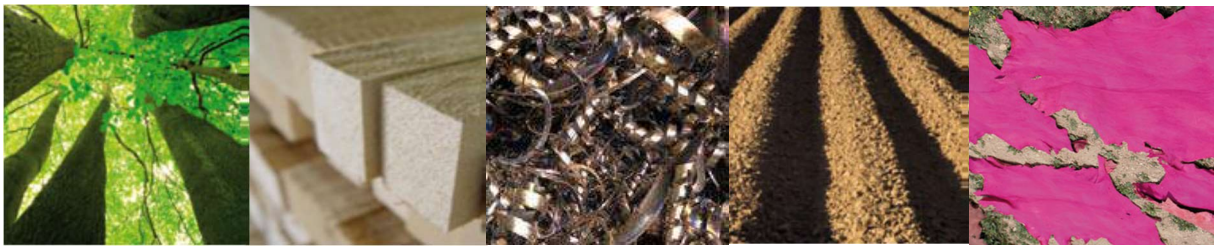

CIP Eco-innovation
Pilot and market replication projects
Call 2012

Call Identifier: CIP-EIP-Eco-Innovation-2012

Design for installation of second urban commercial aquaponics D3.8

Ecoponics

Contract ECO/12/332783/SI2.656985

Covering the reporting period from

18/07/2013 to 17/07/2016

Reporting Date 03/08/2016

Project coordinator: Dr. Ragnheidur Thorarinsdottir

WP3-leader: Paul Rye Kledal IGFF

Project website: http://aquaponics.is/ecoponics/

IGFF & Europafrugt Ltd.: 2.000 m^2 greenhouse for the Aquaponic system and organic herb divison

Europafrugt Ltd and their present conventional herb production of 500.000 herb units/year under 3.500 m^2 greenhouse, which will be supplied with nutrients from the 2.000 m^2 aquaponics production producing 300.000 organic herbs/year and 25 tons of Pike Pearch

1. Introduction

The IGFF aquaponics test plant of 70 m^2 was from the start established with the goal of being a showcase attracting industrial partners from the commercial oriented aqua- and horticultural sector. The equipment utilized for the production, was therefore already well known within those two sectors, but customized to function in an industrial based aquaponics production targeting commercial market sales.

The Norwegian aquaculture company Akva Group Ltd. - with its land-based aquaculture division placed in Denmark - supplied the aquaculture equipment, and together with IGFF innovations were made so it could both operate optimal with the horticultural production as well as provide with *'economies of space'* to improve and lower the overall investment costs in aquaponics.

During 2015 serious inquiries on commercial aquaponics came from both the wholesale industry and the horticulture industry. DGS (Danish Greenhouse Supply Ltd.) and the wholesaler company Europafrugt Ltd. (English: Eurofruit), claimed interest in working together with IGFF and Akvagroup for designing a commercial aquaponic production.

DGS is a turnkey company delivering industrial scale greenhouses, and were receiving inquiries on aquaponics from Check Republic and Canada, but have no experience in fish production or the management of aquaponics.

Europafrugt Ltd. is a Danish horticultural wholesales company with a market share of 14% on Copenhagen Wholesale Market for horticultural products. Likewise, Europafrugt Ltd. already have their own supply chain of 500.000 herbs per year produced under 3.500m^2 greenhouse in the peri-urban distance of 16 km from Copenhagen center.

Europafrugt Ltd. is planning to supply the fast growing organic market with 300.000 herbs per year. For this, they need to establish a new greenhouse that is free from pests and fungus from the beginning, and clearly separated from their conventional production so organic certification can be made.

Europafrugt Ltd. already produces their conventional herbs in soil. The unique experiences made from IGFF producing herbs in soil in the aquaponics test system made the jump to produce organic in this manner, very convincing for Europafrugt. Similarly, the story of combining fish to an organic horticultural production, providing attributes of a food production with zero pollution, substantial energy- and resource savings, was attractive to Europafrugts future marketing as well.

