HORTIN II Co Innovation Programme

Towards cost effective, high quality value chains

Quantitative Economic Evaluation of Crop production innovation

HORTIN-II Research Report no. 13

Witono Adiyoga, Marcel van der Voort, Nikardi Gunadi, Rofik Sinung-Basuki,

Lelystad, The Netherlands, Lembang, Indonesia, December 2010

The purpose of the HORTIN-II programme is to contribute to the development of cost effective high quality value chains for vegetables and fruits. Among others this can be achieved when technology development takes place in close collaboration between public institutions, farmers and private companies.

On the Indonesian side the programme is carried out by the Indonesian Centre for Horticultural Research and Development **(ICHORD),** Jakarta, with the Indonesian Vegetable Research Institute **(IVEGRI)**, Lembang, and the Indonesian Centre for Agricultural Postharvest Research and Development **(ICAPRD)** in Bogor.

In the Netherlands the Agricultural Economics Research Institute **(AEI)**, Den Haag, the Agrotechnology and Food Sciences Group **(ASFG)**, Wageningen, Applied Plant Research **(APR)**, Lelystad, and WUR-Greenhouse Horticulture **(WUR-GH)**, Bleiswijk, all partners in Wageningen University and Research centre, are involved in the programme.

Addresses:

Indonesian Centre for Horticultural Research and Development (ICHORD)
Address : Jl. Ragunan 29A, Pasarminggu, Jakarta 12520, Indonesia
Tel. : +62 21 7890990
Fax : +62 21 7805135
E-mail : pushor@rad.net.id or pushorti@yahoo.com
Internet : www.litbanghortikultura.go.id

Indonesian Vegetable Research Institute (IVEGRI)
Address : Jl. Tangkuban Perahu 517, Lembang-Bandung 40391, West Java, Indonesia
Tel. : +62 22 2786 245
Fax : +62 22 2786 416
E-mail : dir_ivegri@balits.org or balitsa@balitsa.org
Internet : www.balitsa.org

Indonesian Centre for Agricultural Postharvest Research and Development (ICAPRD)
Address : Kampus Penelitian Pertanian, Cimanggu, Bogor 16114, West Java, Indonesia
Tel. : + 62 251 321762
Fax : + 62 251 350920
E-mail : bb_pascapanen@litbang.deptan.go.id or bb_pascapanen@yahoo.com
Internet : www.pascapanen.litbang.deptan.go.id

Agricultural Economics Research Institute (AEI)
Address : Alexanderveld 5, Den Haag, The Netherlands
 : PO Box 29703, 2502 LS Den Haag, The Netherlands
Tel. : +31 70 335 83 30
Fax : +31 70 361 56 24
E-mail : informatie.lei@wur.nl
Internet : www.lei.wur.nl

Agrotechnology and Food Sciences Group (ASFG)
Address : Building 118, Bornsesteeg 59, Wageningen, The Netherlands
 : PO Box 17, 6700 AA, Wageningen, The Netherlands
Tel. : +31 317 480 084
Fax : +31 317 483 011
E-mail : info.asfg@wur.nl
Internet : www.asfg.wur.nl

Applied Plant Research (APR)
AGV Research Unit
Address : Edelhertweg 1, Lelystad, The Netherlands
 : PO Box 430, 8200 AK Lelystad, The Netherlands
Tel. : +31 320 29 11 11
Fax : +31 320 23 04 79
E-mail : infoagv.ppo@wur.nl
Internet : www.ppo.wur.nl

WUR-Greenhouse Horticulture (WUR-GH)
Address : Violierenweg 1, Bleiswijk, The Netherlands
: PO Box 20, 2665 ZG Bleiswijk, The Netherlands
Tel. : +31 317 48 56 06
Fax : +31 10 52 25 193
E-mail : glastuinbouw@wur.nl
Internet : www.glastuinbouw.wur.nl

The HORTIN-II programme is sponsored by the Indonesian Agency for Agricultural Research and Development of the Ministry of Agriculture, Indonesia, and by the Ministry of Agriculture, Nature and Food Quality of the Netherlands (under project nr. BO-10-006-031.02).

Programme Team

	Indonesia	The Netherlands
Programme management	Dr. Yusdar Hilman, Director ICHORD Telephone +62 21 7890990 Fax +62 21 7805135 E-mail: YHILMAN@INDO.NET.ID	Dr. Arij Everaarts, APR, General management Telephone +31 320 291 671 Fax +31 320 230 479 E-mail: ARIJ.EVERAARTS@WUR.NL Mrs. Myrtille Danse, AEI, Supply Chain Management
Sweet pepper pilot project	Dr. Nikardi Gunadi, IVEGRI Telephone +62 22 2786 245 Fax +62 22 2786 416 E-mail: NGUNADI@BDG.CENTRIN.NET.ID	Mrs. Marieke van der Staaij, Ruud Maaswinkel, WUR-Greenhouse Horticulture Telephone +31 317 485 537 Fax +31 105 225 193 E-mail: MARIEKE.VANDERSTAAIJ@WUR.NL RUUD.MAASWINKEL@WUR.NL
Shallot pilot project	Dr. Rofik Sinung Basuki, IVEGRI Telephone +62 22 2786 245 Fax +62 22 2786 416 E-mail: ROFIK@HOTMAIL.COM	Lubbert van den Brink, APR Telephone +31 320 291 353 Fax +31 320 230 479 E-mail: LUBBERT.VANDENBRINK@WUR.NL
Hot pepper pilot project	Dr. Witono Adiyoga, IVEGRI Telephone +62 22 2786 245 Fax +62 22 2786 416 E-mail: VICIANTI@YAHOO.CO.ID	Herman de Putter, APR Telephone +31 320 291 614 Fax:+31 320 230 479 E-mail: HERMAN.DEPUTTER@WUR.NL
Supply chain management	Dr. Witono Adiyoga, Dr. Nikardi Gunadi, Dr. Rofik Sinung Basuki, IVEGRI	Mrs. Myrtille Danse, Mrs. Rolien Wiersinga, Dr. Dave Boselie, AEI Telephone +31 70 3358 341 Fax +31 70 3615 624 E-mail: MYRTILLE.DANSE@WUR.NL ROLIEN.WIERSINGA@WUR.NL DAVE.BOSELIE@WUR.NL
Quantitative Economic Analysis	Dr. Witono Adiyoga, IVEGRI	Marcel van der Voort, APR Telephone +31 320 291 312 Fax +31 320 230 479 E-mail: MARCEL.VANDERVOORT@WUR.NL
Fruit supply chains	Dr. Sri Yuliani, ICAPRD Telephone +62 251 321762 Fax +62 251 350920 E-mail: S.YULIANI@GMAIL.COM	Dr. Jeroen Knol, ASFG Telephone +31 317 480177 Fax +31 317 483011 E-mail: JEROEN.KNOL@WUR.NL

CONTENTS

Executive summary

The Quantitative Economic Analysis project was supplementary to the three technical projects within the HORTIN research programme. The Quantitative Economic Analysis project used the data from each of the three technical projects to determine the economic impact of the changes made in the cultivation practices. This all in relation to the current cultivation practices for the three crops in Indonesia.
As basis for the economic calculations the gross margin is taken as reference. Gross margin calculations make crop and trials comparable, due to the fact that farm specific elements are absent.

The hot pepper and shallot are commonly intercropped in Indonesia. When the research results are related to the farmer reference data this give the following effect. When the current cultivation technique is set at 100%. The result for hot pepper show substantial improvements. On average the gross margin comes to 284%. The result for shallot is a gross margin of 147%. When improvements for both, hot pepper and shallots, are followed through, the average increase in gross margin is a substantial 296% compared to the situation in practice.
The effect for both crops is impressive. The hot pepper increase is mainly due to the use of the screen net. The screen net has limited effect on yield of the shallot, but reduces costs of pesticide use in shallot and hot pepper.
The gross margin in Indonesia is almost identical to the net farm income. There are on Indonesian farm hardly any overhead costs. Therefore it can be concluded that the gross margin effect is almost the net farm income effect.

