Nairobi.

Heyar, K.R. and Price, G.H. 1999. Making recommendations based upon soil tests. In: Peverill, K.I., Sparrow, L.A. and Reuter, D.J. (eds). *Soil Analysis: An Interpretation Manual*. CSIRO Publishing, Collinwood, Victoria, AU. pp 331-357.

Hillocks, R.J. 2001. Cassava in Africa. In: Hillocks, R.J., Thresh, J.M. and Bellotti, A. (ed). *Cassava Biology, Production and Utilization*. CAB International, Wallingford, UK.

Houba, V.J.G., Novozamslay, I. and Vanderlee, J.J. 1990. *Plant and Soil Analysis: Part 4*. University of Wageningen, Netherlands.

Howard, J., Crawford, E., Kelly, V., Demeke, M. and Jeje, J.J. 2003. Promoting high-input maize technologies in Africa: The Sasakawa Global 2000 experience in Ethiopia and Mozambique. *Food Policy* 28:335–348.

Howeler, R.H. 1991. Long term effect of cassava cultivation on soil productivity. *Field Crops Research* 26:1-18.

Howeler, R.H. 2001. Cassava mineral nutrition and fertilization. In: Hillocks, R.J., Thresh, J.M. and Bellotti, A.C. (eds). *Cassava Biology, Production and Utilization*, CAB International, Wallingford, UK. pp 115-148.

Howeler, R.H. 2004. Integrated cassava based cropping systems in Asia: *Farming Practices to Enhance Sustainability. End of Project Report. Second phase of the Nippon Foundation Cassava Project in Asia*. pp 120.

Howeler, R.H. 2005. Cassava in Asia. Present situation and its future potential in agro-industry. In: Setiawan, A. and Fuglie, K.O. (eds.). *Sweetpotato Research and Development: Its Contribution to the Asian Food Economy*. *Proceeding of the International Seminar on Sweetpotato,* held in Bogor, Indonesia, Sept 19, 2003. pp 17-51.

Howeler, R.H., Cadavid, L.F. and Calo, F.A. 1976. The interaction of lime with minor elements and phosphorus in cassava production. *Proceedings of the Fourth Symposium of International Society of Tropical Root Crops*. CIAT, Cali, Columbia. pp 113-117.

Howieson, J.G., O'Hara, G.W. and Carr, S.J. 2000. Changing roles for legumes in Mediterranean agriculture: Developments from an Australian perspective. *Field Crops Research* 65:107-122.

Hudgens, R.E. 2000. Sustainable soil fertilizer in Africa: The potential for legume green manure. Soil technologies for sustainable smallholder farming system in East Africa. In: *Proceeding of the 15th Conference of the Soil Science Society of East Africa*. Nanyuki, Kenya. pp 63-78.

Hudson, B.D. 1994. Soil organic matter and available water capacity. *Soil and Water Conservation* 49:189-194.

Hulse, J.H. 1991. Nature, composition and utilization of grain legumes. In: International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). *Uses of Tropical Legumes*. International Crops Research Institute for the Semi-Arid Tropics, India. pp 11-27.

Hungria, M., Campo, R.J., Mendes, I.C. and Graham, P.H. 2006. Contribution of biological nitrogen fixation to the nutrition of grain crops in the tropics: The success of soybean (*Glycine max L.merr.)* in South America. In: Singh, R.P., Shankar, N. and Jaiwal, P.K. (eds). *Nitrogen Nutrition in Plant Productivity*. Studium Press, Houston, Texas. pp 43-93.

Hungria, M., Franchin, J.C., Campo, R.J. and Graham, P.H. 2005. The importance of nitrogen fixation to soybean cropping in South America. In: Werner, D. and Newton, W.E. (eds). *Nitrogen Fixation in Agriculture, Forestry, Ecology and Environment*. Netherlands. pp 25-42.

International Centre for Soil Fertility and Agricultural Development (IFDC). 2002. Collaborative Research Programme for Soil Fertility Restoration and Management in Resource Poor Areas of Sub-Saharan Africa *Technical Bulletin 67*. IFDC, Muscle Shoals, Alabama, USA.

International Center for Soil Fertility and Agricultural Development. (IFDC). 2003. Input subsidies and agricultural development: Issues and Options for developing and transitional economies. *Paper Series P-29*. IFDC, Muscle Shoals, Alabama, USA. pp 35.

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). 1985-88. International Crops Research Institute for the Semi-Arid Tropics Sahelian Center Annual Report. ICRISAT, Patancheru, India.

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). 1991. Uses of tropical grain legumes. *Proceedings of a Consultants Meeting, 27-30 March 1989*. ICRISAT, Patancheru, India.

International Fund for Agricultural Development (IFAD) 1998. Agricultural implements used by women farmers in Africa. Rome.

Jacobson, J.S., Heller, L.I., L'Hirondelle, S.J. and Lassoie, J.P. 1992. Phenology and cold tolerance of *Picea rubens* Sarg. seedlings exposed to sulfuric and nitric acid mist. *Scandinavian Journal of Forest Research* 7:331-344.

Jacquot, M. and Courtois, B. 1987. *Upland Rice*. The Tropical Agriculturalist Series. Macmillan Publishers, London.

Jafry, T. 2000. Women, human capital and livelihoods: An ergonomics perspective. *Natural Resource Perspectives* No 54. pp 4

Jama, B., Buresh, R.J., Ndufa, J.K. and Shepherd, K.D. 1998. Vertical distribution of roots and soil nitrate: Tree species and phosphorus effects. *Soil Science Society of America Journal* 62:280-286.

Janssen, B.H. 1993. Integrated nutrient management: The use of organic and mineral fertilizers. In: Van Reuler, H. and Prins, W.H. (eds). *The Role of Plant Nutrient for Sustainable Crop Production in Sub-Saharan Africa*. Wageningen, Netherlands. pp 89-105

Javaheri, F. and Joshi, J. 1986. Soybean production by smallscale farmers in Zambia. In: Cole, D.L (ed). *Soybeans in Southern Africa*. Crop Science Department, University of Zimbabwe, Harare. pp 9-12.

Jayne, T.S., Goveren, J., Nyoro, J., Mwanaumo, A. and Chapoto, A. 2002. False promise or false premise: Food market reform in Eastern and Southern Africa. *World Development* 30:1967-1986.

Jayne, T.S., Yamano, T. and Nyoro, J. 2004. Interlinked credit and farm intensification: Evidence from Kenya. *Agricultural Economics* 31:209-218.

Jindal, R. 2006. *Carbon Sequestration Projects in Africa: Potential Benefits and Challenges to Scaling Up*. Earthtrends Environmental Essay, World Resources Institute, London.

Johns, T. 2003. Plant biodiversity and malnutrition: Simple solutions to complex problems. *African Journal of Food and Agricultural Nutrition Development* 11:45-52.

Johnson, N.C. and Pfleger, F.L. 1992. Vesicular-arbuscular mycorrhizae and cultural stresses. In: Bethlenfalvay, G.J. and Linderman, R.G. (eds). *Mycorrhizae in Sustainable Agriculture*. American Society of Agronomy Special Publication No 54, Crop Science Society of America and Soil Science Society of America, Madison. pp 71-97.

Johnson, N.C., Pfleger, F.L., Crookston, R.K., Simmons, S.R. and Copeland, P.J. 1991. Vesicular-arbuscular mycorrhiza response to corn and soybean cropping history. *New Phytolologist* 117:657-663.

Johnson, N.L., Lilja, N. and Ashby, J. 2003. Measuring the impact of user participation in agricultural and natural resources management research. *Agricultural Systems* 78:287-306.

Jones, J.W., Hoogenboom, G., Porter, C.H., Boote, K.J., Batchelor, W.D., Hunt, L.A., Wilkens, P.W., Singh, U., Gijsam, A.J. and Ritchie, J.T. 2003. The DSSAT cropping system model. *European Journal of Agronomy* 18:235-265.

Jones, M.J. and Wild, A. 1975. Soils of the West African Savanna. *Technical Communication No 55*. Commonwealth Bureau of Soils. Harpenden, UK.

Jones, R., Likoswe, A. and Freeman, H.A. 2002. Improving the access of small farmers in Eastern and Southern Africa to global pigeonpea markets. *Agricultural Research and Extension Network Paper No 120*. Overseas Development Institute, Chatham, UK.

Jones, R.B., Snapp, S.S. and Phombeya, H.S.K. 1997. Management of leguminous leaf residues to improve nutrient use efficiency in the sub-humid Tropics. In: Cadisch, G. and Giller, K.E. (eds). *Driven By Nature: Plant Litter Quality and Decomposition*. CAB International, Wallingford. pp 239-250.

Juma, C. 2006. Universities in economic renewal: Enlisting new sources of development. In: *The Role of African Universities in the Attainment of the Millennium Development Goals*. Kenyatta University, Nairobi, Kenya.

Juo, A.S.R. and Manu, A. 1994. Chemical dynamics in slash-and-burn agriculture. In: Sanchez, P.A. and Van Houten, H. (eds). *Alternatives to Slash and Burn Agriculture*. International Center for Research in Agroforestry (ICRAF), Nairobi. pp 62-76.

Kaaria, S., Njuki, J., Abenakyo, A., Delve, R. and Sanginga, P. 2008. Assessment of the enabling rural innovation approach: Case study from Malawi and Uganda. *Natural Resource Forum* 32:53-63.

Kaaria, S.K. and Ashby, J.A. 2001. An approach to technological innovation that benefits women: The resource-to-consumption system. *Working Document No 13*. *CGIAR Systematic Program on Participatory Research and Gender Analysis*. Cali, Colombia. pp 55.

Kamau, J., Ohiokpehai, O., Kimiywe, J. and Oteba, L. 2008. Nutrition and health status of orphaned and vulnerable school children aged 6-9 years in Suba district, Kenya. *Applied Biosciences* 4:45-53.

Kanampiu, F., Ransom, J., Gressel, J., Jewell, D., Friesen, D., Grimanelli, D. and Hoisington, D. 2002. Appropriateness of biotechnology to African agriculture: Striga and maize as paradigms. *Plant Cell, Tissue and Organ Culture* 69:105-110.

Kandji, S.T., Verchot, L. and Mackensen, J. 2006. *Climate Change and Variability in the Sahel Region: Impacts and Adaptation Strategies in the Agricultural Sector*. World Agroforestry Centre, Nairobi.

Kang, B.T. 1983. Nutrient requirements and fertilization of root and tuber crops. *Lecture Notes, Root and Tuber Crop Production Training Course*. IITA, Ibadan, Nigeria.

Kang, B.T. and Okeke, J.E. 1983. Nitrogen and potassium response of two cassava varieties grown on alfisol in Southern Nigeria. In: Shideler, F.S. and Rincon, H. (eds). *Proceedings of Sixth Symposium of the International Society for Tropical Root Crops*. International Society for Tropical Root Crops, Lima, Peru. pp 231-238.

Kang, B.T. and Osiname, O.A. 1985. Micronutrient problems in Tropical Africa. In: Vlek, P.L.G. (ed). *Micronutrients in Tropical Food Crop Production*. Junk Publishers, Dordrecht. pp 95-130.

Kang, B.T. and Wilson, H.L. 1980. Effect of maize population and nitrogen application in intercropped maize and cassava. In:*Tropical Root Crops Research Strategies for the 1980's*, IDRC-Ottawa. pp 129-133.

Kang, B.T., Islam, R., Sanders, F.E. and Ayanaba, A. 1980. Effect of phosphate fertilization and inoculatlon with VAM-mycorrhizal fungi on performance of cassava (*Manihot esculenta* Cranz) on an alfisol. *Field Crops Research* 3:83-94.

