

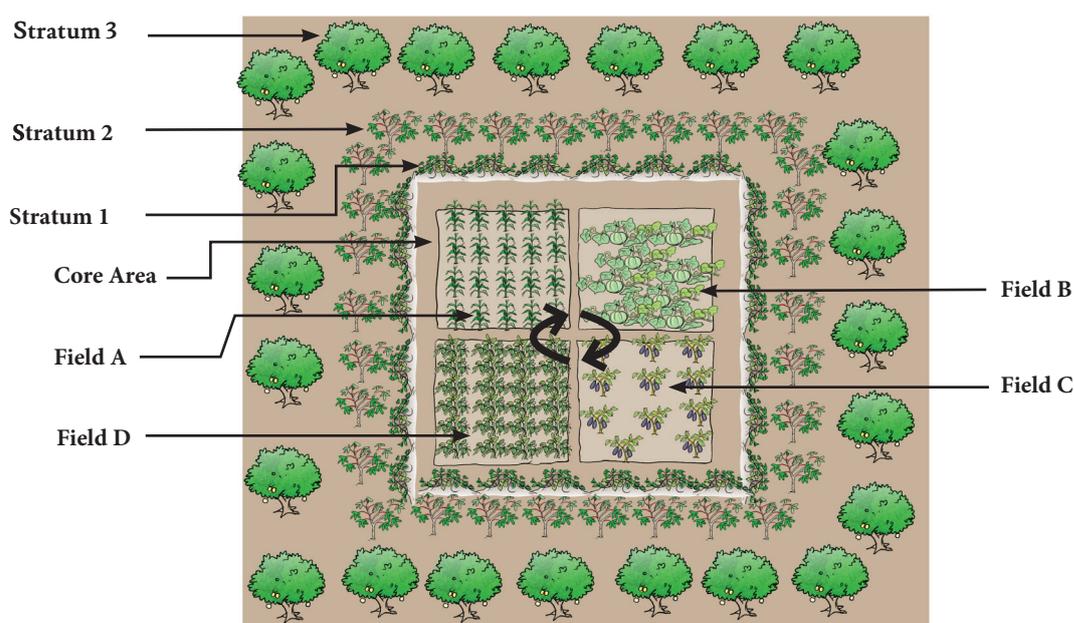
Practice Note 2: Three Food Strata System

Research on sustainable cropping systems for diverse, nutrient dense crops

The three strata forage system (TSFS) is a highly diverse multi-crop system focused on food production, as well as maintaining soil fertility. The three food strata system (TFSS) is a variation of the original TSFS, developed by Nitis et al. (1990¹) in Bali, Indonesia. During the EaTSANE project, the system was adapted due to the focus on improving nutrition and dietary diversity, rather than providing fodder. The TFSS is based on three strata surrounding a core crop area, each stratum fulfilling a separate function and containing a different type of crop or crops.

The aim of the EaTSANE project was not limited to promoting increased diversity of agriculturally produced foods per unit areas, but also, to increase soil health. This was done, by emphasising maximisation of crops' biomass to return into the TFSS in the form of mulch, compost, or manure.

Researchers from the EaTSANE project tested the TFSS system together with farmer groups throughout the research areas. The crops used in the TFSS were adapted to the region. The main aim of the TFSS trials were to introduce the farmers to the different elements of the TFSS, and to introduce new ways of increasing agricultural biodiversity while also maintaining and possibly even increasing soil fertility. Farmer groups in the research area had the possibility to follow the TFSS trials by participating in an accompanying training on the trial



Schematic drawing of the Three Food Strata System, based on the Three Strata Forage System developed by Nitis et al., 1990. From season to season, crops rotate within fields A-D to reduce soil depletion. Schematics by MangoTree.