The sweet pepper is grown in greenhouses in highland areas in Indonesia. The research results show in relation to the farmer reference data the following effect. In sweet pepper the right adaptations in cultivation could increase the yield about 8%. The 8% is an average effect per cropping technique. This means there are no or very limited cost effects. Related to the farmers reference about an average 152% increase in net farm income is seen. The yield effect gives therefore a significant effect in farm income.

1. Introduction

1.1. Research project

Quantitative Economic Analysis was supplementary to the three technical projects within the HORTIN research programme. The Quantitative Economic Analysis project used the data from each of the three technical projects to determine the economic impact of the changes made in the cultivation practices. This all in relation to the current cultivation practices for the three crops in Indonesia.

The following project objects and purpose where formulated at the start of the project.
Long-term objectives:

- Developing a sustainable production system for hot pepper, shallots, sweet peppers production in Indonesia.
- Increasing the yield and quality of hot pepper, shallots and sweet peppers and reducing the production costs.
- Increasing farmers' income
- To improve the competitiveness of Indonesian hot peppers, shallot and sweet peppers production by means of introducing new cost effective methods.
- To increasing the adoption of improved cultivation techniques for sweet pepper, shallots and sweet peppers for research to practice.

Short-term objectives:

- Giving economic insight into the improved cultivation techniques of sweet peppers, shallots and hot peppers to Indonesian farmers.

Purpose:

- To contribute to the development of an innovative, high value and cost-effective supply chain for hot pepper in the northern coastal lowlands of Central Java.
- To contribute to a high value shallot supply chain by making use of true shallot seeds (TSS).
- To contribute to the development of an innovative, high value and cost-effective supply chain for sweet pepper in plastic houses in Indonesia.

1.2. Method and materials

The project consisted out of four parts.

1. Data collection at farm level for each of the three crops. The data gives insight in the economics (gross margin) of the three crops in current cultivation practices.
2. Economic calculation for each of the three technical projects. The economic calculations give insight in the economic effect of the researched cultivation improvements. Based on the amount of researched options a selection was made on the most promising options.
3. The most promising options / techniques will be calculated on the impact for farmers. The data collection at farm level (part 1) will used as starting point. This together with the economic calculations of the three technical project (part 2).
4. Knowledge transfer. The knowledge transfer consists out of two (sub-)parts. First is the knowledge transfer to farmers and extension workers. This should improve the farmers insight in their gross margin and cost price effects of the researched techniques. Second part is the knowledge transfer to the Indonesia researchers. The information and training should raise the economic awareness of Indonesian farmers and researchers.

The approach of this project, combined with the technical project, is similar to the on-farm research stages; Diagnosis, Planning, Experimentation, Assessment, Recommendation (CIMMYT, 1988).

The report follows the four parts of the project. The method and approach of the economic calculations are discussed in chapter 2. The results of the data collection are highlighted in chapter 3. The results of the economic evaluation of three technical projects are highlighted in chapters 4, 5 and 6. Chapter 7 highlights the knowledge transfer activities. Finally the conclusions and recommendations are highlighted in chapter 8.

2. Economic Calculations

2.1. Background of calculations

As basis for the economic calculations the gross margin is taken as reference. Gross margin calculations make crop and trials comparable, due to the fact that farm specific elements are absent. Specific farm elements are e.g. cost for machinery and overhead.
The gross margin of an enterprise is its output less its variable costs. Output includes the market value of any production retained on the farm. Variable costs are specific to the enterprise and vary in proportion to the size of the enterprise. A gross margin is not a profit figure. No account is taken of 'fixed' or 'overhead' costs (rent, labour, machinery, property upkeep, finance charges). Enterprise gross margins will vary considerably between individual businesses, due to differing yields and prices, differing systems, land quality and climate and level of management (SAC, 2001).

Farm economy is build up out of a view steps. Gross margin is the first step in calculating financial farm results. To enlighten the farm economics the figure below shows the steps in calculating farm business profit.

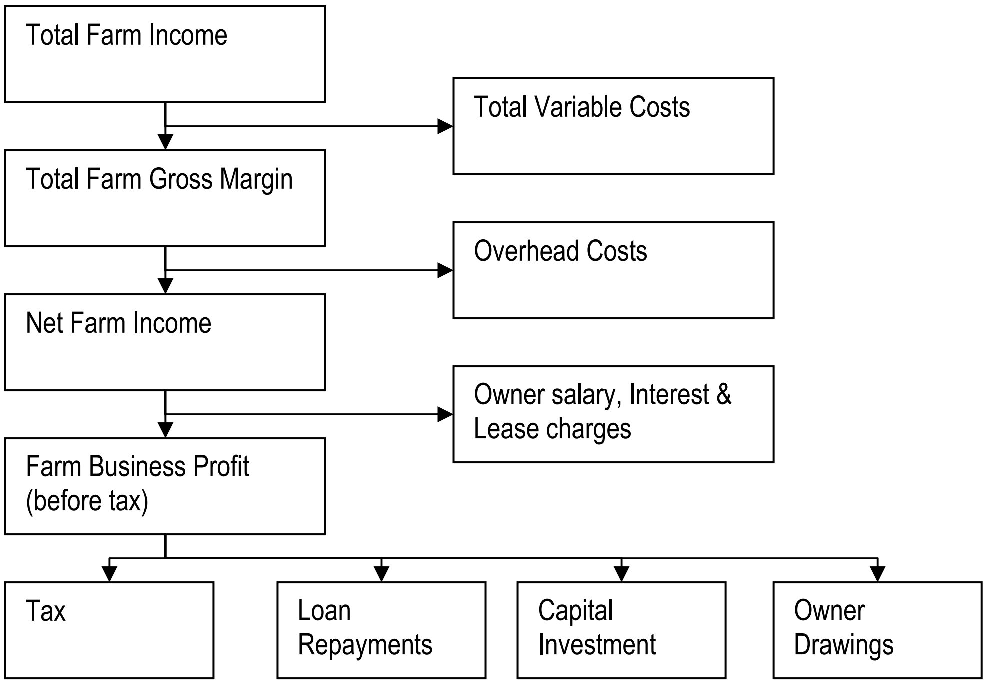

Figure1: How total farm gross margin relates to farm business profit
Source: Northern Victoria, 2005

Gross margin is the first step in calculating farm profits. The gross margin is a tool to calculate the profitability of crops. Therefore the gross margin can be used as a tool to compare crops with each other. In this research gross margin is used to calculate the effect of changes made in cultivation.
Gross margin calculations have limitations. Capital intensive crops or crops with different capital requirements cannot be compared just by gross margin. This would require a more complex budgeting analysis to take into account the differences in capital and timing of cash flows.

2.2. Specific aspects of calculations

International aspects of gross margin calculations

The way in which gross margins calculations are made varies internationally. Different quantitative information sources for gross margin calculations show different methods of gross margin calculations. The difference in method of calculating gross margins makes comparison difficult. Especially the variable costs items vary internationally. The differences are usually related to the specific way agricultural companies are practiced in the region/country. The gross margin in the research project is made up out of the following costs and benefit items.

- Yield and selling price (at farm gate)
- Seed / seedling costs
- Fertilizer costs
- Crop protection costs
- Other / additional material costs
- Labour costs
- Land rent

Labour and land rent are included due to the specifics of agricultural production in Indonesia. Most labour is done by hired labour. Indonesian farmers usually do not own their land, but rent the land per season and per crop.

Muliple year average versus one moment data collection
The gross margin gains significance if most data is collected multiple years. Due to the nature of this research project there is no data collected over a longer period of time. All gross margin calculations show an economic result per year, per season and per crop. Therefore seasonal or weather influences play a significant role in the result. This should be taken into account, when the information is used as reference or in other research projects.