Kanyanjua, S.M., Mureithi, J.G., Gachene, C.K.K. and Saha, H.M. 2000. *Soil Fertility Management Handbook for Extension Staff and Farmers in Kenya*. Kenya Agricultural Research Institute Technical Note Series 6. Nairobi, Kenya

Kanyarati, P. and Moselund, P. 2003. Organic product certification. In: Savala, E.N, Woomer, P.L. and Omare, N.M. (eds). *Organic Resource Management in Kenya. Perspectives and Guidelines*. Forum for Organic Resource Management and Agricultural Technologies, Nairobi, Kenya. pp 173-180.

Kasele, I.N. 1980. Investigation on the effect of shading, potassium, nitrogen and drought on the development of cassava tuber at the early stage of growth. M.Sc Thesis, University of Ibadan, Nigeria. pp 68.

Kasele, I.N. 1992. Growth retardants promote drought resistance in corn (*Zea Mays* L). Ph.D Thesis, Colarado State University. pp 116.

Kelly, V., Adesina, A.A. and Gordon, A. 2003. Expanding access to agricultural inputs in Africa: A review of recent market development experience. *Food Policy* 28:379-404.

Kenya Agricultural Research Institute (KARI). 1994. *Fertilizer Use Recommendations*. Kenya Agricultural Research Institute. Volumes 1-22. Fertilizer Use Recommendation Project, KARI, Nairobi.

Kessler, A., Streiffeler, F. and Obuobie, E. 2004. Women in urban agriculture in West Africa. *Urban Agriculture Magazine* 12:16-17

Khalil, S., Laynachan, T.E. and Tabatabai, M.A. 1994. Mycorrhizal dependency and nutrient uptake by improved and unimproved corn and soybean cultivars. *Agronomy Journal* 86:949-958.

Khan, Z.R., Muyekho, F.N., Njuguna, E., Pickett, J.A., Wadhams, L.J., Dibogo, N., Ndiege, A., Gemga, G. and Lusweti, C. 2005. *A Primer on Planting and Managing Push-pull Fields for Stemborer and Striga Control in Maize: A Step-by-step Guide for Farmers*. International Centre of Insect Physiology and Ecology Science Press, Nairobi.

Kherallah, M., Delgado, C., Gabre-Madhin, E., Minot, N. and Johnson, M. 2002. *Reforming Agricultural Markets in Africa*. International Food Policy Research Institute, Washington, D.C. USA. pp 201.

Kibwage, J.K. and Momanyi, G.M. 2003. The role of community composting groups in Nairobi. In: Savala, E.N., Omare, M.N. and Woomer, P.L. (eds). *Organic Resource Management in Kenya: Perspectives and Guidelines*. Forum for Organic Resource Management and Agricultural Technologies, Nairobi. pp 153-161.

Killough, S. 2005. Participatory approaches to agricultural research and extension. In: Gonsalves, J., Becker, T., Braun, A., Campilan, D., De Chavez, H., Fajber, E., Kapiriri, M., Rivaca-Caminade, J. and Vernooy, R. (eds). *Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook. Volume 1: Understanding Participatory Research and Development*. International Development Research Centre (IDRC). Ottawa, Canada. pp 23-31.

Kiptot E., Hebrinck P., Franzel S. and Richards P. 2007. Adopters, testers or pseudo- adopters? Dynamics of the use of improved tree fallows by farmers in western Kenya. *Agricultural Systems* 94:509-519.

Kirk, G.J.D., George, T., Courtois, B. and Senadhira, D. 1998. Opportunities to improve phosphorous efficiency and soil fertility in rainfed lowland and upland rice ecosystems. Nutrient use efficiency in rice cropping systems. *Field Crops Research* 56:73-92.

Kitch, L.W., Boukar, O., Endondo, C. and Murdock, L.L. 1998. Farmer acceptability criteria in breeding cowpea. *Experimental Agriculture* 34:475-486.

Knowles, D. and Bradshaw, B. 2007. Farmers' adoption of Conservation Agriculture: A review and synthesis of recent research. *Food Policy* 32:25-48.

Kotto-Same, J., Woomer, P.L., Moukam, A. and Zapfack, L. 1997. Carbon dynamics in slash-and-burn agriculture and land use alternatives of the humid forest zone in Cameroon. *Agriculture Ecosystems and Environment* 65:245-256.

Kristjanson, P., Tarawali, S., Okike, I., Singh, B.B., Thornton, P.K., Manyong, V., Kruska, R.L. and Hoogenboom, G. 2002. Genetically improved dual purpose cowpea: Assessment of adoption and impact in the dry savannah region of West Africa. *Impact Assessment Series 9*. International Livestock Research Institute (ILRI). Nairobi, Kenya.

Kueneman, E.A., Root, W.R., Dashiell, K.E. and Hohenberg, J. 1984 Breeding soybeans for the tropics capable of nodulating effectively with indigenous *Rhizobium* spp. *Plant Soil* 82:387-396.

Lacy, W.B. 1996. Research, extension and user partnerships: Models for collaboration and strategies for change. *Agriculture and Human Values* 13:33-41.

Lal, R. 1987. Response of maize (*Zea mays*) and cassava (*Manihot esculenta*) to removal of surface soil from an alfisol in Nigeria. *International Journal of Tropical Agriculture* 5:77-92.

Lal, R. 1997. Residue management, conservation tillage and soil restoration for mitigating greenhouse effect by CO_2-enrichment. *Soil and Tillage Research* 43:81.

Lampkin, N.H. 1990. *Organic Farming.* Farming Press, Ipswich, UK.

Laudelout, H. 1990. La jachère forestière sous les tropiques humides, unité des eaux et forests, centre de Recherches Forestières de Chimay, Université Catholique de Louvan. Louvan-la-Neuve, Belgique.

Lavelle, P. 1996. *Conservation of Soil Fertility in Low Input Agricultural Systems of the Humid Tropics by Manipulating Earthworm Communities.* Macrofauna Project II Final Report. Laboratoire d'Ecologie des Sols Tropicaux, Centre ORSTOM, Bondy, France. 172 pp.

Lavelle, P., Dangerfield, M., Fragoso, C., Eschenbrenner, V., Lopez-Hernandez, D., Pashanasi, B. and Brussaard, L. 1994. The relationship between soil macrofauna and tropical soil fertility. In: Woomer, P. and Swift, J. (eds). *The Biological Management of Tropical Soil Fertility.* John Wiley and Sons, Chichester, UK. 137-169.

Lee, K.E. and Wood, T.G. 1971. *Termites and Soils.* Academic Press, London.

Leihner, D. 1983. *Management and Evaluation of Intercropping Systems with Cassava.* CIAT, Cali, Colombia. pp 70.

Lekasi, J.K., Bekunda, M., Woomer, P.L. and Tenywa, J. 1999. Decomposition of crop residues in banana-based cropping systems of uganda. *Biological Agriculture and Horticulture* 17:1-10.

Lekasi, J.K., Bekunda, M., Woomer, P.L. and Tenywa, J. 2001a. Effect of mulching cabbage with banana residues on cabbage yield, soil nutrient and moisture supply, soil biota and weed biomass. *African Crop Science Journal* 9:499-506.

Lekasi, J.K., Ndung'u, K.W. and Kifuko, M.N. 2003. A scientific perspective on composting. In: Savala, C.E.N., Omare, M.N. and Woomer, P.L. (eds). *Organic Resource Management in Kenya: Perspectives and Guidelines.* The Forum for Organic Resource Management and Agricultural Technologies, Nairobi, Kenya. pp 65-70.

Lekasi, J.K., Tanner, J.C., Kamini, S.K. and Harris, P.J.C. 2001b. *Managing Manure to Sustain Smallholder Livelihoods in the East African Highlands.* HDRA Publications, Coventry, UK. pp 32.

Lekasi, J.K., Tanner, J.C., Kimani, S.K. and Harris, P.J.C. 1998. *Manure Management in the Kenya Highlands: Practices and Potential.* HDRA Publications. Coventry, UK.

Lekasi, J.K., Tanner, J.C., Kimani, S.K. and Harris, P.J.C. 2003. Cattle manure quality in Maragua district, Central Kenya: Effect of management practices and development of simple methods of assessment. *Agriculture Ecosystems and Environment* 94:289-298.

Lerman, Z. 2001. Agriculture in transition economies: From common heritage to divergence. *Agricultural Economics* 26:95-114.

Levin, H.M., Pollitt, E., Galloway, R. and Mcguire, J. 1993. Micronutrient deficiency disorders. In: Jamison, D.T., Mosley, W.H., Measham, A.R. and Bobadilla, J.L. (eds). *Disease Control Priorities in Developing Countries.* Oxford University Press, Oxford. pp 421-451.

Levy, S. and Barahona, C. 2002. Main report of the evaluation programme: Targeted inputs programme. Department for International Development, London.

Lilienfein, J., Wilcke, W., Vilela, L., Avarza, M.A., Do Carmo Lima, S. and Zech, W. 2003. Soil fertility under native Cerrado and pasture in the Brazilian savanna. *Soil Science Society of America Journal* 67:1195-1205.

LiYu, X., YuanZhang, Y. and Jinghui, Q. (eds). 1996. Alternatives to Slash-and–Burn Agriculture. *Proceedings of an International Symposium Held in Kun Ming, P.R. China, 6-16 March 1995.* China Agricultural Sciencetech Press, Nanjing, China.

Lowendorf, H.S. 1980. Factors affecting survival of Rhizobium in soils. In: Alexander, M. (ed). *Advances in Microbial Ecology.* Plenum Press, New York.

Lynam, J.K. and Blackie, M.J. 1994. Building effective agricultural research capacity: The African challenge. In: Anderson, J.R. (ed). *Agricultural Technology: Policy Issues for the International Community*. CAB International, Wallingford, UK. pp 106-134.

Malavoita, E., Graner, E.A., Coury, T., Brasil Sobr, M.O.C. and Pacheco, J.A.C. 1955. Studies on the mineral nutrition of cassava. *Plant Physiology* 30:80-81.

Malik, M.A., Saleem, M.F., Sana, M. and Aziz, A. 2002. Agroeconomic expression of different relay crops after rice harvest under conventional and zero tillage. *International Journal of Agriculture and Biology* 4:277-278.

Manlay, R.J., Kiaries, M., Masse, D., Chotte, J.L., Ciornei, G. and Floret, C. 2002. Carbon, nitrogen and phosphorous allocation in agro-ecosystems of a West African savanna. I. The plant component under semi-permanent cultivation. *Agriculture, Ecosystems and Environment* 88:215-232.

Manson, J.B., Lotfi, M., Dalmiya, N., Sethuraman, K., Deitchler, M., Geibel, S., Gillenwater, K., Gilman, A., Mason, K. and Mock, N. 2001. *The Micronutrient Report: Current Progress in the Control of Vitamin A, Iodine, and Iron Deficiencies*. Micronutrient Initiative. International Development Research Center, Ottawa.

Manu, A., Bationo, A. and Geiger, S.C. 1991. Fertility status of selected millet producing soils in West Africa with emphasis on phosphorus. *Soil Science* 152:315-320.

Manyong, V.M., Makinde, K.O. and Ogungbile, A.G.O. 2002. Agricultural transformation and fertilizer use in the cereal based systems of the Northern Guinea Savanna. In: Vanlauwe, B., Diels, J., Sanginga, N. and Merckx, R. (eds). *Integrated Plant Nutrient Management in sub-Saharan Africa*. CAB International, Wallingford, UK.

Manyong, V.M., Makinde, K.O., Sanginga, N., Vanlauwe, B. and Diels, J. 2001. Fertilizer use and definition of farmer domains for impact-oriented research in the northern Guinea savanna of Nigeria. *Nutrient Cycling in Agroecosystems* 59:129-141.

