Better growing conditions by movable screens

Climate management in East African greenhouses
Green Farming programme

Green Farming is a Dutch programme that unites horticultural networks in the Netherlands, Kenya and Ethiopia. This is achieved by setting up joint activities, projects and co-operations in the areas of research, development and production.

All Green Farming activities are related to one or more of the five main themes of the programme. These five main themes are:

- Water management
- Crop management
- Climate and energy
- Post-harvest and logistics
- Research and knowledge exchange

Who is involved?
The Green Farming consortium consists of a group of leading Dutch companies in horticulture technology. Wageningen University and Research Centre supports the programme and is actively involved at the level of research and knowledge exchange.

Green Farming is coordinated by AVAG, the representative of joint Dutch horticultural suppliers, and by DLV Plant - GreenQ, an advisory company in the international agribusiness. The Dutch Ministries for International Trade and Development Cooperation and Economic Affairs support the programme in close cooperation with the Dutch Embassies in Nairobi and Addis Ababa.

What are the activities?
Green Farming organizes a broad spectrum of activities, both at business-to-business and government-to-government levels. The business-to-business activities include:

- Market studies and sector reviews
- Exhibition visits and participation
- Trade missions
- Matchmaking
- Seminars
- Demonstration projects

Green Farming sets up various demonstration projects together with local businesses and knowledge institutions to show which technologies, products, knowledge and services are available and how these can be applied to the local situation. The results in terms of production levels, efficiency of input use, production costs and revenues are shared with the sector via open days, professional journals and seminars.
Now greenhouses are increasingly being used to protect crops against the negative impacts of the outside climate, it is time for the next step: optimizing the climate inside. The grower can control the growing climate of the plants in a greenhouse with screening and thereby optimize production results.

Advantages of a controlled climate

In the highly competitive flower sector, increasing production volumes and improving flower quality are of utmost importance for growers to stay ahead of the game. The use of movable screening systems offers several opportunities to realize that. When it comes to vegetable production, growing in greenhouses provides good opportunities to support food security and food safety conditions. Mobile screening systems add to production and quality increase by making the growing climate more favourable for the plant.

Green Farming will gather and process the results and share them with the horticulture sector in East Africa.
In the summer of 2014, the demonstration project ‘Climate management in East African greenhouses’ was put into practice at two farms in Kenya: Maridadi Flowers and Kreative Roses (Kordes). During the coming year this project will provide the East African horticultural sector and the Dutch partners with information about the benefits greenhouse climate improvements can offer. The expectation is that the project will demonstrate the advantages of screening; it is an affordable and environmental-friendly solution to counter climate extremes in the greenhouse while improving greenhouse crop production.

Goal of the project
The purpose of the Green Farming Demonstration Project for greenhouse climate management is to realize a more favourable growing climate in greenhouses through the use of movable screening systems.

Greenhouse climate optimization should result in higher production levels with better quality and less use of pesticides and water. Green Farming wishes to convince the East African horticulture sector that Dutch technology, although having higher initial investment costs, will be most cost-effective and environmental-friendly in the long run because of the reduced use of inputs and the increased output.
**Expected results**
The screen will have many positive results for roses, particularly in greenhouses with permanent roof vent openings. Screening during the hottest parts of the day will reduce the day temperature maxima and humidity maxima by 10 percent. The growing climate will become more favourable, leading to increased production and better crop quality. While day temperatures will be reduced, less evaporation and transpiration will take place, so less irrigation water will be needed per stem. Lowering the crop temperature during the day will also improve the quality of the flowers in terms of fewer black spots, less discoloration and longer stems.

The screen also increases night temperatures. Crop temperature will be 3-4 °C higher during the night, which is positive for the growth of the plant as it will increase production. A higher crop temperature during the early morning will reduce the level of condensation on the crop, thereby allowing fewer fungal diseases to develop. Firstly, this is positive for production levels (healthy plants produce better) and for reject levels (fewer damaged flowers). Secondly, it will reduce the use of pesticides significantly.

The screens also diffuse the sunlight, resulting in deeper penetration of radiation into the crop. If radiation can reach deeper into a crop, more leaves can use its energy for photosynthesis, resulting in better growth. Diffusing the incoming radiation therefore leads to higher production.

The expected results for the demonstration project are:
- 10 percent reduction in extreme temperature levels in the greenhouse.
- 10 percent reduction in extreme humidity levels in the greenhouse.
- Reduction in the use of water (per stem) and crop-protection chemicals.
- Reduction in the running costs.
- Increase in annual production numbers by up to 20 percent.
- Increase in product quality in terms of produced weights per square meter by up to 20 percent.
- Increase in level of sustainability of the production system.