Gross and net area
The gross margin calculation is based on a surface area. Due to the method of cultivating the fields there is a difference between gross and net area. This is a substantial difference. The net area is 70% of the gross area. This is a specific aspect relevant to hot pepper and shallot cultivation in this research project. In this research project the gross area (bagian and hectare) is used.

Surface area
The bagian is an Indonesian standard for 1,600 square metres. The bagian is a commonly used unit in Indonesian agriculture. Internationally the hectare is a unit which is commonly used. The bagian and the hectare are used both as surface area in this research project.

Nursery costs
The nursery costs are not calculated separately in Indonesia. In this research project the fixed costs the nursery are seen as separate activity. The reason to calculate the nursery separately from the production, is also the cultivation technique internationally. In a big number of countries it is common to buy seedlings from specialized plant breeding companies. In Indonesia it is common to grow from own seed and/or grow seedling at one's own farm. The development of specialized seed and seedling companies is foreseen. Therefore the nursery is calculated separately.

2.3. Sweet pepper

The method and approach in calculating the results for sweet pepper hold some specific elements. These elements will be highlighted in this paragraph.

Fixed costs
Main costs items are the greenhouse and the irrigation system.
The greenhouse has one specific element. The nursery is done within the greenhouse. This means that there are two activities in one greenhouse. The activities are calculated separately. Therefore part of the fixed costs related to the greenhouse are allocated per activity. This based on the area required for this activity.
The costs of the drip-irrigation are dependent on the type of cultivation system. In the technical research project 8.4 stems per m^2 is used as starting point.

Nursery costs
In most countries with greenhouse production the plant material is supplied by plant breeding companies. Not only fixed costs but also all variable costs of the nursery are calculated separately from the sweet pepper production.

Variable costs

The variable costs are made up out of the following costs items.

- Yield and selling price
- Seed / seedling costs
- Fertilizer costs
- Crop protection costs
- Other / additional material costs
- Labour costs

3. Economic data Indonesian farmers

3.1. Background on economic data

In 2007 and 2008 data on current cultivation techniques and economic results of farmers were collected. Per crop/cultivation technique a questionnaire was drawn up. The questionnaires are added to this report as appendix. To determine the relevant farmers to interview, the production method of each of the three crops was analysed.

Based on the research plans of the three technical projects and the general production and cultivation data, a number of options emerged to decide which farmers to interview. Per crop the most important decisions are highlighted. Due to the fact that hot pepper and shallots are often intercropped, the explanation of decisions are combined.

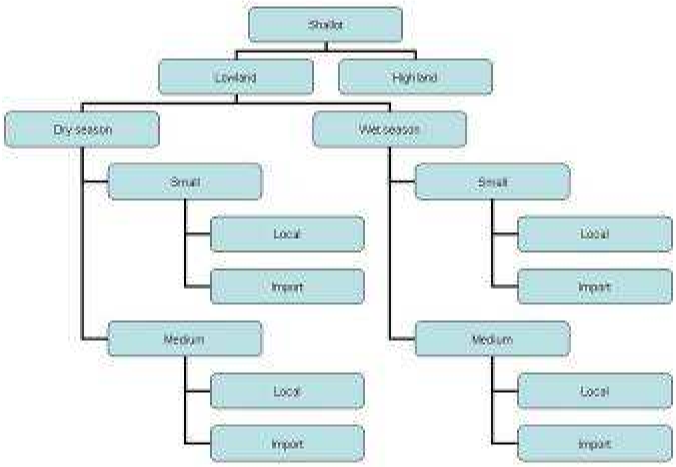

Figure 2.: Shallot decision tree

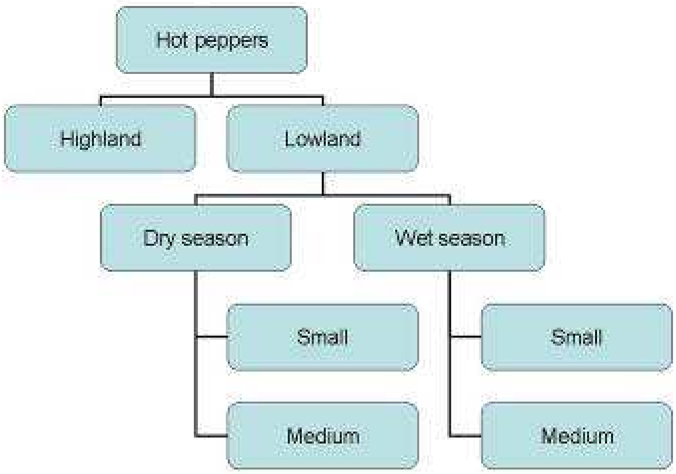

Figure 3.: Hot pepper decision tree

For both, hot pepper and shallot , there were a number of decisions to be made. The interviewed farmers were lowland farmers in Brebes. The most important production regions in Indonesia are lowland regions. The farmers were questioned on dry and wet season cultivation of shallots and hot pepper. The farmers are small or medium size farmers. Who use local and/or imported seed/bulbs.

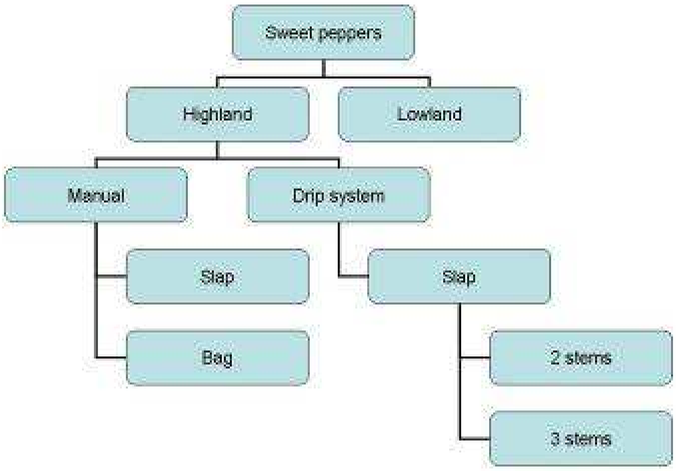

Figure 4.: Sweet pepper decision tree

Sweet peppers are only grown in highland area. Main focus of attention was the difference in techniques applied in practice, for example the watering systems. The manual watering is applied by almost 80% of all farmers. All research on sweet peppers is using the drip-system. Based on the evaluations in the past by IVEGRI they concluded that the drip-system is more capital intensive but also more economically viable. The drip-system saves a lot of manual labour, but also secures sufficient water in hot periods. This results in higher yields. Another effect of the drip-system is the reduction in fertilizer and pesticides use. The consequence of this decision was that 70-80% of the current cultivation practice for sweet peppers is excluded.
The drip-system is mostly used in combination with the slap systems. The bag systems is therefore excluded. The colour of the sweet peppers is mostly red, therefore green and yellow are excluded. Most farmers use two stems per plant and a small number is testing with 3 stems. Additionally the plant density is set as low. In research the plant density is higher and there is no comparison with lower plant densities. Therefore it is decided to used data on cultivation of previous research in the HORTIN-I project.
The farmers who will be interviewed for the sweet pepper cultivation are highland growers with a drip system and 2 stems with a plant density of 5.6 stems per m^2.
Another aspect is the type of green house. The greenhouse type (wood metal / bamboo) makes a difference. In practice the bamboo type greenhouse is used. In research the both types are used, but research is primarily done in the wood/metal type.

The collected data of the Indonesian farmers was based on the recollection of the farmers. The current situation in Indonesian agriculture shows that there is hardly any administration of any kind on farms. This is especially the case for economic data. In the research project 'Train the Chain' that started in 2009, the bottleneck of the collected data also became clear. The data collected in this project was based on the recollection of farmers and proofed to be not accurate. The collected data was compared with a group of farmers who wrote down all their activities and inputs. The result was a significant difference in results. Basically the yield and price are often estimated too high and all the costs too low. This bottleneck is the reason for a number of decisions made during this project.
The economic data of farmers in this chapter should be judged with this information in mind.