Mapfumo, P., Campbell, B.M., Mpepereki, S. and Mafongoya, P. 2001. Legumes in soil fertility management: The case of pigeonpea in smallholder farming systems of Zimbabwe. *African Crop Science Journal* 9:629-644.

Marenya, P.P. and Barett, C.B. 2007. Household-level determinants of adoption of improved natural resources management practices among smallhold farmers in Western Kenya. *Food Policy* 32:515-536.

Marufu, L., Karanja, N. and Ryder, M. 1995. Legume inoculant production and use in East and Southern Africa. *Soil Biology and Biochemistry* 27:735-738.

Mason, S.C. and Leihner, D. 1988. Yield and land-use efficiency of a cassava/cowpea intercropping systems grown at different phosphorous rates. *Field Crops Research* 18:215-226.

Matata, J.B., Anandajayasekeram, P., Kiriro, T.N., Wandera, E.O. and Dixon, J. 2001. *Farming Systems Approach to Technology Development and Transfer*. A Source Book. FARMESA, Harare, Zimbabwe.

Maundu, P. and Tengäs, B. 2005. *Useful Trees and Shrubs for Kenya*. Technical Handbook No 35. World Agroforestry Centre Eastern and Central Africa Regional Programme. ICRAF, Nairobi, Kenya.

Maundu, P. Ngugi, G.W. and Kabuye, C.H.S. 1999. *Traditional Food Plants in Kenya*. Kenya Resource Centre for Indigenous Knowledge. National Museums of Kenya, Nairobi. pp 270.

McIntyre, B.D., Speijer, P.R., Riha, S.J. and Kizito, F. 2000. Effects of mulching on biomass nutrients and soil water in banana inoculated with nematodes. *Agronomy Journal* 92:1081-1085.

Meertens, H.C.C. 2003. The prospects for integrated nutrient management for sustainable rain fed lowland rice production in Sukuma land, Tanzania. *Nutrient Cycling in Agroecosystems* 65:163-171.

Mekonnen, K., Buresh, R.J., Coe, R. and Kipleting, K.M. 1999. Root length and nitrate under *Sesbania sesban*: Vertical and horizontal distribution and variability. *Agroforestry Systems* 42:265-282.

Mendez-Castro, F.A. and Alexander, M. 1976. Acclimatization of rhizobium to salt, increasing temperatures and acidity. *Review Latin America Microbiology* 18:15-158.

Merrill-Sands, D. and Kaimowitz, D. 1990. *The Technology Triangle: Linking Farmers, Technology Transfer Agents and Agricultural Researchers*. Summary report of international workshop held at ISNAR. Roman Press, UK.

Metelerkamp, H.R.R. 1988. Review of crop research relevant to semi-arid areas of Zimbabwe. *Cropping in the Semi-Arid Areas of Zimbabwe: Proceedings of a Workshop*. Agritex, Harare, Zimbabwe. pp 190-315.

Metherell, A.K., Harding, L.A., Cole, C.V. and Parton, W.J. 1993. *Century Soil Organic Matter Model Environment*. Great Plains System Research Unit Technical Report No 4. Fort Collins, USA.

Miguel, E. and Kremer, M. 2004. Worms: Identifying impacts on education and health in the presence of treatment externalities. *Econometrica* 72:159-217.

Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Wellbeing Synthesis*. Island Press, Washington, D.C.

Ministry of Agriculture National Agricultural Laboratories (MOA-NAL). 1988. *Fertilizer Use Recommendation Project (Phase I): Methodology and Inventory of Existing Information*. German Agency for Technical Cooperation, National Agricultural Laboratories. Nairobi, Kenya. 115 pp.

Mokwunye, A.U. 1995. Reactions in soils involving phosphate rocks. In: Gerner, H. and Mokwunye, A.U. (eds). *Use of Phosphate Rocks for Sustainable Agriculture in West Africa*. International Centre for Soil Fertility and Agricultural Development, Africa.

Moreira, F.M.S., Huising, E.J. and Bingell, D.E. (eds). 2008. *A Handbook of Tropical Soil Biology: Sampling and Characterization of Below-ground Biodiversity*. Earthscan Publishers, UK.

Morris, M., Kelly, V.A., Kopicki, R.J. and Byerlee, D. 2007. *Fertilizer Use in African Agriculture: Lessons Learned and Good Practices Guidelines*. World Bank, Washington, D.C. 144 pp.

Mosier, A.R., Syers, J.K. and Freney, J.R. 2004. *Agriculture and the Nitrogen Cycle*. SCOPE 65, Island Press. Washington, DC.

Mosse, B., Stribley, D.P. and Le Tacon, E. 1981. Ecology of mycorrhizae and mycorrhizal fungi. *Advances in Microbial Ecology* 5:137-210.

Mpepereki, S., Javaheri, F., Davis, P. and Giller, K.E. 2000. Soybeans and sustainable agriculture: promiscuous soybeans in Southern Africa. *Field Crops Research* 65:137-149.

Mukhwana, E.J. 2000. Food security and the impact of agricultural development in Western Kenya: Problems and opportunities. *Agricultural Research and Extension Newsletter* 41:21-26.

Mukhwana, E.J. and Musioka, M.W. 2003. Extension of organic resource management technologies. In: Savala, C., Omare, M. and Woomer, P.L. (eds). *Organic Resource Management in Kenya: Perspectives and Guidelines*. The Forum for Organic Resource Management and Agricultural Technologies, Nairobi. pp 146-152.

Mureithi, J.G., Gachene, C.K., Muyekho, F.N., Onyango, M., Mose, L. and Magenya, O. 2002. *Participatory Technology Development for Soil Management by Smallholders in Kenya*. Kenya Agricultural Research Institute Legume Network Project, Nairobi. 551 pp.

Murwira, H.K. 2003. Managing Africa's soils: Approaches and challenges. In: Gichuru, M.P., Bationo, A., Bekunda, M.A., Goma, H.C.M., Mafongoya, P.L., Mugendi, D.N., Murwira, H.K., Nandwa, S.M., Nyathi, P. and Swift, M.J. (eds). *Soil Fertility Management in Africa: A Regional Perspective*. Academy Science Publishers, Nairobi. pp 293-306.

Muzira, R.N., Amoding, A. and Bekunda, M.A. 2003. Preparing compost and silage from water hyacinth. In: Savala, C.E.N., Omare, M.N. and Woomer, P.L. (eds). *Organic Resource Management in Kenya: Perspectives and Guidelines*. Forum for Organic Resource Management and Agricultural Technologies, Nairobi. pp 75-79.

Mwaura, F.M. and Woomer, P.L. 1999. Fertilizer retailing in the Kenyan highlands. *Nutrient Cycling in Agroecosystems* 10:150-157.

Myers, R.J.K., Palm, C.A., Cuevas, E., Gunatilleke, I.U.N. and Brossard, M. 1994. The synchronization of nutrient mineralization and plant nutrient demand. In: Woomer, P.L. and

Swift, M.J. (eds). *The Biological Management of Tropical Soil Fertility*. John Wiley & Sons, Chichester, UK. Pp81-116.

N'dungu, K.W., Kifuko, M.N. and Okalebo, J.R. 2003. Producing fortified compost from crop residues. In: Savala, E.N., Omare, M.N. and Woomer, P.L. (eds). *Organic Resource Management in Kenya: Perspectives and Guidelines*. Forum for Organic Resource Management and Agricultural Technologies, Nairobi. pp 71-74.

Nair, P.G. and Aiyer, R.S. 1985. Effect of potassium nutrition of cassava growth. Yield components and yield. *Journal of Root Crops* 2:23-28.

Nalewaja, J. 2001. Weeds and Conservation Agriculture. *World Congress on Conservation Agriculture* 1:191-200, Madrid.

Nelson, D.W. and Sommers, L.E. 1975. A rapid and accurate procedure for estimation of organic carbon in soils. *Proceedings of Indiana Academy of Science* 84:456-82.

Neue, H.U., Becker-Heidmann, P. and Scharpenseel, H.W. 1990. Organic matter dynamics, soil properties and cultural practices in rice lands and their relationship to methane production. In: Bouwman, A.F. (ed). *Soils and the Greenhouse Effect*. John Wiley Sons, England. pp 458-473.

Nicholson, S.E. 2001. Climatic and environmental change in Africa during the last two Centuries. *Climate Research* 17:123-144.

Nkedi-Kizza, P., Aniku, J., Awuma, K. and Gladwin, C.H. 2002. Gender and soil fertility in Uganda: A comparison of soil fertility indicators for women and men's agricultural plots. *African Studies Quarterly* 6.

Noble, I. and Scholes, R.J. 2001. Sinks and the Kyoto Protocol. *Climate Policy* 1:5-25.

Norman, D.W., Francis, C.A. and Henrich, G.M. 1994. Providing relevant education and training for sub-Saharan African agricultural scientists: Foundation for a sustainable future. *Journal of Sustainable Agriculture* 4:79-90.

Nweke, F.I. 1994. Farm level practices relevant to cassava plant protection. *African Crop Science Journal* 2:563-582.

Nweke, F.I., Lynam, J.K. and Spencer, D.S.C. 2002. *The Cassava Transformation: Africa's Best-kept Secret*. Michigan State University Press, Michigan, USA.

Nye, P.H. and Greenland, D.J. 1960. *The Soil under Shifting Cultivation*. Commonwealth Agriculture Bureaux Technical Communication 51. Harpenden, UK.

Nye, P.H. and Greenland, D.J. 1964. Changes in the soil after clearing tropical forest. *Plant Soil* 21:101-112.

Nziguheba, G., Merckx, R. and Palm, C.A. 2002a. Soil phosphorus dynamics and maize response to different rates of phosphorus fertilizer applied to an Acrisol in Western Kenya. *Plant and Soil* 243:1-10.

Nziguheba, G., Merckx, R., Palm, C.A. and Mutuo, P. 2002b. Combining *Tithonia diversifolia* and fertilizers for maize production in a phosphorus deficient soil in Kenya. *Agroforestry Systems* 55: 165-174.

Nziguheba, G., Merckx, R., Palm, C.A. and Rao, M.R. 2000. Organic residues affect phosphorus availability and maize yields in a nitisol of Western Kenya. *Biology and Fertility of Soils* 32:328-339.

O'Hara, G.W., Howieson, J.G. and Graham, P.H. 2002. Nitrogen fixation and agricultural practice. In: Leogh, G.J. (ed). *Nitrogen Fixation in the Millennium*. Elsevier Applied Science Publishers, Essex, England. pp 391-410.

Obigbesan, G.O. and Fayemi, A.A. 1976. Investigation on Nigerian root and tuber crops: Influence of nitrogen fertilization on the yield and chemical composition of two cassava cultivars (*Manihot esculenta*). *Journal of Agricultural Science* 86:401-406.

Odhiambo, G. and Woomer, P.L. 2005. Striga emergence and seed bank dynamics under different maize management practices in Western Kenya. *African Crop Science Conference Proceedings* 7:473-477.

Odingo, R.S. 1971. *The Kenya Highlands: Land Use and Agricultural Development.* AST Africa Publishing House, Nairobi. 229 pp.

Ofori, C.S. 1973. The effect of ploughing and fertilizer application on yield of cassava (*Manihot esculenta* Crantz). *Agricultural Science* 6:21-24.

Oganization for Economic Co-operation and Development (OECD). Enhancing women's market access and promoting pro-poor growth: An extract from promoting pro-poor growth-private sector development. OECD Development Assistance Committee (DAC). Organization for Economic Cooperation And Development, Paris.

Ojiem, J.O. 2006. *Exploring Socioecological Niches for Legumes in Smallholder Farming Systems of Western Kenya.* Ph.D Thesis, Wageningen University, Wageningen.