**Expected output**
All inputs and outputs are registered by the computer. A year-round data set of input needs, production results and required running costs is collected. Ultimately, the project will result in a report on greenhouse climate data, use of irrigation water and crop-protection chemicals linked to production results and a detailed financial business plan. Thanks to the improved production results combined with the reduced use of water, fertilizers and crop protection chemicals, the running costs per produced flower will be lower while the return increases. Calculation of eventual payback time for the installed technology forms an important outcome of the project.
The demonstration project has been implemented by two rose farms in Naivasha: Maridadi and Kreative Roses. At both project sites a movable, light-diffusing shade screen has been installed in a plastic-covered greenhouse. The implementation of movable shading provides the opportunity to optimize greenhouse temperatures and humidity levels during the different conditions of the day and during the different seasons.

**Maridadi**

At Maridadi Flowers the demonstration project is set up in one compartment of a greenhouse. The total demonstration area is 10,000 m² inside a production greenhouse of 30,000 m². In this greenhouse, nine bays are being used for the trial and nine others are used as reference. In the greenhouse the settings for irrigation can be made per 0.5 hectare. All parameters on greenhouse climate, irrigation and screening are being registered and managed by the Hoogendoorn iSii computer. The greenhouse has a fixed top vent. This means that at the top the greenhouse is always open on one side. There is no greenhouse heating system. The greenhouse plastic is one of the most transparent types of plastic, UV Clear.

The owner did some small tests to check different types of screening fabrics in combination with the plastic on the greenhouse and chose a specific type of fabric based on the results (see below: Screen type)
**Multifunctional screen type**

A white screen with an open structure for enhanced light diffusion and shading, Ludwig Svenssons HARMONY 3015 O, has been chosen for the specific conditions in Kenya. The screen textile consists of white, transparent and open strips. The balance between the three determines the amount of radiation that is reflected, which for the screens used in these projects is 30 percent. It also determines the degree to which the screen diffuses the radiation. The white strips reflect part of the radiation and diffuse the part that goes through. The transparent strips allow all radiation through, but diffuse it. The open strips are applied for ventilation. The haze of the screening material used in these projects is 40 percent, which means that the textile diffuses 40 percent of the radiation that goes through. Total radiation is let through by 70 percent. The screen is installed horizontally as a hanging structure and slides over polyester support wires.

**Automation optimizes climate management**

The screen is linked to a computer with climate management software. With this software automated settings can be made for the amount of crop screening, in combination with adjusted irrigation. Based on weather data and climate recordings inside the greenhouse, the screen will be (partially) closed or opened to optimize the greenhouse climate. All data in the computer can be shared online with project partners via the LetsGrow.com application.

**Kreative Roses**

In the Kreative Roses’ greenhouse, hundreds of different rose varieties are being tested on their performance under Kenyan growing conditions. New rose plants are being produced in another compartment. The demonstration project is set up in the compartment where the rose varieties are being tested and shown to interested rose growers. This compartment is a little over 9,000 m².

Just as at Maridadi Flowers, the greenhouse has a fixed top vent. There is no greenhouse heating system and the greenhouse plastic is also of a transparent type; to achieve the required UV level in the greenhouse UV-blocking plastic for mono colour roses and UV-clear plastic for bi-colours. However, from a small testing area it appeared that working with screens is better, as this offers more flexibility.

In this project, no trial and reference area could be set up as the facility is not large enough to make a separation. All parameters on greenhouse climate, irrigation and screening is being registered and managed by computer. The observed climatic results can be compared with data from previous years. As this company is always registering production data from its rose varieties and the computer registers the growing conditions in the greenhouse, this comparison can be made for several different rose varieties on annual average basis.
Prognosis and meaning for East African horticulture

The Green Farming demonstration project is not only interesting for Kenyan horticulture, but also for other producers in East Africa. In most horticultural businesses in East Africa, installation of climate screening can take place without major modifications.

Local partner Maridadi Flower is expecting an increase in production numbers from the movable screening and a positive impact on the colour of the different rose varieties. Kreative Roses expects that better management of the required radiation levels in their specialised showcase greenhouse will result in significant improvements in production quality through longer and thicker rose stems. The results on these parameters will be determined during the demonstration project. In addition, water conservation per stem is expected to increase, while chemical use is expected to be lower.