During 2015 plans for setting up an industrial based and commercial aquaponics production with the horticultural produce certified organic came into action. IGFF is the intermediary coordinating the process between the suppliers of Akva Goup Ltd., DGS Ltd. and Europafrugt Ldt., and will be in charge of the aquaponic management.

2. Production design

Decisions were made to base the fish production on the high-end market fish Pike Pearch, and produce 25 tons per year hence a weekly sale of approximately 500 kg. The 25 tons were based on market analyses stating that this amount would not disturb the prevalent market for Pike Pearch, and so in this way avoid a downward trend in prices. Four to six restaurants have been chosen as the main target on the demand side. Organic herb production will be from 300.000 to 350.000 units per year and an all-year-round production. The fish manure from the aquaponics production will supply both the conventional as well as the organic herb production, and the fish feed will be organic. In total, the aquaponics production will be under 5.500 m^2 greenhouse. An organic division covering 2.000 m^2 and a conventional division covering of 3.500 m^2. If markets go well and production can increase in both the horticultural section as well as the fish production, the 2.000 m^2 organic section can easily be replicated and so cover a production area of 7.500 m^2.

In the Appendix, two figures of the aquaponic production are shown and relates to the organic produce which will take place under a 2.000 m^2 greenhouse. Thousand square meters (1.000 m^2) will be occupied by the aquaculture production, and the other 1.000 m^2 will be dedicated to the horticultural (herb) provided by the moving gutter system. Five hundred square meters (500 m^2) or 25% of the greenhouse will be a common area shared by both the fish and the horticulture production (spatial economics) as part of keeping the investment costs down. This shared area is shown in figure 2 where a metal grid shelf is placed two meters above the six large grow-out tanks, and will carry all the seed – and propagation trays. The trays placed above the fish tanks, will in the same function as a shade for the Pike Perch.

The herb production will after propagation be transplanted to the moving gutter system from DGS based on NFT piping, and where holes are made to fit the pots containing soil (see photo below of the moving gutter system).

Figure 1. The moving gutter system of DGS.

The holes are made for pots to fit in, and the pipes themselves are flexible so they can be moved further apart as the plants grow and needs more space giving a very high space productivity.

3. Production system: decoupled aquaponics

In traditional aquaponics systems the water circulates from fish to plants, and via bio-filtering returns back to the fish. The water quality is specifically managed to fit the requirements of the fish species being cultured, and suitable plants are normally chosen to fit the fish environment. It is not always guaranteed that the fish preferences are completely aligned with the optimum requirements of the plants. This calls for compromising of the plant's needs, and as a result they may not achieve their full growth capacity, hence reducing a full optimization of the production and its investments. Likewise, the biological dependency built in traditional aquaponics is a major risk factor hindering large-scale commercial market orientation.

Focus in the scientific environment has therefore started to be oriented towards dividing the water flow into two independent subsystems that can occasionally communicate whenever plants need a boost in nutrients or the fish require reclaimed water from plants to dilute the wastes accumulating in the fish sub-unit. This solution, which is referred to as a "decoupled" aquaponics system (Figure 2) would not only secure optimal environmental conditions for both the plant and fish production units, but also eliminate the biological dependency in aquaponics hence minimize the economic risk substantially.