Ojiem, J.O., De Ridder, N., Vanlauwe, B. and Giller, K.E. 2006. Socioecological niche: A conceptual framework for integration of legumes in smallholder farming systems. *International Journal of Agricultural Sustainability* 4:79-93.

Okalebo, J.R. 2009. *Recognizing the Constraint of Soil Fertility Depletion and Technologies to Reverse it in Kenyan Agriculture.* Moi University Inaugural Lecture Series No 1. Moi University Press, Eldoret, Kenya.

Okalebo, J.R., Gathua, K.W. and Woomer, P.L. 2002. *Laboratory Methods of Soil and Plant Analysis. Second Edition.* SACRED-Africa Press, Nairobi. pp 128.

Okalebo, J.R., Otieno, C.O., Woomer, P.L., Karanja, N.K., Semoka, J.R.M., Bekunda, M.A., Mugendi, D.N., Muasya, R.M., Bationo, A. and Mukhwana, E.J. 2006. Available technologies to replenish soil fertility in East Africa. *Nutrient Cycling in Agroecosystems* 76:153-170.

Okalebo, J.R., Palm, C.A., Lekasi, J.K., Nandwa, S.M., Otieno, C.O., Waigwa, M. and Ndungu, K.W. 2003. Use of organic and inorganic resources to increase maize yields in some Kenyan infertile soils: A five-year experience. In: Bationo, A. (ed). *Managing Nutrient Cycles to Sustain Soil Fertility in sub-Saharan Africa.* Academy Science Publishers, Nairobi, Kenya. pp 359-372.

Okali, C. and Sumberg, J. 1994. *Farmer Participatory Research: Rhetoric and Reality.* Intermediate Technology Press, London.

Okeke, J.E. 1984. Cassava productivity in intercropping systems. In: *Symposium of the International Society for Tropical Root Crops.* Chichester, Great Britain. pp 109-163.

Okello-Oloya, T. and Spain, A.V. 1986. Comparative growth of two pasture plants from North Eastern Australia on the mound materials of grass and litter feeding termites (*Isoptera: Termitidae*) and on their associated surface soils. *Revue Ecology and Biology of Soil* 23:381-92.

Okigbo, B.N. 1990. Sustainable agricultural systems in tropical Africa. In: Edwards, C.A., Lal, R., Madden, P., Miller, R. and House, G. (eds). *Sustainable Agricultural Systems.* Soil and Water Conservation Society. Akeny, Iowa. pp 323-352.

Okoth, J., Braun, A., Delve, R., Khamaala, H., Khisa, G. and Thomas, J. 2006. *The Emergence of Farmer Field Schools Networks in Eastern Africa.* Paper presented at the CAPRI program on collective action and property rights research workshop on collective action and market access for smallholders. CIAT, Cali, Colombia.

Olaniyan, G.O., Tiamiyu, S.A., Umar, A. and Oyegoke. 2002. Participatory evaluation of the effect of post-rice upland crops on the profitability of lowland rice production systems. In: Sayang, S., Ajayi, A. and Sy, A.A. (eds). *Proceedings of the Second Biennial Regional Rice Review.* The Africa Rice Center, Bouake, Cote d'Ivoire. pp 65-74.

Oliver, R. 1982. The Nilotic contribution to Bantu Africa. *Journal of African History* 23:433-442.

Olsen, R.A., Anderson, E.N., Frank, K.D., Gabrouski, P.H., Rehin, G.W. and Shapiro, C.A. 1987. Soil testing interpretations: Sufficiency vs. build-up and maintenance. In: Brown, J.R. (ed). *Soil Testing: Sampling Correlation, Calibration and Interpretation.* Soil Science Society of America, Madison. pp 41-64.

Olsen, S.R., Cole, C.V., Watanabe, F.S. and Dean, L.A. 1954. Estimation of available phosphorous in soils by extraction with sodium bicarbonate. *USDA Circular No 939.* USDA, Washington D.C.

Omamo, S.W. 1998 Transport costs and smallholder cropping choices: An application to Siaya district, Kenya. *American Journal of Agricultural Economics* 80:116-123.

Omamo, S.W. 2006. *Back to the Future: Reversing Recent Trends for Food Security in Eastern Africa.* International Food Policy Research Institute (IFPRI), Washington, D.C.

Omamo, S.W. and Farrington, J. 2004. Policy research and African agriculture: Time for a dose of reality. *Natural Resource Perspectives 90*. Overseas Development Institute, London.

Omore. A., Staal, S. and Thorpe, W. 1997. The role of membership organizations and the gap they fill in private veterinary services delivery. http://www.fao.org/ag/aga/agah/vets-1/e91.

Ong, C.K. and Black, C.R. 1995. Complementary in resource use in agroforestry systems. In: Kang, B.T. (ed). *Proceedings of Second International Alley Farming Workshop.* International Development Research Centre, Ottawa, Canada.

Otieno, H., Maina, J., Omare, M.N., Omanya, G. and Woomer, P.L. 2005. Field testing imazapyr-resistant maize to control striga in Western Kenya. *African Crop Science Conference Proceedings* 7:461-465.

Owour, C., Tenywa, J.S., Muwanga, S., Woomer, P.L. and Esele, P. 2002. Performance of a sorghum-legume intercrops in response to row orientation and arrangement under two levels of nitrogen. *Program and Extended Abstracts. FORUM Working Document No 5*. The Forum on Agricultural Resource Husbandry, Nairobi. pp 542-544.

Palm, C.A., Gachengo, C.N., Delve, R.J., Cadisch, G. and Giller, K.E. 2001. Organic inputs for soil fertility management: Some rules and tools. *Agriculture Ecosystems and Environment* 83:27-42.

Palm, C.A., Myers, R.J.K., and Nandwa, S.M. 1997. Organic-inorganic nutrient interaction in soil fertility replenishment. In: Buresh, R.J., Sanchez, P.A. and Calhoun, F. (eds). *Replenishing Soil Fertility in Africa.* Soil Science Society of America, Madison Wisconsin. pp 193-218.

Palm, C.A., Swift, M. and Woomer, P. 1996. Soil biological dynamics in slash and burn agriculture. *Agriculture Ecosystems and Environment* 58:61-74.

Parton, W., Woomer, P. and Martin, A. 1994. Modeling soil organic matter dynamics and plant productivity in tropical ecosystems. In: Woomer, P.L. and Swift, M.J. (eds). *The Biological Management of Tropical Soil Fertility.* John Wiley and Sons, Chichester, UK. pp 171-189.

Patel, B.K. and Woomer, P.L. 2000. Strengthening agricultural education in Africa: The approach of the forum for agricultural resource husbandry. *Journal of Sustainable Agriculture* 16:53-74

Patel, B.K., Muir-Leresche, K., Coe, R. and Hainsworth, S.D. 2004. *The Green Book: A Guide to Effective Graduate Research in African Agriculture, Environment and Rural Development.* The African Crop Science Society, Kampala, Uganda. 248 pp.

Peverill, K.I., Sparrow, L.A. and Reuter, D.J. 1999. *Soil Analysis: An Interpretation Manual.* CSIRO Publishing, Collinwood, Australia. pp 369.

Philip, T., Taylor, D., Sanni, L., Okechukwu, E., Ezedinma, C., Akoroda, M., Lemchi, J., Ilona, P., Orbe, E., Okoro, E. and Dixon, A. 2005. The Nigerian cassava industry: Statistical handbook. IITA, Ibadan, Nigeria. 30 pp.

Pieri, C. 1989. Fertilite des terres de savannes. SIRAD Insititute Recherches Agronomiques Tropicales, Paris.

Piha, M.I. 1993. Optimizing fertilizer use and practical rainfall capture in a semi-arid environment with variable rainfall. *Experimental Agriculture* 29:405-415.

Pinheiro, S.L.G., Chamala, S. and Pearson, C.J. 1996. Participation in farming system research and extension: New perspectives for small family farmers or just a reformulation of old development paradigms. In: Ranaweera, N.F.C., Gunasena, H.P.M. and Senanayake, Y.D.A. (eds). *Changing Agricultural Opportunities: The Role of Farming Systems Approaches.* Proceedings of the 14th International Symposium on Sustainable Farming Systems. Colombo, Sri Lanka. pp 129-139.

Place, F., Barrett, C.B., Freeman, H.A., Ramisch, J.J. and Vanlauwe, B. 2003. Prospects for integrated soil fertility management using organic and inorganic inputs: Evidence from smallholder African agricultural systems. *Food Policy* 28:365-378.

Porter, W.M. 1979. Most probable number method for enumerating infective propagules of vesicular arbuscular mycorrhizal fungi in soil. *Australian Journal of Soil Research* 17:515-519

Poulton, C., Kydd, J. and Dorward, A. 2006. Increasing fertilizer use in Africa: What have we learned? *Agriculture and Rural Development Discussion Paper 25*. World Bank, Washington, D.C.

Poulton, C., Kydd, J., Wiggins, S. and Dorward, A. 2005. *State Intervention for Food Price Stabilization in Africa: Can It Work?* Department for International Development Workshop Managing Food Price Risks and Instability. World Bank, Washington, D.C.

Pound, B., Snapp, S., Mcdugall, C. and Braun, A. (eds). 2003. *Managing Natural Resources for Sustainable Livelihoods. Uniting Science and Participation*. International Development Research Centre (IDRC). Earthscan Publications, London.

Powell, J.M. and Williams, T.O. 1995. An overview of mixed farming in sub-Saharan Africa. In: Powell, L.M., Fernandez-Rivera, S., Williams, O.T. and Renard, C. (eds). *Livestock and Sustainable Nutrient Cycling in Mixed Farming Systems of Sub-Saharan Africa. Volume II. Technical Papers*. International Livestock Centre for Africa, Addis Ababa, Ethiopia. pp 21-36.

Powell, J.M., Fernandez, S., Hiernaux, P. and Turner, M. 1996. Nutrient cycling in integrated rangeland/cropland systems of the Sahel. *Agricultural Systems* 52:143-170.

Powell, J.M., Pearson, R.A. and Hiernaux, P.H. 2004. Crop-livestock interactions in the West African drylands. *Agronomy Journal* 96:469-483.

Prudencio, C.F. 1993. Ring management of soils and crops in the West African semi-arid tropics: The case of the Mossi farming system in Burkina Faso. *Agriculture Ecosystems and Environment* 47:237-264.

Purseglove, J.W. 1972. *Tropical Crops: Monocotyledons*. John Wiley and Sons, New York. pp 607.

Pypers, P., Verstraete, S., Thi, C.P. and Merckx, R. 2005. Changes in mineral nitrogen, phosphorous availability and salt-extractable aluminum following the application of green manure residues in two weathered soils of South Vietnam. *Soil Biology and Biochemistry* 37:163-172.

Quiñones, M.A., Borlaug, N.E. and Dowswell, C.R. 1997. A fertilizer-based green revolution for Africa. In: Buresh, R.J., Sanchez, P.A. and Calhoun, F. (eds). *Replenishing Soil Fertility in Africa*. Soil Science Society of America Special Publication 51, Madison, USA. pp 81-95.

Quisumbing, A.R. 1996. Male-female differences in agricultural productivity: Methodological issues and empirical evidence. *World Development* 24:1579-1595

Rahman, A., James, T.K. and Gunther, P. 1993. Bioassays of soil applied herbicides. *Proceedings of the International Symposium of Indian Society of Weed Science*. Indian Society of Weed Science, Hisar.

Rahman, F.H. 1993. Not a burden but a force. *International Agricultural Development* January/February. pp 11-12

Rainbow, R. 2008. Integration of no-till and precision agriculture technologies and future challenges to Conservation Agriculture in Australia. In: Goddard, T., Zoebisch, M.A., Gan, Y.T., Ellis, W., Watson, A. and Sombatpanit, S. (eds). *No-Till Farming Systems*. World Association of Soil and Water Conservation, Bangkok. pp 223-246.