3.2. Hot pepper / shallot

The gross-margin calculations were drawn up for all three crops. To establish a baseline for the research results. A number of farmers is interviewed on their cultivation practice and its relevant financial aspects. For Hot pepper and shallot 10 farmers who are intercropping both crops are interviewed. This group of 10 farmers are the baseline.
Ten farmers from Brebes were taken as reference. Based on the interview data the following economic calculations are made. The data is based on the Indonesian bagian area unit, which is 1,600 m2,

Table 1a. Economic results of farmers, per bagian, 2007

	Growers				
	1	2	3	4	5
Yield					
Hot pepper (kg)	1,100	1,200	1,180	825	680
Shallot (kg)	1,429	1,800	2,000	2,125	2,429
Total income (Rp.)	9,376,500	13,000,000	13,760,000	14,862,900	9,741,500
Costs					
Seed/planting mat.	21,000	21,000	21,000	21,000	31,000
Fertilizer	977,500	1,100,500	837,200	1,417,000	982,000
Crop protection	2,993,000	2,770,000	715,000	1,085,996	1,491,000
Other inputs	10,000	15,000		10,000	
Labour	890,200	1,031,000	708,940	945,680	819,450
Land rent	733,333	1,200,000	533,333	1,000,000	1,666,666
Irrigation	100,000	500,000	200,000	70,000	200,000
Total variable costs	5,725,033	6,637,500	3,015,473	4,549,676	5,190,160
Gross margin	3,651,467	6,362,500	10,744,527	10,313,224	4,551,384

Table 1b. Economic results of farmers, per bagian, 2007

	Growers				
	6	7	8	9	10
Yield					
Hot pepper (kg)	1,000	1,500	700	900	1,000
Shallot (kg)	1,722	1,500	2,400	2,000	1,600
Total income (Rp.)	12,765,000	7,107,500	10,140,000	10,560,000	11,525,000
Costs					
Seed/planting mat.	56,750	66,000	93,000	93,000	93,000
Fertilizer	742,000	1,855,000	1,553,000	706,250	1,142,500
Crop protection	2,695,000	1,475,500	1,545,000	1,116,750	1,351,000
Other inputs	10,000				
Labour	693,160	1,034,894	778,340	1,046,900	866,540
Land rent	766,666	750,000	733,333	766,666	733,333
Irrigation	310,000	125,000	200,000	200,000	200,000
Total variable costs	5,263,576	3,090,697	4,902,673	3,929,566	4,386,373
Gross margin	7,501,424	4,016,803	5,237,327	6,630,434	7,138,627

In paragraph 3.4 an analysis of the economic data can be found.

3.3. Sweet pepper

For sweet pepper three farmers were interviewed on their cultivation of sweet pepper. The farmers have all a bamboo house, with slabs and drip-irrigation. The farmers are among the most advanced greenhouse farms in Indonesia.
Due to the capital intensive nature of greenhouse cultivation a gross margin and a cost-price calculation were made. There are some differences between the three sweet pepper growers. Grower 1 is cultivating red sweet pepper, grower 3 is cultivation yellow and red sweet pepper and grower 3 is cultivating green and red sweet pepper. Grower 1 did not differentiate between variable costs. Therefore there is just a sum total of variable costs. Labour mentioned in the variable costs is the hired labour. Growers themselves have only management tasks.

Table 2. Economic results of farmers, 2007

	Growers		
	1	2	3
Yield (in kg)			
Grade A	6,000	9,000	2,700
Grade B	1,500	3,000	1,500
Grade C	500	3,000	300
Total income (Rp.)	86,500,000	108,000,000	38,400,000
Costs (in Rp.)			
Seed/planting mat.		1,670,000	755,000
Fertilizer		9,300,000	4,350,000
Crop protection		3,000,000	3,270,000
Other inputs			350,000
Labour	5,600,000	5,600,000	5,600,000
Nursery		5,117,000	2,682,000
Total variable costs (Rp.)	32,000,000	24,789,500	17,007,000
Gross margin (Rp.)	54,500,000	83,211,000	24,075,000
Area (m^2)	594	1,000	360
Gross margin (per m^2)	91,750	83,210	66,875

Table 3. Net farm income calculation farmers, 2007

	Growers		
	1	2	3
Total income (Rp.)	**86,500,000**	**108,000,000**	**38,400,000**
Total variable costs (Rp.)	32,000,000	24,789,500	14,325,000
Greenhouse (Rp.)	45,000,000	25,858,000	3,333,000
Irrigation (Rp.)	7,128,000	13,777,500	923,000
Total farm costs	**78,528,000**	**53,610,500**	**18,581,000**
Net farm income	7,972,000	54,389,500	4,135,000
Area (m^2)	594	1,000	360
Net farm income (per m^2)	**13,420**	**54,390**	**4,446**

3.4. Conclusion and analysis

No Best Practice

It is likely to conclude that there is no best practice for any of the crops. The farmer data shows a wide variation per element of cultivation. The only observation which can be made is that it is possible to determine the focus crop of the farmer, in case of intercropping. Even for equal products prices vary very much. For example one brand of pesticide can be twice as expensive when two farmers are compared. Therefore is was not possible to generate one average gross margin calculation out of the 10 farmers, who intercropped hot pepper and shallot.

Fertilizer, crop protection, labour and land rent

The costs of fertilizer, crop protection, labour and land rent are the most significant cultivation costs. Crop protection 36%, Fertilizers 26%, Labour costs 20% and Land rent 19%. The changes in input of fertilizer, crop protection and labour can therefore influence the profitability of the crops most.

A significant amount of different pesticides is used in the cultivation of hot pepper/shallot. Reducing the amount of pesticides used will influence the crop protection costs positively. For hot pepper/shallot cultivation the labour costs of land preparation, watering, spraying and harvest are the most significant. There is all most no mechanisation on farms. This is mainly due to the low labour costs and small area / fields.

Price of inputs / materials
An observation is the difference in prices of the same brand of pesticide per unit. The price of a unit of pesticide looks arbitrary. A number of farmers could save significantly on costs of fertilizer and pesticides, if they bought for a lower price. The similar observation can be made for sweet pepper cultivation. The price range for similar products show also a significant difference. It was mentioned that a number of traders in crop protection sell their product for a higher price. They then include a lottery ticket with the product. This is one explanation of the higher price. It is not clear if there are more reasons to this wide variety in prices.

Hot pepper / shallot intercropping
An observation is that farmers seem to have one crop that has the primary focus of attention. Three of the ten farmers earn more of their total income per ha with hot pepper production. The other seven farmers earn more of their total income with the shallot production. Based on the yield distribution of both crops the ten farmers show an average share of hot pepper to shallots of 45 to 55%.
One of all farmers uses the hot pepper variety Tit Randu, all others use Tit Segitiga. Three farmers use the shallot variety Bangkok Warso, all seven others use Bima Curut.

Sweet pepper
The differences in economic results can not only be explained by number only. Therefore a few significant differences in characteristics between farmers is highlighted.

Table 4. Differences in characteristics sweet pepper farmers, 2007

	Growers		
	1	2	3
Number of greenhouses	1	15	4
Owner (own / rent)	100%	50%	100%
Colour sweet pepper	red/yellow 80-90%	red/yellow 90%	red/yellow 90%
Plants per m^2	3.7 plants	2.8 plants	3.3 plants
Yield per m^2	13.5 kg	15 kg	4.8 kg

The third grower has a substantial lower yield, it is not stated why. As reference, the yield in the experiments at IVEGRI varied per situation between 13 kg/m^2 and 18 kg/m^2 in 2009. The first two growers sold red and/or yellow. The third grower sold red and green sweet pepper. The red fruits give the best yield and the best prices. Followed by yellow and green fruits. Grower 1 is cultivating red sweet pepper, grower 2 is cultivation yellow and red sweet pepper and grower 3 is cultivating green and red sweet pepper. Grower 1 did not differentiate between variable costs. Therefore there is just a sum total of variable costs. Labour mentioned in the variable costs is the hired labour. Growers themselves have only management tasks.
The costs are quite different per grower. Especially the variable costs and greenhouse costs seem not related to the area of greenhouse. Due to the limited number of growers interviewed it is hard to draw any conclusions from this difference in costs. Analysis of the costs show, for example, that a number of separate parts of the greenhouse have different prices per grower. This is similar to the observation with intercropping of hot pepper and shallot.

