Semi-Autotrophic Hydroponics for Pyrethrum Multiplication

KALRO
Kenya Agricultural & Livestock Research Organization

NAVCDP
NATIONAL AGRICULTURAL VALUE CHAIN DEVELOPMENT PROJECT

Introduction

Semi-autotrophic Hydroponics (SAH) is a hydroponic growing system that combines elements of both soil-based and hydroponic cultivation methods. In this system, plants are grown in a soilless medium, such as perlite, which provides physical support and retains moisture, but nutrients are supplied through a hydroponic nutrient solution. In most areas of Sub-Saharan Africa, pyrethrum planting materials are produced through clonal multiplication, which involves splits established and mature plants and planting these directly in the field. However, this approach limits the speed at which new improved varieties can be released to a large number of farmers because it takes multiple years before sufficient volumes of planting materials can be produced.

Obtaining good quality pyrethrum planting material through traditional clonal multiplication is challenged as the technique is prone to contamination with pests and diseases. Multiplying pyrethrum through propagation methods that use seed and tissue culture is conversely limited by low multiplication ratios i.e. producing few planting materials from one seed.

Use of traditional clonal multiplication

Semi-autotrophic hydroponics systems would comparatively increase the multiplication rate, making it possible for farmers to have rapid access to new varieties.

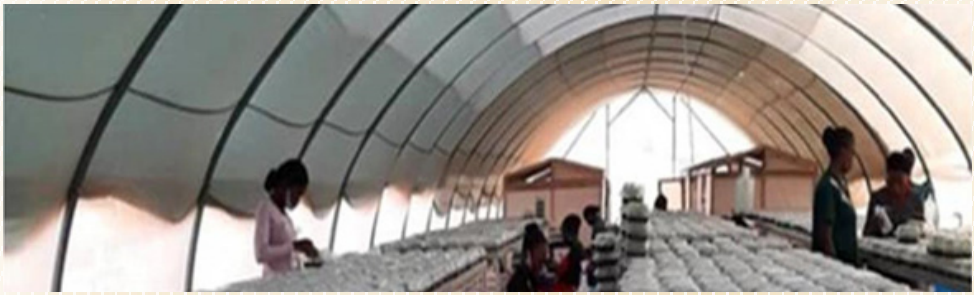
The technology is associated with benefits such as its high multiplication ratio and the fact that it allows for the propagation of true-to-type and pathogen-free pyrethrum plantlets. Additionally, costs for producing pyrethrum planting materials using SAH are lower compared to those when tissue culture is used for propagation. It is easier to transport the disease-free SAH plantlets, in boxes between farms in various counties.

Technical Description

Semi-autotrophic hydroponic systems for crop multiplication were first

developed for cassava propagation but can be adapted to other clonal plants including pyrethrum. The SAH technique utilizes clean plantlets generated from tissue culture. Cuttings from the plantlets are rapidly multiplied in trays filled with growth media in a micro-climate controlled growth room at the initial stages, after which the plantlets are hardened in a screen house. Once the plantlets are hardened, they are transplanted in the open field for further production of planting materials.

SAH plantlets inside tray



Screen house for Semi autotrophic hydroponics multiplication

The initial costs for setting up the infrastructure may be higher. Thereafter, the costs associated with the production using SAH are comparatively lower, which makes the clean seed produced more affordable. The resulting plantlets have well-developed shoots and roots which result in a high establishment percentage in the field compared to the use of pyrethrum splits, which could have damaged root systems. The SAH technology results in materials that are entirely free of pests and diseases unlike traditional pyrethrum stem-cutting methods, which translated into higher resistance when planted in the open field.

Application

The SAH technology is suitable for rapid dispersal of improved pyrethrum varieties in all major growing areas in Kenya as it makes use of simple facilities and requires limited capital investments. Commercial biotechnology companies and

community based organizations can implement the SAH technique for propagating disease free and high quality pyrethrum planting materials close to the fields where farmers cultivate the crop. This will enable access of early generation as well as certified clean planting materials by the rural communities that rely on pyrethrum for income.

Composition

The required amenities for SAH multiplication of pyrethrum include basic growth chambers or screen houses sealed off with nets with micro-climate control systems, in which shelves are placed to hold trays field with sterile growth media for planting.