Rashid, A. and Fox, R.L. 1992. Evaluating internal zinc requirement of grain crops by seed analysis. *Agronomy Journal* 84:469-474.

Rattray, A. and Ellis, B. 1952. Maize and green manuring in Southern Rhodesia. *Rhodesia Agricultural Journal* 49:188-197.

Reardon, T., Kelly, V., Crawford, E., Jayne, T., Savadogo, K. and Clay, D. 1997. Determinants of farm productivity in Africa: A synthesis of four case studies. *Technical Paper No. 75. SD Publication Series*. Office of Sustainable Development, Bureau for Africa.

Reddy, P.H. and Roger, P.A. 1988. Dynamics of algal populations and acetylene reducing activity in five rice soils inoculated with blue-green algae. *Biology and Fertility of Soils* 6:14-21.

Reeves, F.B. 1985. Survival of VA Mycorrhizal fungi- Interactions of secondary succession, mycorrhizal dependency in plants, and resource competition. *Sixth North American Conference on Mycorrhizae*. Oregon State University, Forest Research Laboratory, USA.

Reeves, F.B., Wagner, D., Moorman, T. and Kiel, J. 1979. The role of endomycorrhizae in revegetation practices in the semi-arid west. I. A comparison of incidence of mycorrhizae in severely disturbed vs. natural environments. *American Journal of Botany* 66:6-13.

Reicosky, D.C. 2008. Carbon sequestration and environmental benefits from no-till systems. In: Goddard, T., Zoebisch, M.A., Gan, Y.T., Ellis, W., Watson, A. and Sombatpanit, S. (eds). *No-Till Farming Systems*. World Association of Soil and Water Conservation, Bangkok. pp 43-58.

Reij, C. and Thiombiano, T. 2003. Development rural et environment au Burkina Faso: La rehabilitation de la capacite productive des terroirs sur la partie nord du plateau central entre 1980 et 2001. Free University of Amsterdam, Amsterdam. pp 80.

Reij, C., Scoones, I. and Toilmin, C. (eds). 1996. *Sustaining the Soil: Indigenous Soil and Water Conservation in Africa*. Earthscan, London.

Republic of Kenya (RoK). 2001. *Kenya Population and Housing Census 1999. Volume 1: Population by Administrative and Urban Centres*. Central Bureau of Statistics, Ministry of Finance and Planning, Nairobi. pp 415.

Roose, E. and Barthès, B. 2001. Organic matter management for soil conservation and productivity restoration in Africa: A contribution from francophone research. *Nutrient Cycling in Agroecosystems* 61:159-170.

Rufino, M.C., Tittonell, P., Van Wijk, M.T., Castellanos-Navarrete, A., de Ridder, N. and Giller, K.E. 2007. Manure as a key resource to sustainability of smallholder farming systems: Analysis farm scale nutrient cycling efficiencies within the NUANCES framework. *Livestock Science* 112:137-150.

Rumley, O.R. and Ong, C. 2007. Wetting Africa's appetite. Conservation Agriculture is turning rainfall into higher crop yields and catching on. *RELMA Review Series 3*, Nairobi.

Rundgren, G. 1998. *Building Trust in Organics: A Guide to Setting up Organic Certification Programmes*. International Federation of Organic Agriculture Movements. Tholey-Theley, Germany.

Rusike, J., Sukume, C., Dorward, A., Mpepereki, S. and Giller, K.E. 1999. *The Economic Potential of Smallholder Soybean Production in Zimbabwe*. Soil Fertility Network for Maize-based Cropping Systems in Malawi and Zimbabwe. CIMMYT, Harare.

Russell, E.W. 1973. *Soil Conditions and Plant Growth. Tenth Edition*. Longman, London.

Sá, J.C.M. 2004. Adubação fosfatada no sistema de plantio direto. In: Yamada, T. Silvia, R.S., Piracicaba, A. and Potafós, S.P. (eds). *Sympósio Sobre Fósforo Na Agricultura Brasileira, Anais*. pp 201-222.

Sae-Lee, S., Vitykon, P. and Prachaiyo, B. 1992. Effects of trees on paddy bund on soil fertility and rice growth in north east Thailand. *Agroforestry Systems* 18:213-223.

Sahrawat, K.L., Jones, M.P. and Diatta, S. 1995. Response of upland rice to phosphorous in an ultisol in the humid forest zone of West Africa. *Nutrient Cycling in Agroecosystems* 41:1-6.

Saint Macary, H., Beunard, P., Scaglia, J., Hakizimna, A. and Pandzou, A. 1993. Inoculant des legumineuses en milieu tropical: Recherché-developpement et aspects economiques In: Mulongony. K., Gueye, M. and Spencer, D.S.C. (eds). *Biological Nitrogen Fixation and Sustainability of Tropical Agriculture*. John Wiley and Sons, New York. pp 343-351.

Saito, K.A. and Weidemann, C.J. 1990. Agricultural extension for women farmers in Africa. *Policy Research Working Paper Series No 398*. The World Bank, Washington D.C.

Sakala, W.D., Cadisch, G. and Giller, K.E. 2000. Interactions between residues of maize and pigeonpea and mineral N fertilizer during decomposition and N mineralization. *Soil Biology and Biochemistry* 32:699-706.

Samaké, O. 2003. *Integrated Crop Management Strategies in Sahelian Land Use Systems to Improve Agricultural Productivity and Sustainability: A Case Study in Mali*. Ph.D. Thesis, Wageningen University, Netherlands.

Samaké, O., Smaling, E.M.A., Kropff, M.J., Stomph, T.J. and Kodio, A. 2005. Effects of cultivation practices on spatial variation of soil fertility and millet yields in the Sahel of Mali. *Agriculture Ecosystems and Environment* 109:335-345.

Sama-Lang, P. 2004. Soil and water conservation in banana production between mount Cameroon and Bambutus Mountain. *International Soil Conservation Organization Conference*. Brisbane, Australia.

Sanchez, P.A. 1994. Tropical soil fertility research toward the second paradigm. *15th World Congress of Soil Science*. Acapulco, Mexico. pp 65-88.

Sanchez, P.A. 2009. A smarter way to combat hunger. *Nature* 458:1-3.

Sanchez, P.A., Palm, C., Sachs, J., Denning, G., Flor, R., Harawa, R., Jama, B., Kiflemarium, T., Konecky, B., Kozar, R., Llerai, E., Malik, A., Modi, V., Mutuo, P., Niang, A., Okoth, H., Place, F., Sachs, S.E., Said, A., Siriri, D., Teklehaimanot, A., Wang, K., Wangila, J. and Zamba, C. 2007. The African millennium villages. *Proceedings of the National Academy of Sciences* 104:16775-16780.

Sanchez, P.A., Shepherd, J.D., Soule, M.J., Place, F.M., Buresh, R.J., Izac, A.M.N., Mukwonye, A.U., Keswiga, F.R., Ndiritu, C.G. and Woomer, P.L. 1997. Soil fertility replenishment in Africa: An investment in natural resource capital. In: Buresh, R.J., Sanchez, P.A. and Calhoun, F. (eds). *Replenishing Soil Fertility in Africa*. SSSA Special Publication No. 51. Soil Science Society of America. Madison, USA. pp 1-46.

Sanginga, N., Carsky, R.J. and Dashiell, K.E. 1999. AMF Response to rhizobial inoculation and cropping systems in farmer's fields in the Guinea savanna. *Biology and Fertility of Soil* 30:179-186.

Sanginga, N., Dashiell, K., Diels, J., Vanlauwe, B., Lyasse, O., Carsky, R., Tarawali, J.S., Asafo-Adjei, B., Menkir, A., Schulz, S., Singh, B.B., Chikoye, D., Keatinge, D. and Rodomiro, O. 2003. Sustainable resource management coupled to resilient germplasm to provide new intensive cereal–grain legume–livestock systems in the dry savanna. *Agriculture Ecosystems and Environment* 100:305-314.

Sanginga, N., Dashiell, K., Okogun, J.A. and Thottappilly, G. 1997. Nitrogen fixation and N contribution in promiscuous soybeans in the Southern Guinea Savanna of Nigeria. *Plant and Soil* 195:257-266.

Sanginga, N., Ibewiro, B., Houngdandan, P., Vanlauwe, B., Okogun, J.A., Akobundu, I.O and Versteeg, M. 1996. Evaluation of symbiotic properties and nitrogen contribution of mucuna to maize grown in the derived savanna of West Africa. *Plant and Soil* 179:119-129.

Sanginga, N., Okogun, J.A., Vanlauwe, B. and Dashiell, K. 2002. The contribution of nitrogen by promiscuous soybeans to maize-based cropping in the moist savanna of Nigeria. *Plant and Soil* 241:223-231.

Sanginga, N., Okogun, J.A., Vanlauwe, B., Diels, J. and Dashiell, K. 2001a. Contribution of nitrogen fixation to the maintenance of soil fertility with emphasis on promiscuous soybean-based cropping systems in the moist savanna of West Africa. In: Tian, G. Ishida, F. and Keatinge, J.D.H. (eds). *Sustaining Soil Fertility in West Africa*. SSSA Special Publication No. 58. Soil Science Society of America. Madison, USA. pp 157-178.

Sanginga, N., Thottappilly, G. and Dashiell, K. 2000. Effectiveness of rhizobia nodulating recent promiscuous soybean selections in the moist savanna of Nigeria. *Soil Biology and Biochemistry* 32:127-133.

Sanginga, P., Kaaria, S., Muzira, R., Delve, R., Njuki, J., Vanlauwe, B., Chiarm, J. and Sanginga, N. 2007. The resources-to-consumption system: A framework for linking soil fertility management innovations to market opportunities. In: Bationo, A., Waswa, B., Kihara, J. and Kimetu, J. (eds). *Advances in Integrated Soil Fertility Management in sub-Saharan Africa: Challenges and Opportunities*. Springer, Dordrecht, The Netherlands. pp 979-992.

Sanginga, P.C., Best, R., Chitsike, C., Delve, R., Kaaria, S. and Kirkby, R. 2004. Enabling rural innovation in Africa: An approach for integrating farmer participatory research and market orientation for building the assets of rural poor. *Uganda Journal of Agricultural Sciences* 9:942-957.

Savala, C.E.N., Omare, M.N. and Woomer, P.L. (eds). 2003. *Organic Resource Management in Kenya: Perspectives and Guidelines*. Forum for Organic Resource Management and Agricultural Technologies. Nairobi, Kenya. pp 184.

Sayang, S., Ajayi, A. and Sy, A.A. (eds). 2002. *Proceedings of the Second Biennial Regional Rice Review*. The Africa Rice Center (WARDA), Bouake, Cote d'Ivoire.

Sayer, J.A. and Campbell, B. 2001. Research to integrate productivity enhancement, environmental protection and human development. *Conservation Ecology* 5.

Schutte, K. 1954. A survey of plant minor element deficiencies in Africa. *African Soils* 3:285-292.

Selener, D. 2005. Definitions, assumptions, characteristics and types of farmer participatory research. In: Gonsalves, J., Becker, T., Braun, A., Campilan, D., De Chavez, H., Fajber, L., Kapiriri, M., Rivaca-Caminade, J. and Vernooy, R. (eds). *Participatory Research and Development for Sustainable Agriculture and Natural Resource Management. Understanding Participatory Research and Development*. International Development Research Centre, Ottawa, Canada. pp 5-9.

Seward, P. and Okello, D. 1999. Rural roads and natural resource management in the semi-arid lands of Kenya, Mini-pac method. *SCODP Special Report No 1*. Sustainable Community Oriented Development Programme, Sega, Kenya.

Shapiro, B.I. and Sanders, J.H. 1998. Fertilizer use in semi-arid West Africa: Profitability and supporting policy. *Agricultural Systems* 56:467-482.