4. Hot pepper research experiments

4.1. Background on economic analysis of research experiments

From 2007 to 2009 a number of research experiments were carried out to improve the cultivation of hot pepper in Central Java, Indonesia. There were two or three experiments per year. Each experiment consisted out of 10 till 20 different treatments. The experiments per year consisted out of a nursery experiment followed by a field experiment. In total a number of 97 different treatments were tested in the experiments. Due to this high number of experiments, a number of scenarios is determined based on the research carried out.
The technical aspects and background of the each of the experiments can found in the specified HORTIN-II research reports. This report is describes only the economics per scenario.
There are a number of specific elements that should be mentioned in relation to the economic results. The cultivation of crops in Indonesia differs for other countries. These specific difference should be taken into account in using or analysing the research results. The differences are for example the intercropping, the cultivation of vegetables after rice and the small field size.

Intercropping
The common practices is to intercrop hot pepper with shallot in the Brebes region. Therefore in a number of experiments hot pepper was intercropped with shallot. In the gross margin calculations the results of both crops are combined into one single gross margin calculation.

Nursery
An economic analysis of the nursery is reported separately. Therefore an economic analysis is not included in this chapter. In chapter 7 the method of the economic calculation of the nursery is included. The example given in chapter 7 is based on the hot pepper seedling nursery. The price of seedlings used in the field productions are calculated in the seed costs. This ensures the nursery costs are incorporated in the gross margin of the field production.

4.8. Research experiments hot pepper

In close cooperation with the researchers involved in the technical research a number of likely scenarios based on the research conducted were prepared. Based on the outcome of research experiments on hot pepper the following economic calculations were made.

Table 5. Economically analysed scenarios

	Variety	Container	Type	Cultivation System
1	Tit Segitiga	Direct sowing	Open field	Intercropping
2	Gada	Transplants	Open field	Intercropping
3	Gada	Transplants	Screen net	Intercropping
4	Tit Segitiga	Direct sowing	Screen net	Intercropping

The first scenario is similar to the cultivation of hot pepper in practice. The other three scenarios highlights the specific attention point of the research. A detailed gross margin calculation per scenario can be found in the annex III of this report.

Table 6. Results of scenarios per bagian, in IDR (x 1000,-)

Experiment	Total income	Total variable costs	Gross margin
1	17,025	18,571	-1,546
2	17,225	19,096	-1,871
3	32,750	24,131	8,618
4	30,650	23,358	7,291

Table 7. Results of scenarios per hectare, in IDR (x 1000,-)

Experiment	Total income	Total variable costs	Gross margin
1	131,607	132,650	-11,043
2	123,036	136,400	-13,364
3	233,929	172,364	61,557
4	218,929	166,843	52,079

4.9. Analysis and conclusion

Based on the technical experiments over the past years a number of conclusions can be made.

- Seedlings versus direct sowing
  The use of seedlings instead of direct sowing is less economically viable. The use of seedlings results in a slightly higher yield in hot pepper (intercropped with shallot). The yield effect is too low to compensate the costs of seedlings. In both cases the gross margin is negative (between -1,5 and -1,8 million IDR per bagian).
- Open Field versus Screen net
  The use of a screen net in field production of hot pepper has a tremendous effect on the yield of hot pepper. The yield increase is about 2.5 times the yield of current cultivation practise (open field, direct sowing of Open Pollinated seed). Due to the tremendous effect on the yield of hot pepper the costs of the screen net in the field is still positive. The gross margin falls between 7 and 8,6 million IDR per bagian.
  - Seedling versus direct sowing
  The use of seedlings leads to a positive effect when the screen net is used. The gross margin increases with 1,6 million IDR per bagian when seedlings are used under the screen net.
  - Open field versus Screen net
  The technical explanation is that the use of the screen net reduces the pest pressure. Although the hot pepper is intercropped with shallot, the yield effect is only seen in hot pepper.

Recommendations

- The screen net, in combination with hybrid seedlings, has the best gross margin. The screen net costs are substantial (7,9 million IDR per bagian). It could be researched if there are more crops that benefit in a similar way to use of the screen net like hot pepper. The screen net then could be used for multiple crops. This could reduce the costs per bagian.

The hot pepper could be mono-cropped under the screen net. The plant density of hot pepper can then probably be raise to further increase the yield per bagian. The shallot did not benefit from the screen net. Further optimization could be sought in the option of mono-cropping.

5. Shallot research experiments

5.1. Background

From 2007 to 2009 a number of research experiments were carried out to improve the cultivation of shallot cultivation in Central Java, Indonesia. There were two till four experiments per year. Each experiment consisted out of 10 till 20 different treatments. The experiments per year consisted out of a nursery experiment followed by a field experiment. Based on this large amount of experiments a selection was made based on the success and comparability of the experiments.
The technical aspects and background of the each of the experiments can found in the specified HORTIN-II research reports. This report is describes only the economics per experiment.
The cultivation of crops in Indonesia differs for other countries. These specific difference should be taken into account in using or analysing the research results.

Mono-cropping
The common practices is to intercrop hot pepper with shallot in the Brebes region. The research on shallot was mono-cropping instead of intercropping. In the gross margin calculations are the result of mono-cropping shallot.

5.2. Research experiments 2008 – 1

In close cooperation with the researchers involved in the technical research a number of experiments was selected. The experiment was to determine the effect of seedling and seed use in shallot cultivation. There was also a diverse in plant density for seedling use.

Table 8. Economically analysed research experiments 2008 - 1

	Code	Variety	Starting material	Cultivation System
1	T1	Tuktuk	Seedling	100 seedlings/m^2
2	T2	Tuktuk	Seedling	150 seedlings/m^2
3	T7 hy	Sanren	Seedling	100 seedlings/m^2
4	T8 hy	Sanren	Seedling	150 seedlings/m^2
5	T11	Bima	seed	store, 326 kg
6	T12	Tanduyung	seed	imported, 421 kg
7	T13	Bima	seed	farmer, 308 kg

1) HORTIN-II Research Report nr. 20

Table 9. Results of experiment per bagian, in IDR (x 1000,-)

Experiment	Total income	Total variable costs	Gross margin
T1	24,720	14,325	10,394
T2	28,960	15,662	13,298
T7 hy	31,760	14,492	17,267
T8 hy	34,000	16,165	17,834
T11	11,440	14,903	-3,463
T12	18,560	18,380	179
T13	13,600	11,827	1,852

Table 10. Results of experiment per hectare, in IDR (x 1000,-)

Experiment	Total income	Total variable costs	Gross margin
T1	154,500	89,533	64,966
T2	181,000	97,887	83,112
T7 hy	198,500	90,578	107,921
T8 hy	212,500	101,032	111,467
T11	71,500	93,149	-21,649
T12	116,000	114,879	1,120
T13	85,500	73,921	11,578

The hybrid variety is the most economically viable cultivation option. The increase in plant density also stimulate the economic return (gross margin). The sowing of local or imported varieties is not an economically viable option.

The detailed gross margin calculation can be found in the annex IV of this report.

5.3. Research experiment 2008 – 2 & 3a

The research experiment 2008 – 2 & 3a was to determine differences in varieties when sown directly.