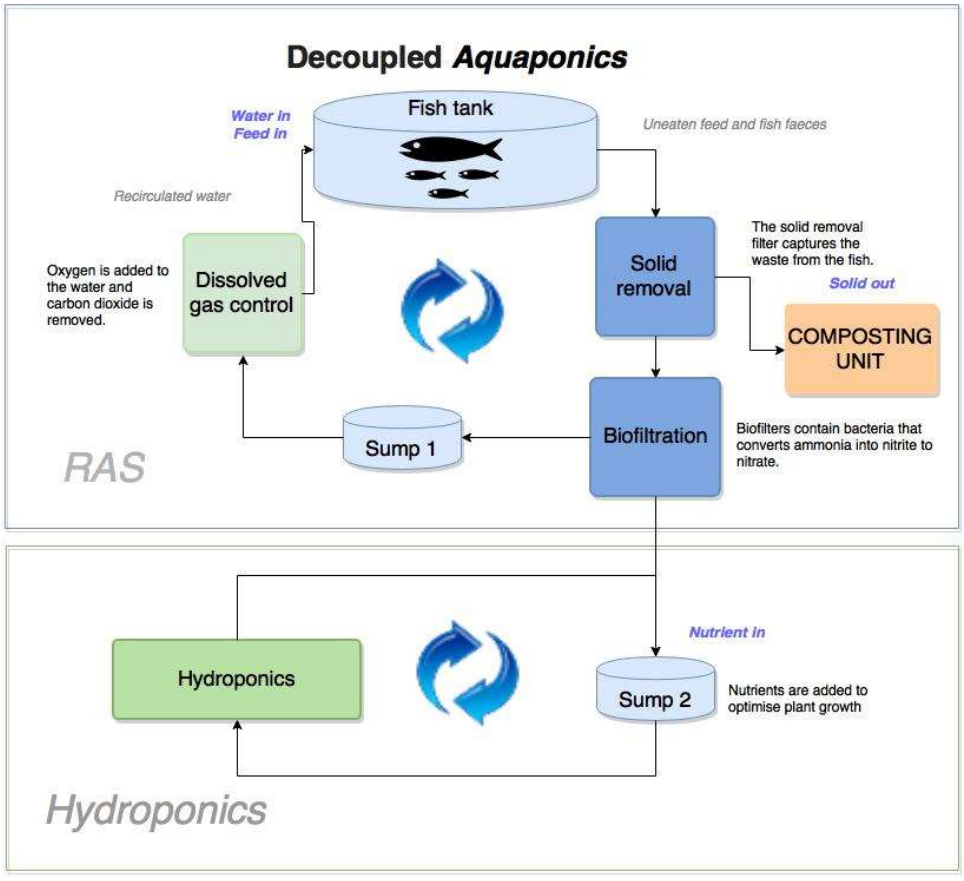

Figure 2. The principles of a decoupled aquaponics system. The fish and the plant system have their own independent production loop, but are in the same time also connected. In this way the symbiotic benefits are gained, but the dependency risk are minimized (Thorarinsdottir ed., 2015).

IGFF's test system of a 'decoupled aquaponics' has therefore been chosen as the production model, to secure a safe and economically optimized commercial and industrialized output from both the fish- and the horticultural section.

The processing of sludge from the aquaponics system has recently received increased interest. Not only is prompt removal from the system helping to maintain healthier and more resilient systems for fish, but it also improves the productivity by better capitalizing by-products through their reintroduction into the production system. In the new IGFF/Europafrugt Ltd. system described, the sludge from the fish manure will be composted and reused as soil for the pots utilized in the horticultural production. Soil is also a requirement for obtaining an organic certificate in horticulture production. Practical experience on utilizing soil in both Europafrugt Ltd. and IGFF's production provides both stronger and healthier looking plants compared to plants grown in soilless hydroponic systems only. A working hypothesis is that the soil provides both moist and a food package for the plants, making them able to stay fresh and 'alive' longer during transport as well as providing longer shelf life in shops giving both a higher premium to the producer and product attribute to the customer.

4. Results

Based on the IGFF test-plant a new design for a second peri-urban aquaponics system has been made. It will in the first phase consist of a 2.000 m^2 greenhouse section dedicated to the organic production of 300.000 to 350.000 herbs and 25 tons of the luxury fish Pike Pearch per year. The choice of 25 tons are based on a market study showing that this amount will not influence the market negatively and press the producer price downward. The 25 tons will be sold to four to six restaurants with 500 kg per week.

The 25 tons of fish, will besides the organic herb production, also provide the nutrients to the existing conventional herb production of Europafrugt ltd. covered by 3.500 m^2 greenhouse. Altogether, the total aquaponics production will be under 5.500 m^2 greenhouse area. If markets increase simultaneously in both the fish and horticulture area, a replication of the 2.000 m^2 organic section can easily be connected to the existing production and increase the aquaponics area of 7.500 m^2.