Shepherd, G., Buresh, R.J. and Gregory, P.J. 2001. Inorganic soil nitrogen distribution in relation to soil properties in smallholder maize fields in the Kenya highlands. *Geoderma* 101:87-103.

Shepherd, K.D. and Soule, M.J. 1998. Soil fertility management in West Kenya: Dynamic simulation of productivity, profitability and sustainability at different resource endowment levels. *Agriculture Ecosystems and Environment* 71:131-145.

Shepherd, K.D. and Walsh, M.G. 2007. Infrared spectroscopy enabling evidence-based diagnostic surveillance approach to agricultural and environmental management in developing countries. *Journal of Near Infrared Spectroscopy* 15:1-19.

Sieverding, E. and Liehner, D.E. 1984. Influence of crop rotation and intercropping of cassava with legumes on VA mycorrhizal symbiosis of cassava. *Plant Soil* 80:143-146.

Sifri, Z., Darnton-Hill, I., Baker, S.K., Bendech, M.A., Baker, S.K., Aguayo, V.M. and Bendech, M.A. 2002. A concise overview of micronutrient deficiencies in Africa and future directions. *African Journal of Food, Agriculture, Nutrition and Development* 2:78-85.

Sileshi, G. and Mafongoya, P.L. 2003. Effect of rotational fallows on abundance of soil insects and weeds in maize crop in Eastern Zambia. *Applied Soil Ecology* 23:211-222.

Sillanpa, M. 1982. *Micronutrients and the Nutrient Status of the Soils: A Global Study*. FAO, Rome.

Sillanpa, M. 1990. Micronutrient assessment at the country level: An international study. *FAO Soils Bulletin* 63. FAO, Rome.

Silvestre, P. 1989. Cassava. The Tropical Agriculturalist. Macmillan Publishers, London.

Singh, P., Alagarswamy, G., Hoogenboom, G., Pathak, P., Wani, S.P. and Virmani, S.M. 1999. Soybean-chickenpea rotation on vertic inceptisols. II. Long-term simulation of water balance and crop yields. *Field Crops Research* 63:225-236.

Singh, Y., Bains, J.S. and Singh, B. 2004. Need-based fertilizer nitrogen management using leaf color chart in irrigated rice in Punjab, India. Punjab Agricultural University, Ludhiana, India. pp 1-7.

Singleton, P.W. and Tavares, J.W. 1986. Inoculation response of legumes in relation to the number and effectiveness of indigenous rhizobium population. *Applied and Environmental Microbiology* 51:1013-1018.

Siziba, S. 2008. *Assessing the Adoption of Conservation Agriculture in Zimbabwe's Smallholder Sector*. Ph.D Thesis, University of Hohenheim, Germany.

Slingerland, M.A., Traore, K., Kayodé, P. and Mitchikpe, E. 2006. Fighting Fe deficiency malnutrition in West Africa: An interdisciplinary program on a food chain approach. *NJAS* 53(3-4): 253-279

Smaling, E.M.A, Nandwa, S.M. and Janssen, B.H. 1997. Soil fertility is at stake! In: Buresh, R.J., Sanchez, P.A. and Calhoun, F. (eds). *Replenishing Soil Fertility in Africa.* SSSA Special Publication No. 51. Soil Science Society of America, Madison, Wisconsin, USA. pp 47-61.

Smaling, E.M.A. (ed). 1998. Nutrient flows and balances as indicators of productivity and sustainability in sub-Saharan African agro-ecosystems. *Agriculture Ecosystem and Environment* 71 (special issue)

Smaling, E.M.A. and Braun, A.R. 1996. Soil fertility research in sub-Saharan Africa: New dimensions, new challenges. *Communication in Soil Science Plant Analysis* 27:365-386.

Smaling, E.M.A. and Janssen, B.H. 1993. Calibration of QUEFTS, a model predicting nutrient uptake and yields from chemical soil fertility indices. *Geoderma* 59:21-44.

Smaling, E.M.A. and Reij, C.P. 2008. Analyzing successes in agriculture and land management in sub-Saharan Africa: Is macro-level gloom obscuring positive micro-level change? *Land Use Policy* 25:410-420.

Smaling, E.M.A., Fresco, L.O. and De Jager, A. 1996. Classifying, monitoring and improving soil nutrient stocks and flows in African agriculture. *Ambio* 25:492-492.

Smaling, E.M.A., Nandwa, S.M., Presteele, H., Roetter, R. and Muchena, F.N. 1992. Yield response of maize to fertilizers and manure under different agro-ecological conditions in Kenya. *Agriculture Ecosystems and Environment* 41:241-252.

Smaling, E.M.A., Toure, M., de Ridder, N., Sanginga, N. and Breman, H. 2006. Fertilizer use and the environment in Africa: Friends or foes? *Background Paper Prepared for the African Fertilizer Summit.* Abuja, Nigeria.

Smith, J.A., Barau, D., Goldman, A. and Mareck, J.H. 1994. The role of technology in agricultural intensification: The evolution of maize production in the Northern Guinea Savanna of Nigeria. *Economic Development and Cultural Change* 42:537-554.

Smithson, P.C., Mcintyre, B.D., Gold, C.S., Ssali, H. and Kashaija, I.N. 2001. Nitrogen and potassium fertilizer vs. nematode and weevil effects on yield and foliar nutrient status of banana in Uganda. *Nutrient Cycling in Agroecosystems* 59:239–250.

Snapp, S.S. 2004. Innovation in extension: Example from Malawi. *Hortitechnology* 14:8-13.

Snapp, S.S., Nyiraneza, J. and O'Neil, K. 2003. Organic inputs and a cover crop short rotation for improved potato productivity and quality. In: *Michigan Potato Research Report. Volume 34*. Michigan State University Agricultural Experimental Station in cooperation with the Michigan Potato Industry Commission, East Lansing, Michigan. pp 139-144.

Sogbedji, J.M., Van, H.M., Melkonian, J.R.R. and Schindelbeck, R.R. 2006. Evaluation of the PNM model for simulating drain flow nitrate-N concentration under manure fertilized maize. *Plant and Soil* 282:343-360.

Sombroek, W.G., Braun, H.M.H. and Van Der Pouw, B.J.A. 1982. Exploratory Soil Map and Agroclimatic Zone Map of Kenya. *Kenya Soil Survey Report No E*1. National Agricultural Research Laboratories, Nairobi. pp 56.

Spielman, D.J., Hartwich, F. and Von Grebmer, K. 2007. *Sharing Science, Building Bridges and Enhancing Impact: Public-private Partnerships in the CGIAR.* The International Food Policy Research Institute (IFPRI) Discussion Paper No 00708. Washington, D.C.

Stockbridge, M., Dorward, A. and Kydd, J. 2003. *Farmer Organizations for Market Access: A Briefing Paper.* Imperial College, London.

Stoorvogel, J.J., Smaling, E.M.A. and Janssen, B.H. 1993. Calculating soil nutrient balances in Africa at different scales. Supra-national scale. *Fertilizer Research* 35:227-335.

Stover, R.H. and Simmonds, N.W. 1987. *Bananas.* 3rd Edition. Longman, London.

Stringfellow, R., Coulter, J., Lucey, T., McKone, C. and Hussain, A. 1997. Improving the access of smallholders to agricultural services in sub-Saharan Africa: Farmer cooperation and the role of the donor community. *Natural Resource Perspectives No 20*. Overseas Development Institute, London.

Sustainable Agriculture Center for Research, Extension and Development in Africa (SACRED-Africa). 2004. Cereal banking thrives in Western Kenya. *Farmer's Journal*: May/June 2004. pp 7-9.

Swedish International Development Agency (SIDA). 1995. Uganda country gender profile. Department for East and West Africa and Department for Policy and Legal Issues, Stockholm.

Swift, M.J. and Shepherd, K.D. 2007. (eds). *Saving Africa's Soils: Science and Technology for Improved Soil Management in Africa*. World Agroforestry Centre, Nairobi.

Swift, M.J., Heal, O.W. and Anderson, J.M. 1979. *Decomposition in Terrestrial Ecosystems*. Blackwell Scientific Publishers, Oxford, UK.

Sylvester-Bradley, R. 1984. Rhizobium inoculation trials designed to support a tropical forage selection programme. *Plant and Soil* 82:377-386.

Tabo, R., Bationo, A., Gerald, B., Ndjeunga, J., Marchal, D., Amadou, B., Annou, M.G., Sogodogo, D., Taonda, J.B.S., Hassane, O., Diallo, M.K. and Koala, S. 2006. Improving cereal productivity and farmers' income using a strategic application of fertilizers in West Africa. In: Bationo, A., Waswa, B.S., Kihara, J. and Kimetu, J. (eds). *Advances in Integrated Soil Fertility Management in sub-Saharan Africa: Challenges and Opportunities*. Springer, Netherlands. pp 201-208

Talwana, H.L., Speijer, P., Adipala, E. and Maslen, N.R. 1997. Evaluation of cassava for reaction to root-knot nematodes (*Meloidogyne* spp) in Uganda. *African Journal of Plant Protection* 6:125-134.

Tarawali, S.A., Larbi, A., Fernandez-Rivera, S. and Bationo, A. 2001. The role of livestock in the maintenance and improvement of soil fertility. In: Tian, G., Ishida, F. and Keating, J.D.H. (eds). *Sustaining Soil Fertility in West Africa*. Soil Science Society of America Special Publication No. 58. Soil Science Society of America and American Society of Agronomy, Madison, WI, USA. pp 281–304.

Terrent, J. and Poerbo, H. 1986. Strengthening community-based technology management systems. In: Korten, D.C. (ed). *Community Management, Asian Experience and Perspectives*. Kumarian Press, West Hartford, Connecticut, USA. pp 172-182.

Thies, J.E., Bohlool, B.B. and Singleton, P.W. 1991. Subgroups of cowpea miscellany: Symbiotic specificity within *Bradyrhizobium* spp. for *Vigna unguiculata, Phaseolus lunatus, Arachis hypogaea,* and *Macroptilium atropupureum*. *Applied Environmental Microbiology* 57:1540-1545.

Tiffen, M.M., Mortimore, M. and Gichuki. 1994. *More People, Less Erosion: Environmental Recovery in Kenya*. John Wiley and Sons, New York.

Tittonell, P., Vanlauwe, B., Leffelaar, P.A., Rowe, E. and Giller, K.E. 2005a. Exploring diversity in soil fertility management of smallholder farms in Western Kenya. I. Heterogeneity at region and farm scale. *Agriculture Ecosystems and Environment* 110:149-165.

Tittonell, P., Vanlauwe, B., Leffelaar, P.A., Shepherd, K.D. and Giller, KE. 2005b. Exploring diversity in soil fertility management of smallholder farms in Western Kenya. II. Within farm variability in resource allocation, nutrient flows and soil fertility status. *Agriculture Ecosystems and Environment* 110:166-184.

Tripp, R. 2006. Is low external input technology contributing to sustainable agricultural development? *Natural Resource Perspectives No 102*. Overseas Development Institute, London.

Tripp, R., Wijeratne, M. and Piyadasa, V.H. 2005. What should we expect from farmer field schools? A Sri Lanka case study. *World Development* 33:1705-1720.

Tropical Soil Biology and Fertility Institute of the International Centre for Tropical Agriculture (TSBF). 2005. *Integrated Soil Fertility Management in the Tropics: From Knowledge to Implementation*. Tropical Soil Biology and Fertility Institute of the International Centre for Tropical Agriculture: Strategy and Work Plan, 2005-2010. TSBF-CIAT, Cali, Columbia. pp 48.

Tropical Soil Biology and Fertility Institute of the International Centre for Tropical Agriculture. (TSBF). 2009. Strengthening agro-dealer technical capacity in integrated soil fertility management in western Kenya. Final project report. TSBF-CIAT, Nairobi.