Flower growers in high-altitude growing areas in East Africa struggle with humid conditions in the greenhouse during the early morning hours. The high humidity conditions create optimal circumstances for the development of all types of fungi. Especially in the rainy season, growers try to battle the development of, for instance, mildew and botrytis by implementing intensive crop-protection programmes. Several growers have reported that they spray against botrytis on a daily basis, yet are still experiencing high levels of infection and very high yield losses. The expectation is that climate screens, ideally in combination with heating, will improve this.

Sharing output
During 2014 and part of 2015, Green Farming will gather and process the results and share them with the horticulture sector in East Africa. The Greenhouse Climate Management Demonstration Project will show the sector what is actually achievable in practice (in Africa).

Roll out to vegetables
The use of climate screens can also be very beneficial to production results in vegetable growing. Greenhouse vegetable production is on the rise in Kenya and surrounding countries. Domestic markets are increasingly selling products such as tomatoes, capsicums and peppers. Growing in greenhouses increases food security as the risk of large losses due to adverse weather conditions is greatly reduced. Production levels of vegetables grown in greenhouses can be double to triple the levels of those grown in open fields. A movable screen will secure the production output and the quality of the greenhouse-grown vegetables, comparable with the expected positive impact in rose greenhouses.

Greenhouse climate optimization should result in higher production levels with better quality and less use of pesticides and water.
In Kenya, the projects have been implemented at rose producer Maridadi Flowers and Kreative Roses, the production location of rose breeder and propagator Kordes Roses. The Institute of Energy and Environmental Technologies and the Department of Horticulture at Jomo Kenyatta University of Agriculture and Technology (JKUAT) are cooperating with the farms and DLV Plant in data recording, processing and data analysis.

**Maridadi**
Maridadi Flowers is one of the large flower producing farms in Naivasha Kenya. It is the Kenyan farm of the Dutch rose company Kneppers Rozen. A key aspect in Maridadi Flowers' strategy is to offer the market a wide assortment of high-quality flowers with a long shelf life.

42 hectare greenhouses
13 rose varieties, grown in blocks of 3 hectare.
www.kneppersrozen.nl

**Kreative Roses**
Kreative Roses in Naivasha facilitates the commercial testing of breeder Kordes’ new rose varieties for East Africa. New variety selections are planted in commercial trials in order to prove technical characteristics and market potential, offering customers reliable information as a basis for new variety decisions. Kreative Roses, which was established six years ago, is located in the Flower Business Park in Naivasha.

24 hectare greenhouses
20 rose varieties in the commercial area, approximately 75 varieties are being tested under commercial conditions in the trial areas
www.kreativeroses.com
Bosman Van Zaal
With a long history of combined strengths, international experience and office locations in the Netherlands, Kenya and Ethiopia, Bosman Van Zaal facilitates growers in Protected Horticulture worldwide. In their joint ambition to act as an international player, they produce, deliver and maintain conditioned facilities for vegetable and floriculture production. Six areas of expertise are offered - greenhouses & constructions, water systems, cultivation systems, heating & cooling systems, electrical systems and control systems & software - for any turnkey project solution. For more specific information, please contact:

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DLV Plant – GreenQ
DLV Plant – GreenQ is the largest global commercial knowledge provider in the field of food and flower production. Services include consultancy, on-site practical research or research at the DLV Plant – GreenQ greenhouse complex, and training and support in the development of (turnkey) projects. The company has over 200 knowledge-driven consultants working worldwide, with offices in Africa, Latin America and Europe, and has a strong network within the agricultural, horticultural and affiliated sectors.

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Hoogendoorn Growth Management
Hoogendoorn is known as the most innovative supplier of process automation in the horticultural industry and has worldwide experience in greenhouse automation projects. Their user-friendly irrigation, climate and energy software is customized for greenhouses and open-field projects in Africa. Energy and water savings combined with optimum climate are easy to achieve with Hoogendoorn’s automation solutions. To guarantee 24-hour service, maintenance and spare parts, Hoogendoorn works with local partners in Ethiopia, Kenya and South Africa.

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Ludvig Svensson
Ludvig Svensson is a world leader in climate screens. The Svensson® screens give the grower more effective climate control. They provide protection from strong sunlight during the day and from the cold at night. The screens save large amounts of energy and reduce the need of pesticides, creating better water management and a better climate. No matter where in the world the operation is located, Svensson knows how to make the most of your natural climate. So when every plant counts, count on Svensson for a better climate!

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Peter Dekker Installaties
PDI is a company specialized in screen and blackout installations for all kinds of greenhouses, glass and poly houses. It is an innovative and reliable organization with almost thirty years’ experience worldwide. PDI delivers complete installations or just the materials for maintenance with installation guidance or supervision. Quality systems for all purposes.

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