The design is shown in appendix.

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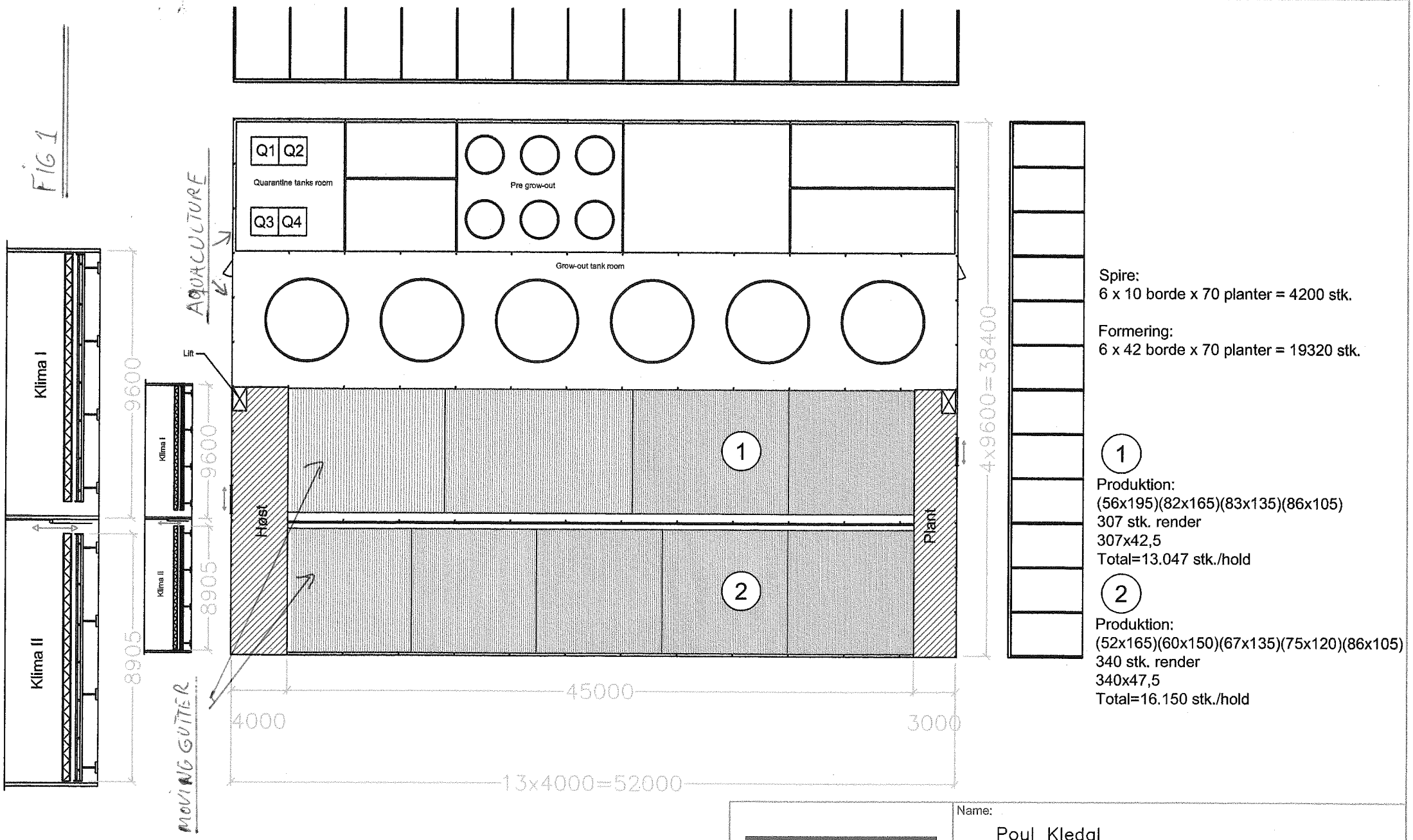
FIG 1



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Formering:
6 x 42 borde x 70 planter = 19320 stk.