Table 11. Economically analyzed research experiment 2008 – 2 & 3a

	Code	Variety	Starting material	Cultivation System
1	D2	Tuktuk	Seed	
2	D9 IL	Ilokos	Seed	
3	D10 BC	Bima	Seed	

1) HORTIN-II Research Report nr. 20

Table 12. Results of experiment per bagian, in IDR (x 1000,-)

Experiment	Total income	Total variable costs	Gross margin
D2	17,495	17,710	-215
D9 IL	27,380	14,335	13,044
D10 BC	18,830	9,636	9,193

Table 13. Results of experiment per hectare, in IDR (x 1000,-)

Experiment	Total income	Total variable costs	Gross margin
D2	109,343	110,693	-1,349
D9 IL	171,125	89,595	81,529
D10 BC	117,687	60,230	57,456

The direct sowing of the three varieties showed that the Ilokos variety is superior to the other two varieties. The high yield and low fertilizer costs are the most significant characteristics. The high costs of fertilizer for Tuktuk is the most important reason for its poor performance. In the experiment and additional amount of stable manure was supplied to the Tuktuk field. The stable manure was not supplied on the other two fields, with Ilokos and Bima. Another reason is the high costs of weed control.
The detailed gross margin calculation can be found in the annex V of this report.

5.4. Research experiment 2009 – Fertilization

In this experiment the optimal level of N-fertilization is researched. This for the varieties Tuktuk and Sanren. The varieties Bima and Ilokos are reference varieties. The plant density is the same for all seedling plots, 150 seedlings per m^2. The two seed bulb plots were planted with 326 kg seed bulbs.

Table 14. Economically analyzed research experiments 2009 - Fertilization

	Code	Variety	Starting material	Cultivation System
1	T120	Tuktuk	Seedllings	120 kg N/ha
2	T180	Tuktuk	Seedllings	180 kg N/ha
3	T240	Tuktuk	Seedllings	240 kg N/ha
4	T300	Tuktuk	Seedllings	300 kg N/ha
5	H120	Sanren	Seedllings	120 kg N/ha
6	H180	Sanren	Seedllings	180 kg N/ha
7	H240	Sanren	Seedllings	240 kg N/ha
8	H300	Sanren	Seedllings	300 kg N/ha
9	F-B	Bima	Seed bulbs	180 kg N/ha
10	F-IL	Ilokos	Seed bulbs	180 kg N/ha

1) HORTIN-II Research Report nr. 20

Table 15. Results of experiment per bagian, in IDR (x 1000,-)

Experiment	Total income	Total variable costs	Gross margin
T120	13,630	15,445	-1,815
T180	14,615	15,480	-865
T240	12,345	15,515	-3,170
T300	12,050	15,550	-3,500
H120	19,320	16,453	2,866
H180	20,600	16,488	4,111
H240	22,520	16,523	5,996
H300	24,855	16,558	8,296
F-B	11,385	15,233	-3,848
F-IL	9,470	16,863	-7,393

Table 16. Results of experiment per hectare, in IDR (x 1000,-)

Experiment	Total income	Total variable costs	Gross margin
T120	85,187	96,535	-11,347
T180	91,343	96,753	-5,410
T240	77,156	96,972	-19,816
T300	75,312	97,190	-21,878
H120	120,750	102,835	17,914
H180	127,750	103,053	25,696
H240	140,750	103,272	37,477
H300	155,343	103,490	51,852
F-B	71,156	95,210	-24,054
F-IL	59,187	105,398	-46,210

The fertilization experiment shows an unusual phenomenon. The effect of additional N-fertilization above 180 kg N, leads to a decline in yield for the variety Tuktuk. For the Hybrid variety Sanren each additional N-fertilization step leads to a yield increase. In case of fertilizer application the economic optimal level is 180 kg N per hectare for Tuktuk. For Sanren the economically optimal level is 300 kg N per hectare.
The local variety Bima and the imported variety Ilokos perform less than Tuktuk.
The detailed gross margin calculation can be found in the annex VI of this report.

5.5. Research experiment 2009 – Plant density

The plant density experiment was to determine the optimal plant density for Tuktuk and Sanren.

Table 17. Economically analyzed research experiments 2009 – Plant density

	Code	Variety	Starting material	Cultivation System
1	T75	Tuktuk	Seedllings	75 seedlings/m^2
2	T125	Tuktuk	Seedllings	125 seedlings/m^2
3	T175	Tuktuk	Seedllings	175 seedlings/m^2
4	T225	Tuktuk	Seedllings	225 seedlings/m^2
5	H75	Sanren	Seedllings	75 seedlings/m^2
6	H125	Sanren	Seedllings	125 seedlings/m^2
7	H175	Sanren	Seedllings	175 seedlings/m^2
8	H225	Sanren	Seedllings	225 seedlings/m^2
9	D-B	Bima	Seed bulbs	
10	D-IL	Ilokos	Seed bulbs	

1) HORTIN-II Research Report nr. 20

Table 18. Results of experiment per bagian, in IDR (x 1000,-)

Experiment	Total income	Total variable costs	Gross margin
T75	7,505	13,729	-6,224
T125	11,050	15,066	-4,016
T175	15,510	16,402	-892
T225	15,920	17,738	-1,818
H75	14,470	13,801	668
H125	16,250	15,473	776
H175	18,330	17,145	1,184
H225	18,345	18,817	-472
D-B	10,895	15,665	-4,770
D-IL	11,385	17,295	-5,910

Table 19. Results of experiment per hectare, in IDR (x 1000,-)

Experiment	Total income	Total variable costs	Gross margin
T75	46,906	85,811	-38,905
T125	69,062	94,162	-25,100
T175	96,937	102,513	-5,576
T225	99,500	110,864	-11,364
H75	90,437	86,257	4,180
H125	101,562	96,708	4,853
H175	114,562	107,159	7,402
H225	114,656	117,610	-2,954
D-B	68,093	97,910	-29,816
D-IL	71,156	108,097	-36,941

The plant density shows that the highest plant density is the most economically viable option.
The detailed gross margin calculation can be found in the annex VII of this report.

5.6. Nursery experiments

Part of the technical shallot research project was testing of nursery techniques. Three techniques were researched. The table nursery with net cover, the seedling in trays on a bed under net cover and the seedling in a bed under an net cover. The table nursery proved not to be a suitable technique. The seedlings dried to much by the air from underneath the table. The economic comparison between seedling on net covered beds lead to the following conclusion. The trays are the main difference in technique. The trays are also a significant cost item. Another aspect of seedling nursery with tray is the large amount of soil and manure needed. The practical problem was the availability of especially the stable manure needed. The seedling cultivation in the covered beds is the technique that proved to be the practicable.
An economic analysis of the nursery is part of the shallot report (HORTIN report no. 20). Therefore an economic analysis is not included in this report. In chapter 7 the method of the economic calculation of the nursery is included. The price of seedlings used in the field productions are calculated in the seed costs. The nursery costs are incorporated in the gross margin.

5.7. Conclusions and recommendations

Based on the technical experiments over the past years a number of conclusions can be made.

- Seedlings versus direct sowing
  The use of seedlings instead of direct sowing is more economically viable. The main effect is a significantly higher yield in shallots.
- Hybrid varieties perform better
  The hybrid variety Sanren performs better than local variety Tuktuk.
- Direct sowing less favourable
  Direct sowing of shallot seed is comparison with seedlings and seed bulbs not an economically viable option. If sown directly the imported variety Ilokos gives the best gross margin.
- Fertilizer
  The effect of increasing levels of N-fertilizer application show different results per variety. The Tuktuk variety has the best gross margin with a 180 kg N-fertilizer application per hectare. The hybrid Sanren

has the best gross margin at 300 kg N-fertilizer application per hectare. The Sanren variety could maybe benefit from an even higher N-fertilizer application. This was not part of the experiment. The increase in yield shows no relapse per step N-fertilizer increase.