Tucker, R. 1999. Essential plants nutrients: Their presence in North Carolina soils and role in plant nutrition. http://www.agr.state.nc.us/agronomi/pdffiles/essnutr.pdf

Tungani, J.O., Mukhwana, E. and Woomer, P.L. 2002. *MBILI is Number 1: A Handbook for Innovative Maize-Legume Intercropping*. SACRED-Africa Press, Nairobi. pp 20.

Uganda Women's Network (UWONET). 1995. Women and structural adjustment, a case study of Arua district, Uganda. UWONET, Kampala.

United Nations Statistics Division. 2005. *Progress Towards the Millennium Development Goals*. Department of Economic and Social Affairs. United Nations, New York. pp 7.

Uphoff, N., Ball, A., Fernandez, E., Herren, H., Husson, O., Laing, M., Palm, C., Pretty, J. and Sanchez, P. 2006. (eds). *Biological Approaches to Sustainable Soil Systems*. CRC Press, Boca Raton. USA. 784 pp.

Van de Fliert, E. and Braun, A.R. 2004. Conceptualizing integrative, farmer participatory research for sustainable agriculture: From opportunities to impact. *Agriculture and Human Values* 19:25-38.

Van Der Pol, F. 1992. Soil mining: An unseen contribution to farm income in Southern Mali. *Bulletin 325*. Institut Royal des Tropiques, Amsterdam

Van Kauwenberg, S.J. 1991. Overview of phosphate deposits in East and Southern Africa. *Fertilizer Research* 30:127-150.

Van Kauwenbergh, S.J. 2006. Fertilizer raw material resources of Africa. *Reference Manual 16*. IFDC, Muscle Shoals, Alabama, USA.

Van Keulen, H. 1982. Graphical analysis of annual crop response to fertilizer application. *Agricultural Systems* 9:113-126.

Van Rensburg, H.J., Strijdom, B.W. and Kriel, M.M. 1976. Necessity for seed inoculation of soybeans in South Africa. *Phytophylactica* 8:91-96.

Van Straaten, P. 2002. *Rocks for Crops: Agrominerals of sub-Saharan Africa*. International Centre for Research in Agroforestry (ICRAF), Nairobi, Kenya. pp 338.

Vandenbeldt, R.J. 1992. *Faidherbia albida in the West African Semi-arid Tropics*. International Crops Research Institute for the Semi-Arid Tropics and International Centre for Research in Agroforestry, Andhra Pradesh, India.

Vanlauwe, B. and Giller, K.E. 2006. Popular myths around soil fertility management in sub-Saharan Africa. *Agriculture Ecosystems and Environment* 166:43-46.

Vanlauwe, B. and Sanginga, N. 1995. Efficiency of the use of N from pruning and soil organic matter dynamics in *Leucaena leucocephala* alley cropping in Southwestern Nigeria. In: Dudal, R. and Roy, R.N. (eds). *Integrated Plant Nutrition Systems*. FAO, Rome. pp 279-292.

Vanlauwe, B., Aihou, K., Aman, S., Iwuafor, E.N.O., Tossah, B.K., Diels, J., Sanginga, N., Merckx, R. and Deckers, S. 2001a. Maize yield as affected by organic inputs and urea in the West African moist savanna. *Agronomy Journal* 93:1191-1199.

Vanlauwe, B., Bationo, A., Carsky, R.J., Diels, J., Sanginga, N. and Schulz, S. 2003. Enhancing the contribution of legumes and biological nitrogen fixation in cropping systems: Experiences from West Africa. *Grain Legumes And Green Manures of Soil Fertility in Southern Africa: Taking Stock of Progress. Proceedings of Soil Fertility Network Meeting*. Vumba, Zimbabwe. pp 3-13.

Vanlauwe, B., Diels, J., Sanginga, N., Carsky, R.J., Deckers, J. and Merckx, R. 2000a. Utilization of rock phosphate by crops on a representative toposequence in the Northern Guinea Savanna Zone of Nigeria: Response by maize to previous herbaceous legume cropping and rock phosphate treatments. *Soil Biology and Biochemistry* 32:2079-2090.

Vanlauwe, B., Nwoke, O.C., Diels, J., Sanginga, N., Carsky, R.J., Deckers, J. and Merckx, R. 2000b. Utilization of rock phosphate by crops on a representative toposequence in the

Northern Guinea Savanna Zone of Nigeria: Response by *Mucuna pruriens*, *Lablab purpureus*, and maize. *Soil Biology and Biochemistry* 32:2063-2077.

Vanlauwe, B., Ramisch, J. and Sanginga, N. 2006. Integrated soil fertility management in Africa: From knowledge to implementation. In: Uphoff, N., Ball, A., Fernandez, E., Herren, H., Husson, O., Laing, M., Palm, C., Pretty, J. and Sanchez, P. 2006. (eds). *Biological Approaches to Sustainable Soil Systems*. CRC Press, Boca Raton. USA. pp 257-272.

Vanlauwe, B., Sanginga, N. and Merckx, R. 1998. Soil organic matter dynamics after addition of nitrogen-15-labeled leucaena and dactyladenia residues. *Soil Science Society of America Journal* 62: 461-466.

Vanlauwe, B., Tittonell, P. and Mukulama, J. 2006. Within-farm soil fertility gradients affect response of maize to fertiliser application in Western Kenya. *Nutrient Cycling in Agroforestry* 76:171-182.

Vanlauwe, B., Wendt, J. and Diels, J. 2001b. Combined application of organic matter and fertilizer. In: Tian, G., Ishida, F. and Keating, J.D.H. (eds). *Sustaining Soil Fertility in West Africa*. SSSA Special Publication No. 58. Soil Science Society of America. Madison, USA. pp 247-280.

Vedeld, T. 2000. Village politics: Heterogeneity, leadership and collective action. *Journal of Development Studies* 36:105-134.

Viljoen, S.A. and Reinecke, A.J. 1992. The temperature requirements of the epigeic earthworm species *Eudrilus eugeniae (Oligochaeta)*: A laboratory study. *Soil Biology and Biochemistry* 24:1345-1350.

Villarejo, D. and Baron, S.L. 1999. The occupational health status of hired farm workers. *Occupational Medicine* 144:613-635.

Vincent, J.M. 1970. *A Manual for the Practical Study of the Root Nodule Bacteria*. Blackwell Scientific Publications, Oxford and Edinburgh.

Vlaar, J.C.J. 1992. Description des techniques de C.E.S. In: Vlaar, J.C.J. (ed). *Le Techniques De Conservation Des Eaux Et Des Sols Dans Les Pays Du Sahel*. University of Wageningen, Netherlands.

Von Davidson, D. and Loy, C. 2001. New partnerships in the microfinance sector. *Agriculture and Rural Development* 8:34-37.

Waddington, S.R., Gilbert, R. and Giller, K.E. 1998. Best bet technologies for increasing nutrient supply for maize on smallholder farms. In: Waddington, S.R., Murwira, H.K., Kumwenda, J.D.T., Hikwa, D. and Tagwira, F. (eds). *Soil Fertility Research for Maize-Based Farming Systems in Malawi and Zimbabwe*. Soil Fertility Network, CIMMYT, Harare, Zimbabwe. pp 245-250.

Watanabe, I. 1982. *Azolla-Anabaena* symbiosis: its physiology and use in tropical agriculture. In: Dommergues, Y.R. and Diem, H.G. (eds). *Microbiology of Tropical Soils and Plant Productivity*. Martinus Nijhoff, The Hague. pp 168-185.

Welch, R.M. and Graham, R .D. 1999. A new paradigm for world agriculture: Meeting human needs. Productive, sustainable and nutritious. *Field Crop Research* 60:1-10.

Wendt, J.W., Jones, R.B. and Itimu, O.A. 1994. An integrated approach to soil fertility improvement in Malawi, including agroforestry. In: Craswell, E.T. and Simpson, J. (eds). *Soil Fertility and Climatic Constraints in Dryland Agriculture. Australian Council for International Agricultural Research Proceedings No 54*. Canberra, Australia. pp 74-79.

White, F. 1983. *The Vegetation of Africa*. United Nations Educational Scientific and Cultural Organization, Paris. 356 pp.

White, R. and Eicher, C.K. 1999. *NGO'S and the African Farmer: A Skeptical Perspective*. Staff paper No 99-01. Department of Agricultural Economics, Michigan State University, East Lansing, Michigan .

Wiggins, S. and Slater, R. 2005. Responding to HIV/AIDS in agriculture and related activities. *Natural Resource Perspective No.58*. Overseas Development Institute, London.

Windmeijer, P.N. and Andriesse W. 1993. Inland valleys in West Africa: An agroecological characterization of rice growing environments. *Publication No 52*. International Institute for Land Reclamation and Improvement. Wageningen, Netherlands.

Witt, C, and Dobermann, A. 2002. A site-specific nutrient management approach for irrigated, lowland rice in Asia. *Better Crops International* 16:20-24.

Wood, T.G. 1978. Food and feeding habits of termites. In: Brian, M.V. (ed). *Production Ecology of Ants and Termites*. Cambridge University Press, UK.

Wood, T.G. 1988. Termites and the soil environment. *Biology and Fertility of Soils* 6:228-236.

Wood, T.G., Johnson, R.A. and Anderson, J.M. 1983. Modification of soils in Nigerian savannas by soil-feeding cubitermes (*Isoptera, Termitidae*). *Soil Biology and Biochemistry* 15:575-79.

Woomer, P.L. 2002. Moving toward better marketing. *Farmer's Journal, November/December Issue*. Biznet communications, Nairobi. pp 8-11.

Woomer, P.L. 2003. Approaches to impact-oriented agricultural research. In: Patel, B.K., Muir-Leresche, K., Coe, R. and Hainsworth, S.D. (eds). *The Green Book: A Guide to Effective Graduate Research in African Agriculture, Environment and Rural Development*. The African Crop Science Society, Kampala, Uganda. pp 37-50.

Woomer, P.L. 2004. New approaches to controlling striga infestation. *Farmer's Journal. November/December Issue*. Biznet communications, Nairobi. pp 3-5.

Woomer, P.L. 2007. Costs and returns to soil fertility management options in Western Kenya. In Bationo, A. (ed). *Advances in Integrated Soil Fertility Research in sub-Saharan Africa: Challenges and Opportunities*. Springer Scientific Publishers. Dordrecht, The Netherlands. pp 877-885.

Woomer, P.L. and Muchena, F.N. 1996. Recognizing and overcoming soil constraints to crop production in tropical Africa. *African Journal of Crop Science* 14:503-518.

Woomer, P.L. and Patel, B.K. 2000. Strengthening agricultural education in Africa: The approach of the Forum for Agricultural Resource Husbandry. *Journal of Sustainable Agriculture* 16:53-74.

Woomer, P.L. and Swift, M.J. 1994. (eds). *The Biological Management of Tropical Soil Fertility*. John Wiley & Sons, Chichester, West Sussex, UK. 243 pp.

Woomer, P.L., Bekunda, M. and Bwamiki, D. 1998. Modelling banana growth and soil organic matter dynamics with the Century model. *African Crop Science Journal* 6:205-214.

Woomer, P.L., Bekunda, M. and Nkalubo, S. 1999. Estimation of banana yield based on bunch phenology. *African Crop Science Journal* 7:341-347.

Woomer, P.L., Bekunda, M.A., Karanja, N.K., Moorehouse, T. and Okalebo, J.R. 1998. Agricultural resource management by smallhold farmers in East Africa. *Nature and Resources* 34:22-33.

Woomer, P.L., Bennet, J. and Yost, R. 1990. Overcoming the inflexibility of most-probable number procedures. *Agronomy Journal* 82:349-353.