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Name: Poul Kledal

Regarding: Mobile Growing System

Date: 09-11-2015

Sig.: KS

Size:	Measure:	Case num.:	Drawing num.:
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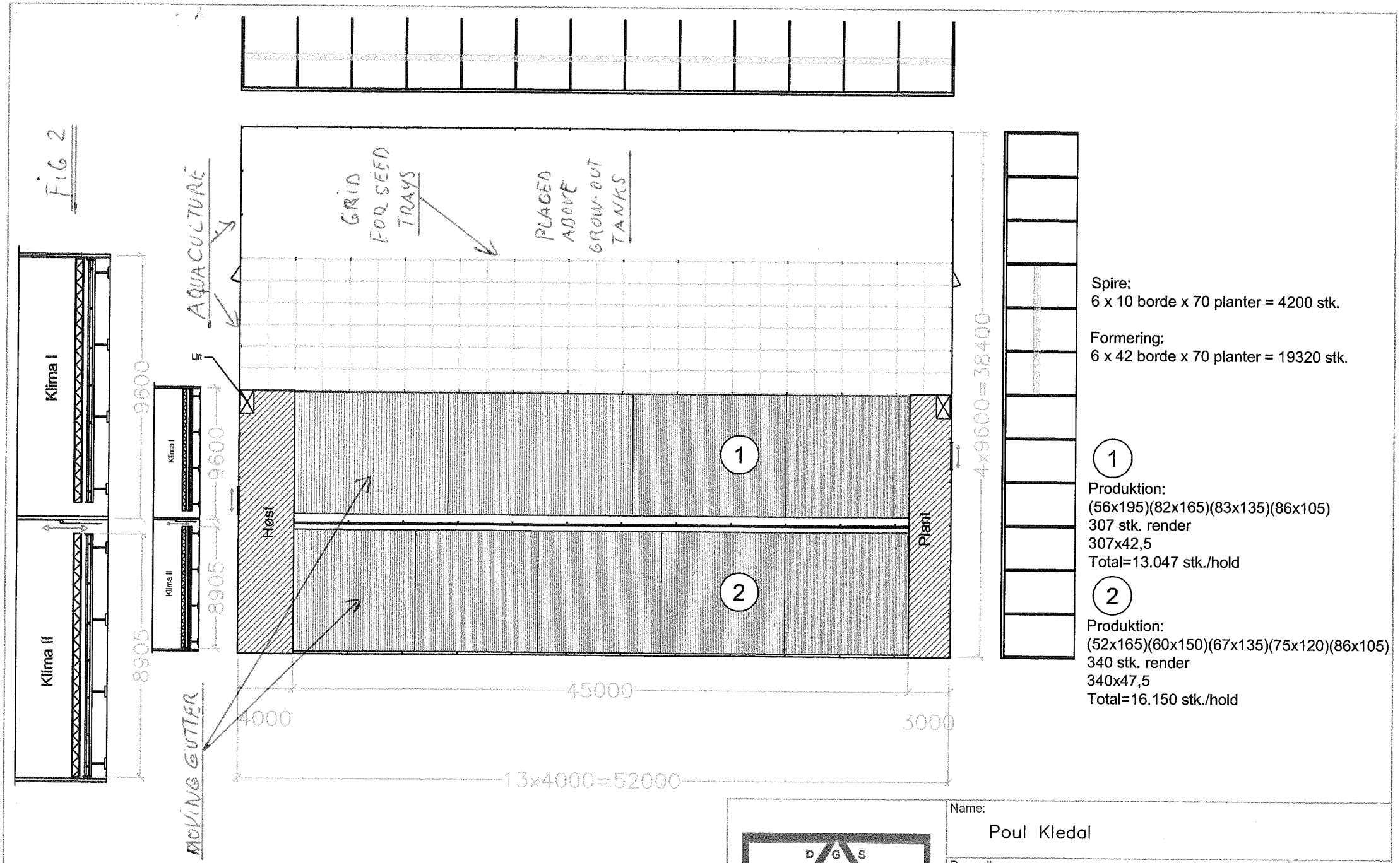

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