¹Nitis IM, Lana K, Suarna M, et al (1990) Three strata forage system for smallholder in dryland farming area. *Indones Agric Res Dev J* 12:23–28



Benefits of crop diversification in the strata system

- Using three different strata as well as a core area encompasses different types of crops, which increases the biodiversity of the system. Increased biodiversity can help deliver ecosystem services that is to say, it promotes beneficial organisms like bees and other beneficial arthropods, creates conditions that prevent pests and diseases and reduces soil erosion. When this is achieved, the amount of inputs, such as pesticides, herbicides, and chemical fertilisers can be reduced.
- Planting various types of crops leads to dietary diversity as a number of different food types can be produced, ranging from grains and legumes to fruits and vegetables. Multiple crops also allow for different non-food products such as firewood, building materials, compost/manure for soil improvements, and animal fodder.

How to set up a Three Food Strata System

The TFSS is set up around a core area of crops and different borders surrounding it. Since the system has a high level of biodiversity, its success is based very much on soil fertility management. In this case, it is vital to replace exported nutrients through harvest by mulching or composting crop residues and mixing them back into the cropping system.

Core area: This is where the farmer grows the main crop of the season. In this area, a number of different crops can be cultivated, and in the interest of maintaining or even increasing soil fertility, an intercrop or crop rotation containing a legume (e.g. peas, cowpea, or climbing bean) would be the best practice. In this area, maize can be teamed with beans in an intercrop, or even the three sisters system that includes maize, beans and pumpkins. The core area can also be the production site of a variety of vegetables. The size of the core area or any of the strata is flexible and can be the decision of the farmer; planted to fit specific fields.

1

First stratum/border: The first stratum surrounding the core area features a low growing grass or legume or root crop like sweet potato. This first stratum crop can be used for multiple purposes, such as human consumption, animal fodder, or biomass for mulching and subsequent soil improvement. Soil improvement should always be a central aim, and crop residues not used for consumption or animal fodder should be returned to the soil in the form of mulch, compost, or animal manure.

2

Second stratum/border: The second stratum surrounding the first stratum and core area should feature hedge height crops. These could feature berries or fruits such as African eggplant, tamarillo; leafy vegetables such as Amaranths, cassava, tall legumes like pigeon peas, tall grasses for fodder such as elephant grass, or a fast growing woody hedge to be used as fuelwood. The second stratum has an additional function of providing protection against wind, thereby reducing soil erosion. Moreover, it provides a natural barrier protecting the inner two strata from foraging animals.

3





4

Third stratum/border: The third and final stratum surrounding the others features trees and preferably fruit trees. The trees, being in the third stratum are close enough to the core crop area to provide the ecosystem service benefits, such as attracting beneficial species, but far enough away to not interfere through shading or root growth. The trees, similar to the hedge also provide a barrier against wind, as well as holding the soil with the roots, and therefore preventing soil erosion. Examples of fruit trees are pawpaw, guavas, mango and oranges.

Discussions/interactions between farmers and researchers during training sessions of the EaTSANE project showed that, while including all strata from the TFSS can maximise biodiversity and more ecosystem services, it is not always required to use all strata. Planting trees for example is problematic in some areas as there can be a lack of access and availability of seedlings or issues with land ownership. The TFSS can be adapted to only include the strata that field size and resource availability allows, and can also be understood as a guideline to inspire farmers to create options for increasing agricultural biodiversity of their fields.



Potential benefits of the Three Food Strata System, based on participatory action research, group discussions on innovations, and training of improved practices. Images by the EaTSANE research team.



About the EaTSANE project

The EaTSANE project is an interdisciplinary research project on diversified agriculture, nutrition, and value chains, implemented by research and development institutions from Kenya, Uganda, Germany and the Netherlands in the period from 2018 until 2021. The main objectives are to develop more sustainable farming practices and improve diets of households in Teso South, Kenya and Kapchorwa, Uganda by diversifying the food system with a participatory action research approach. The research teams identified practical implications across the project activities, which led to a set of practice notes.

Further Reading and Training Material

On the EaTSANE website, further presentations and research results on the TFSS in Kenya and Uganda can be found: <https://www.eatsane.info/publications>



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