SAH growth chamber in the Tissue Culture laboratory

High quality media is prepared using a mixture of forest soils with peat, rock wool, vermiculite and perlite that provide anchorage for the plantlets, hold up plant nutrients and water, and allow air exchange between the roots and the atmosphere.

Means of application

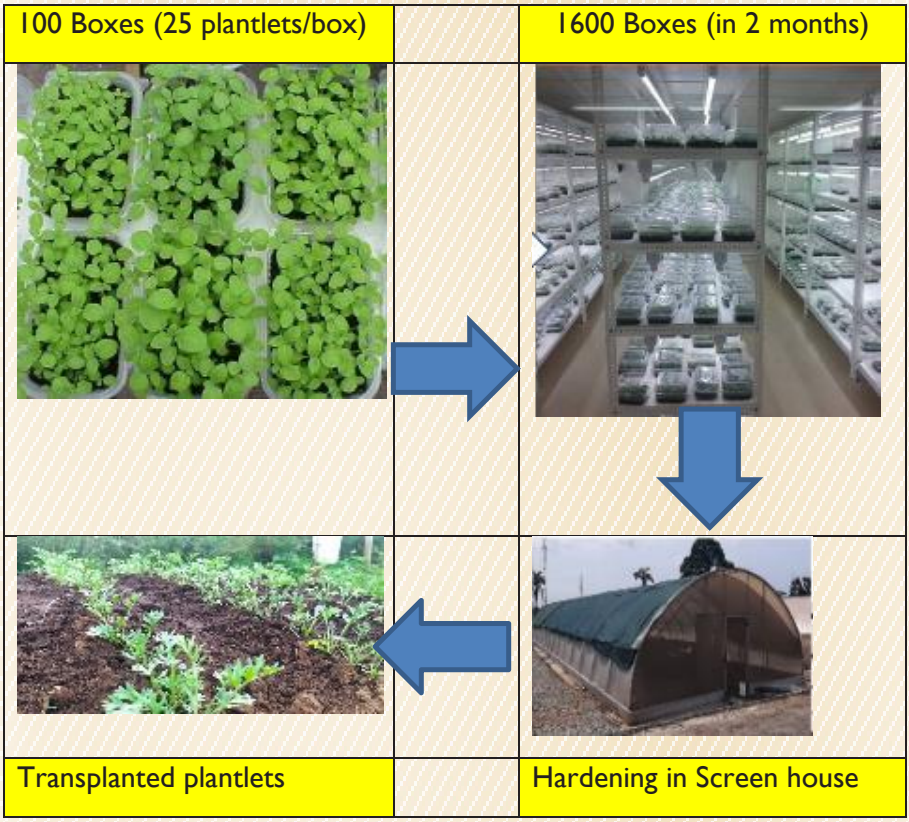
At the start of the SAH process, cuttings from tissue cultured (in vitro) plantlets are planted in trays and placed in a micro climate-controlled growth room. Once these cuttings are established, they are then cut again and planted in another set of trays and the cycle continues to the fourth time. After the fourth cycle, the plantlets are hardened and then could be planted in the open field for

Slicing cuttings from an established SAH plantlets for further multiplication

further multiplication.
Trays can be transported in perforated cardboard boxes for over 48 hours, after which these can directly be planted in open fields for production or screen house for breeding.

Startup Requirements

1. Sensitize farmers and multipliers about the benefits of SAH propagation technique.
2. Obtain seeds or in-vitro mother plants from improved pyrethrum varieties that are free of pathogens.
3. Construct growth chamber or screen house and procure shelves and growth media for propagation.
4. Organize marketing and delivery of SAH plantlets through existing suppliers in the pyrethrum seed



A flow chart for SAH seed multiplication technology in pyrethrum

system.

Customer Segmentation

Commercial and community-based multipliers of pyrethrum and biotechnology companies

Licensing Requirements

Propagation of pyrethrum through SAH and marketing to farmers has to fulfil national phytosanitory regulations and multipliers need a license for setting up SAH activities.

Innovation as Public Good

The technology for pyrethrum is a public good that is developed and disseminated in Africa by the International Institute of Tropical Agriculture.

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