Woomer, P.L., Bokanga, M. and Odhiambo, G.D. 2008. Striga management and the African farmer. *Outlook on Agriculture* 37:245-310.

Woomer, P.L., Karanja, N.K. and Okalebo, J.R. 1999. Opportunities for improving integrated nutrient management by smallhold farmers in the central highlands of Kenya. *African Crop Science Journal* 7:441-454.

Woomer, P.L., Karanja, N.K., Mekki, E.I., Mwakalombe, B., Tembo, H., Nyika, M., Nkwiine, C., Ndekidemi, P. and Msumali, G. 1997. Indigenous populations of rhizobia, legume response to inoculation and farmer awareness of inoculants in East and Southern Africa. *African Crop Science Conference Proceedings* 3:297-308.

Woomer, P.L., Kotto-Same, J., Bekunda, M.A. and Okalebo, J.R. 1998. Biological management of tropical soil fertility: Some research and development priorities for Africa. In: Lal, R. (ed). *Soil Quality and Agricultural Sustainability*. Ann Arbor Press, Chelsea, USA. pp 112-126.

Woomer, P.L., Lan'gat, M. and Tungani, J.O. 2004. Innovative maize-legume intercropping results in above and below ground competitive advantages for under storey legumes. *West African Journal of Applied Ecology* 6:85-94.

Woomer, P.L., Martin, A., Albrrecht, A., Resck, D.V.S. and Sharpenseel, H.W. 1994. The importance and management of soil organic matter in the tropics. In: Woomer, P.L. and Swift, M.J. (eds). *The Biological Management of Tropical Soil Fertility*. John Wiley and Sons, Chichester, UK. pp 47-80.

Woomer, P.L., Mukhwana, E.J. and Lynam, J.K. 2002. On-farm research and operational strategies in soil fertility management. In: Vanlauwe, B., Sanginga, N. and Merckx, R. (eds). *Integrated Plant Nutrient Management in sub-Saharan Africa*. CAB International, Wallingford, UK. pp 313-331.

Woomer, P.L., Muzira, R., Bwamiki, D., Mutetikka, D., Amoding, A. and Bekunda, M.A. 1999. Biological management of water hyacinth waste in Uganda. *Biological Agriculture and Horticulture* 17:181-196.

Woomer, P.L., Okalebo, J.R. and Sanchez, P.A. 1997. Phosphorus replenishment in Western Kenya: From field experiments to an operational strategy. *African Crop Science Conference Proceedings* 3:559-570.

Woomer, P.L., Omare, M.N. and Mukhwana, E.J. 2003. The operations of rural self-help groups. In: Savala, C., Omare, M. and Woomer, P. (eds). *Organic Resource Management in Kenya: Perspectives and Guidelines*. Forum for Organic Resource Management and Agricultural Technologies. Nairobi. pp 131-145.

Woomer, P.L., Palm, C., Alegre, J., Castilla, C., Cordeiro, D., Hairiah, K., Kotto-same. J., Moukam, A., Rodrigues, V.R. and van Noordwijk, M. 2000. Slash-and-burn effects on carbon stocks in the humid tropics. In: Lal, R., Kimble, J.M. and Stewart, B.A. (eds). *Global Climate Change and Tropical Ecosystems*. CRC Press, Boca, Raton, Florida

Woomer, P.L., Tieszen, L.L., Tappan, G., Touré, A. and Sall, M. 2004. Land use change and terrestrial carbon stocks in Senegal. *Journal of Arid Environments* 59:625-642.

Woomer, P.L., Tungani, J., Odhiambo, G. and Mwaura, F.M. 2005. Striga management options in Western Kenya. *African Crop Science Conference Proceedings* 7:479-484.

Wopereis, M.C.S., Donovan, C., Nebiė, B., Guindo, D. and N' Diaye, M.K. 1999. Soil fertility management in irrigated rice systems in the Sahel and savanna regions of West Africa: Part 1. Agronomic analysis. *Field Crops Research* 61:125-145.

World Bank 1995. Uganda: The challenges of growth and poverty reduction. The World Bank, Washington, DC.

World Bank 1996. *Natural Resource Degradation in sub-Saharan Africa: Restoration of Soil Fertility*. The World Bank, Washington, D.C. U.S.A.

Wright, P. 1985. Water and soil conservation by farmers. In: Ohm, H.W. and Nagy, J.G. (eds). *Appropriate Technologies for Farmers in Semi-arid West Africa*. Purdue University, West Lafayette, Indiana. pp 54-60.

Yanggen, D., Kelly, V., Reardon, T. and Naseem, A. 1998. Incentives for fertilizer use in sub-Saharan Africa: A review of empirical evidence on fertilizer yield response and profitability. *International Development Working Paper No 70*. Michigan State University, East Lansing, USA.

Young, A. 1989. *Agroforestry for Soil Conservation*. CAB International, Wallingford, UK. pp 276.

Yusuf, A.A., Abaidoo, R.C., Iwuafor, E.N.O., Olufajo, O.O. and Sanginga, N. 2009. Rotation effects of grain legumes and fallow on maize yield, microbial biomass and chemical properties of an alfisol in the Nigerian savanna. *Agriculture Ecosystems and Environment* 129:325-331.

Zake, Y.K., Bwamiki, D.P. and Nkwiine, C. 2000. Soil management requirements for banana production on the heavy soils around Lake Victoria in Uganda. *Acta Horticulturae* 540:285-292.

Zingore, S., Murwira, H.K., Delve, R.J. and Giller, K.E. 2007a. Influence of nutrient management strategies on variability of soil fertility, crop yields and nutrient balances on smallholder farms in Zimbabwe. *Agriculture Ecosystems and Environment* 119:112-126.

Zingore, S., Murwira, H.K., Delve, R.J. and Giller, K.E. 2007b. Soil type, historical management and current resource allocation: Three dimensions regulating variability of maize yields and nutrient use efficiencies on African smallholder farms. *Field Crops Research* 101:296-305.

Zougmoré, R., Kaboré, D. and Lowenberg-Deboer, J. 2000. Optimal spacing of soil conservation barriers: Example of rock bunds in Burkino Faso. *Agronomy Journal* 92:361-368.

Zougmoré, R., Mando, A., Ringersma, J. and Stroosnidjer, L. 2003. Effect of combined water and nutrient management on runoff and sorghum yield in semi-arid Burkina Faso. *Soil Use and Management* 19:257-264.

About this book, editors and contributors

About this book

The Bill and Melinda Gates Foundation is investing in soil health as an important component of the African Green Revolution, a thrust that is intended to bring food security and improve the living standards of millions of poor, small-scale farmers in sub-Sahara Africa. During 2007, the Foundation commissioned the Tropical Soil Biology and Fertility Institute of CIAT to develop a series of concept papers and technical reports on Integrated Soil Fertility Management for its internal use in designing an African Soil Health Initiative. In response to that challenge, a team of fifteen experts was drawn from Africa and elsewhere to prepare these reports that later served as the structure for the development of this book, an effort that was further assisted by a grant from the Foundation. This grant permitted 4000 copies of this book to be printed by the United Nations of Nairobi Printing Unit and distributed free-of-charge to development specialists, educators, extension specialists and agricultural scientists throughout Africa. Those requiring a copy of this book are invited to contact TSBF-CIAT in Nairobi.

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Index

Integrated Soil Fertility Management In Africa: Principles, Practices and Developmental Process

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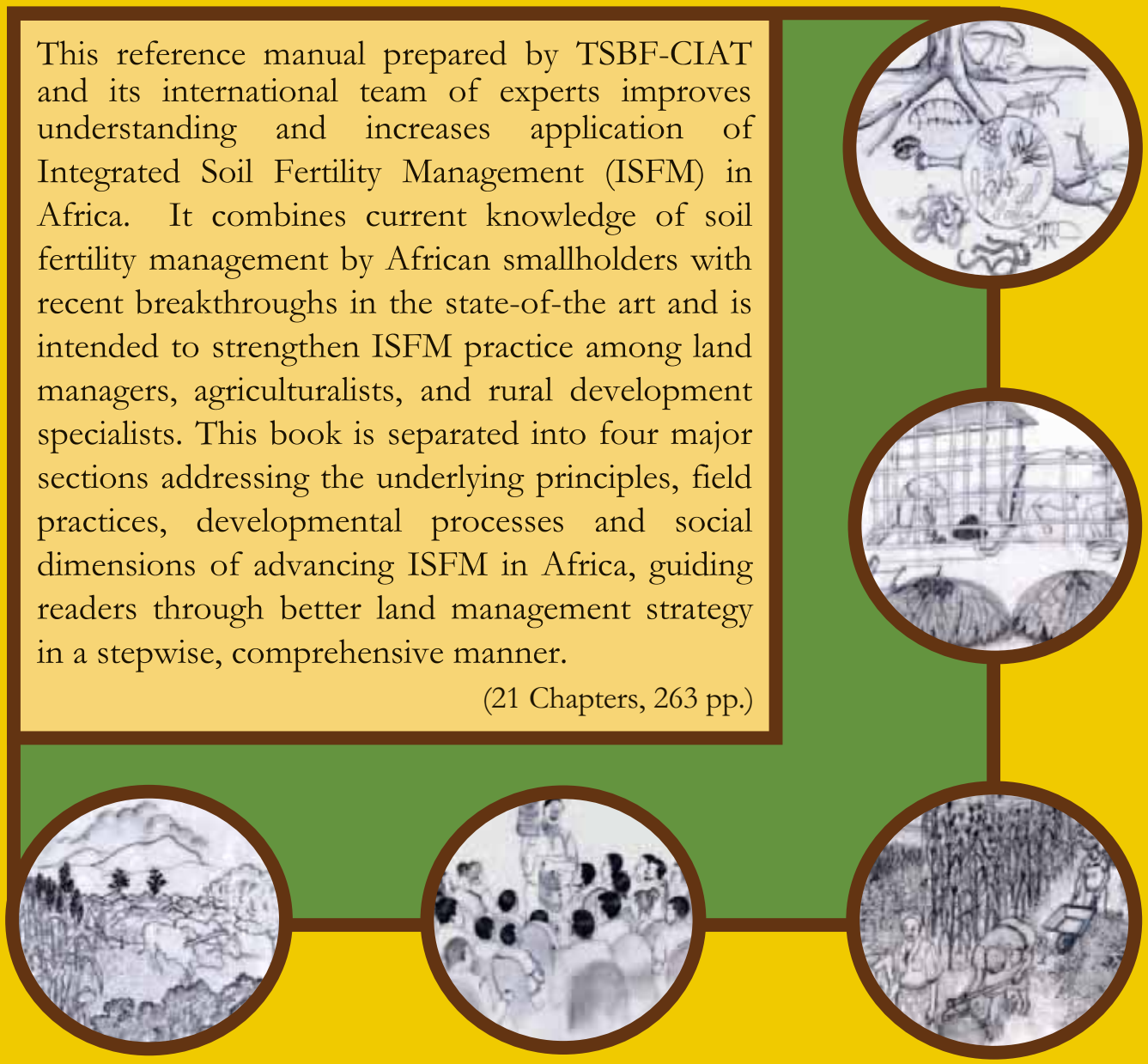
This reference manual prepared by TSBF-CIAT and its international team of experts improves understanding and increases application of Integrated Soil Fertility Management (ISFM) in Africa. It combines current knowledge of soil fertility management by African smallholders with recent breakthroughs in the state-of-the art and is intended to strengthen ISFM practice among land managers, agriculturalists, and rural development specialists. This book is separated into four major sections addressing the underlying principles, field practices, developmental processes and social dimensions of advancing ISFM in Africa, guiding readers through better land management strategy in a stepwise, comprehensive manner.

(21 Chapters, 263 pp.)



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