- High plant density (175 seedlings per m^2)
  The seedling use is more economically viable than direct sowing or seed bulbs. The plant density optimum is 175 seedling per m^2. This plant/seedling density shows a good yield in comparison to the costs of seedlings. There is a difference between Tuktuk and Sanren in reaction on plant density. The response of Sanren on lower plant densities fluctuates less erratic. The response of Tuktuk on lower plant densities fluctuates considerably.

Recommendations

- The use of hybrid seedlings show a significant yield increase. Based on the average yield of the interviewed farmers a 3.5 times higher yield can be obtained.
- The use of fertilizer to increase yield is an interesting option. The fertilizer costs make up a small part of the total variable costs. Therefore a relatively small increase in costs gives a substantial yield increase. The optimization of fertilizer application is therefore recommended. This varies per variety, but for Sanren the tipping point is not found in this experiments.

6. Sweet pepper research experiments

6.1. Background

From 2007 to 2009 a number of research experiments were carried out to improve the cultivation of sweet pepper cultivation in Java, Indonesia. The research was carried out predominantly at IVEGRI institute at Lembang, Bandung. The cultivation took place in a wood-metal type greenhouse with drip irrigation. The research in Pasirlangu was, in consultation with the researchers, not included in these results.
The reporting of the results for sweet pepper is based on a number of promising scenarios. The first calculated scenario is based on the research. The second and third scenarios are potential opportunities, a perspective study. The data from the technical research is taken to see if there are potential opportunities to improve yield or gross income.

- The differences between 2, 3 and 4 stems per plant, with a 8.4 stems per m^2 density
- The effect of higher stem density, for 8.4 to 11.2 stems per m^2
- The effect of differentiating planting date on price setting

The three scenarios are discussed in the following paragraphs.

Reference for the economic calculations is the wood-metal greenhouse at IVEGRI. Regarding the economic calculations a few specific aspects are relevant.

Greenhouse
The greenhouse is 307 m^2 in size. The cost of the greenhouse are allocated over two activities by area (m^2), nursery (30 m^2) and production (277 m^2). The detail on economic calculation of the greenhouse production can be found in annex VIII.
Within the HORTIN-2 chain project three famers were interviewed in 2009. Two of the interviewed farmers had wood-metal type greenhouses. The information of this research project was studied. The greenhouse costs in this research was based on the actual wood-metal type greenhouse at IVEGRI. The cost of the wood-metal greenhouse of farmers (chain project) and that of IVEGRI are almost similar per m^2. This indicated that the greenhouse costs were representative.

6.2. The effect of 2, 3 and 4 stems per plant

The 2, 3 and 4 stems per plant were all carried out in a 8.4 stems per m^2 stem density. The number of stems per plant have impact on yield and costs. The calculations should make the economic impact of stem density visible.

Table 20. Results of sweet pepper experiment, yield per number of stems per plant, in kg/m^2

Cultivar	kg/m^2 at 2 stems	kg/m^2 at 3 stems	kg/m^2 at 4 stems
Spider	14.82	17.19	14.69
E41.9560	14.31	15.66	14.19
Zamboni	14.32	16.78	14.10
Inspiration	13.79	15.99	13.75

The total yield in 2009 was almost 90% Grade A. Grade A had an average price of IDR 8,243 per kg and Grade B had an average price of IDR 4,297 per kg in 2009. This give the following yield per square meter.

Table 21. Results of sweet pepper experiment, per number of stems per plant, in IDR/m^2

Cultivar	IDR/m^2 at 2 stems	IDR/m^2 at 3 stems	IDR/m^2 at 4 stems
Spider	115,616	134,100	114,598
E41.9560	111,634	122,149	110,697
Zamboni	111,723	130,902	109,995
Inspiration	107,576	124,739	107,265

Both previous tables show the effect of the number of stems per plant per cultivar in yield (in weight and financial). The financial result is the gross income per m^2.

6.3. The higher stem density

The general cultivation practice is 8.4 stems per m^2. In the research is was concluded that even 11.2 stems per m^2 was not the maximum productions possible. As a study for the perspective of the 11.2 stems per m^2 the higher stems density was calculated. The calculation method was linear. Based on the higher number of plants per m^2 the yield and all relevant costs were increase.
Based on this method the costs increase with 24%, while the yield increases with 33%.

Table 21. Results of sweet pepper, stem density

Cultivar	Total income/m^2	Variable costs/m^2
Spider (8.4 stems)	134,100	127,791
Spider (11.2 stems)	178,697	159,368

Table 21 indicates the possible potential of the higher stems densities. An important side effect is probably that due to the different strategy the overall net income of the greenhouse is higher.
In a number of experiments the gross income is too low to earn back all costs, including the greenhouse costs. This is also due to the cautious approach in cultivation to guarantee production. No production means no results in this type of research. The number of experiments with a negative (greenhouse) net farm income indicates the thin line between making and losing money in sweet pepper cultivation.

6.4. The variation in planting date

Due to the favourable climate the cultivation of sweet pepper can be started at any given moment during the year. The cultivation period for sweet pepper is variable in Indonesia. Farmers can therefore plan their cultivation based on the expected price variation during the year.
Unfortunately the price information of sweet pepper is not collected in Indonesia. Therefore there was no long-term price information available. The option still is mentioned to highlight the possibility to interested farmers.

6.5. Conclusions and recommendations

Based on the technical experiments over the past years a number of conclusions can be made.

- 2, 3 and 4 stems per plant
  The 3 stems per plant leads to the highest gross margin per m^2. The effect varies per variety, but the effect is between 1.5 and 2 kg per m^2.
- Varieties
  The researched varieties were Spider, E41.9560, Zamboni and Inspiration. Spider gives the best gross margin / yield per m^2. The yield is about 0.4 kg per m^2 more as the second variety (Zamboni) and about 1.5 kg per m^2 as the poorest variety (E41.9560).

Recommendations

- The cultivation of sweet pepper can start at any time. This is due to the climate situation in Indonesia. This means that the grower can vary the cultivation period. The price variations throughout the year can be a basis for the planning of the cultivation. The required price information was not available in this project. The option of variation of cultivation period based on price information could be researched.
- More options in improving not only cultivation techniques but also improve greenhouse and related systems and materials could provide further economic improvement options. The step from bamboo to wood-metal type greenhouses is a first step. Another option is the increase in stem density (11.2 stems/m^2). Further improvements in irrigation and media could also be researched.

7. Nursery

7.1. Background

The technical research on the three crops also included nurseries. Especially for hot pepper and shallot a number of options was researched. The researched options to grow seedlings for hot pepper and shallot was part of the technical research projects. The focus in the economic research was on the effect of the field production. The field production can be compared with the farmer reference. The nursery is not highlighted with specific results. The economics of the nursery were incorporated into the field production economics by the seedling price which was calculated based on the nursery.

7.2. Researched options

The technical project researched a number of options. These are found in the HORTIN-reports of the technical projects. The most important options are briefly highlighted below.

- Type of nursery (direct sowing, on beds, table nursery)
- Type of containers (Plastic bags, plastic trays)
- Types of media (mixtures of fertilizer, soil, rice husk, etc.)
- Other aspects (sowing boxes, Drenches, shelters, etc.)

The most relevant economic aspects of the nursery are given below.

Table nursery

The table nursery is a wood/bamboo construction. A table with a roof construction to hold the screen net. The technical detail can be found in the HORTIN-reports on technical research.
The relevant economic parameters are:
- table nursery - IDR 205.000,- with a life span of 6 years
- screen net – IDR 225.000,- with a life span of 2 years

Container types

There are three types of containers used during testing, the transparent plastic bags, plastic trays 128 cels and plastic trays 70 cells.

Model

In order to assist technical researchers a model to calculate the nursery costs is developed. The model (in excel) is designed as follows. The calculation is based on three elements, durable goods, variable costs and labour costs.
The general part in the model consists out of a number of elements, the germination, the plant loss, the number of cropping seasons per year and the number of seedling in the nursery.
The durable goods (table nursery, container types and wooden boxes) are calculated in separate boxes. Per box a durable good can be filled in (Purchase price, life span, remaining value). The result is than a unit price per year.
Labour costs are mentioned per activity. Per activity the required hours are filled in. A distinction is made to man and woman labour. There is a price difference in labour costs between man and woman labour in Indonesia. The labour costs give a total of labour costs. The variable costs are filled in per item by amount and price.
The result is the costs of the total nursery and the cost per seedling are given.

7.3. Results

The HORTIN-reports per technical research project feature the results of tested options. The results of the economic calculations are used in the gross margin calculation, by means of the seedling price.
The technical research on shallot showed that the table nursery was not suitable for growing shallot seedlings. The plants became too dry due to the air flow from under the table. The table nursery for shallot seedlings cultivation was then abandoned. Finally due to technical and economic reasons the shallot seedlings were grown directly on beds with a screen net cover (shelter). The poor availability of sandy soil and stable manure as media

was one of the technical reasons to switch to direct sowing on beds. The costs of the trays were an economic bottleneck. The bottleneck was also indicated by farmers on field demonstrations.
The hot pepper seedlings were grown in table nurseries. Below the economic calculation on the 1st experiment of 2009 is given. This is an example to indicate the method and approach of the nursery calculation.

Table 22. Unit price calculation durable goods (in IDR)

Durable good	Life span (in years)	Purchase price	Remaining value
Table nursery	5	205,000	0
Net	2	225,000	0
Trays	3	15,000	0
Wooden box	5	15,000	0

Table 23. Hot pepper seedling nursery costs, hybrid variety (in IDR)

Germination	90%	Plant loss	20%		
Number of seedling planted		1244	Number of seedlings needed		896

Durable goods	Amount	Unit	price	IDR total	IDR plant
Table nursery	1	pcs	20,500	20,500	22.89
Net	1	pcs	56,250	56,250	62.80
Trays	6	pcs	2,500	15,000	16.75
Wooden box	1	pcs	1,500	1,500	4.89
Variable costs					
Seed (hybrid)	5	gram	9,000	48,510	54.16
Transparent bags	128	pcs	5.7	730	0.81
Manure	7.92	kg	600	4,752	5.31
NPK	112	gram	11	1,232	4.01
Daconil	1.12	gram	140	157	0.18
Antracol	0.56	gram	78	44	0.05
Regent	0.98	gram	350	343	0.38
Agrimec	0.28	gram	1,100	308	0.34
Alvadre	0.63	gram	580	365	0.41
Midik	0.56	gram	462	259	0.29
Nurel D	0.56	gram	260	146	0.16
Borer	0.14	gram	106	15	0.02
Labour costs				13,194	14.73
Total				**163,304**	**188.17**

The hybrid seedling cost IDR 188.- to grow. The OP variety cost IDR 124.- per seedling. As indicated technical aspects determine the setup of the nursery. The economic aspects have proven to be less definitive.

7.1. Conclusion and recommendations

The conclusion is that when seedlings are grown in this capital intensive way, the costs can be reduce by growing more than just for one crop. The nursery is currently used twice a year for seedling production. The time period is maximum of 28 days to grow the hot pepper seedlings. This means the nursery is only in use for 56 days at the most per year. This leaves about 300 days were the nursery is not in use. When more seedlings of different crops are grown the costs of the durable goods can be further reduced. In the example above the cost of durable goods is 57% of the total. More efficient use of the nursery can therefore reduce these costs significantly.
The nursery was calculated separately as indicated in paragraph 2.2. The conclusion supports the ground to calculate the nursery separately. A plant breeding company can achieve the cost reduction foreseen when growing more seedlings than just for one crop. About the future developments in Indonesia can be speculated. For example one farmer or a group of farmers can act as plant breeder. Another option is that a group of farmers can share the nursery for the plant breeding. Finally a seed company could decide to grow seedlings for their seed. The can offer then seedlings instead of seed.

8. Research results and economic data farmers

8.1. Background

Basic premises of the research was comparing the research results with farmer practice. The goal which was appointed at the start of the project was to substantiate the impact of the technical research projects. The analysis of research results with the economic data of farmers presented a bottleneck. The bottleneck is the data of farmers. The farmers do not or to a limited extend keep records or have a financial administration. The economic data collected by interviewing farmers, is based on the memory of the farmer. The recollection of the farmer proved to be unreliable. The yield is mostly too high and the costs are too low.
In the following paragraphs the results are therefore an indication of possible gross margin increase. Therefore no conclusions were drawn up based on the differences between the research results and the agricultural practice. Within the analysis on research results with economic farmer data for sweet pepper was supplemented with economic data of the HORTIN Chain development project.

8.2. Hot pepper / shallot

To pre-empt the bottleneck of the farmer data, three scenarios are determined based on the hot pepper and shallot research. The following three scenarios are calculated:

- 1. Hot pepper: Intercropping under screen net with hybrid hot pepper transplants
- 2. Shallots: Intercropping with TSS hybrid seedlings, with 180 kg N fertilizer and 175 seedlings per m^2 plant density
- 3. Final: combination of all of the above.

For each of the scenarios is chosen to calculate the yield or cost effect based on the percentage of change for current situation. This means that from the research results a percentage of increase or decrease of costs is foreseen. This leads to a percentage of change of yield and total variable costs in the farmer data. The percentages are given below, table 24.

Table 24. The assumptions for the scenarios

	1	2	3
Yield			
Hot pepper	291%	-	291%
Shallot	-	111%	111%
Total variable costs			Combined
Hot pepper	129%	-	132%
Shallot	-	103%	

The percentages used on the farmer data from paragraph 3.2 give the following results per scenario.

Table 25a. Scenario 1: economic results of farmers, per bagian (x IDR 1.000,-)

	Growers				
	1	2	3	4	5
Yield					
Hot pepper (kg)	3.208	3,499	3,441	2,406	1,983
Shallot (kg)	1,429	1,800	2,000	2,125	2,429
Total income	21,039	32,594	28,645	30,367	16,433
Total variable costs	7,385	8,562	3,899	5,869	6,695
Gross margin	13,654	24,032	24,755	24,498	9,737

Table 25b. Scenario 1: economic results of farmers, per bagian (x IDR 1.000,-)

	Growers				
	6	7	8	9	10
Yield					
Hot pepper (kg)	2,916	4,374	2,041	2,624	2,916
Shallot (kg)	1,722	1,500	2,400	2,000	1,600
Total income	25,245	24,309	28,247	18,497	21,780
Total variable costs	6,790	3,986	6,324	5,069	5,658
Gross margin	18,454	20,322	11,922	13,428	16,121

Table 26a. Scenario 2: economic results of farmers, per bagian (x IDR 1.000,-)

	Growers				
	1	2	3	4	5
Yield					
Hot pepper (kg)	1,100	1,200	1,180	825	680
Shallot (kg)	1,586	1,998	2,220	2,359	2,696
Total income	11,051	17,391	15,960	16,934	12,156
Total variable costs	5,896	6,836	3,105	4,686	5,345
Gross margin	5,154	10,554	12,854	12,248	6,810

Table 26b. Scenario 2: economic results of farmers, per bagian (x IDR 1.000,-)

	Growers				
	6	7	8	9	10
Yield					
Hot pepper (kg)	1,000	1,500	700	900	1,000
Shallot (kg)	1,911	1,665	2,664	2,220	1,776
Total income	14,601	15,240	10,860	12,480	12,992
Total variable costs	5,421	3,183	5,049	4,047	4,517
Gross margin	9,179	12,056	5,810	8,432	8,474

Table 27a. Scenario 3: economic results of farmers, per bagian (x IDR 1.000,-)

	Growers				
	1	2	3	4	5
Yield					
Hot pepper (kg)	3.208	3,499	3,441	2,406	1,983
Shallot (kg)	1,586	1,998	2,220	2,359	2,696
Total income	21,589	33,485	29,525	31,302	17,368
Total variable costs	7,557	8,761	3,980	6,005	6,850
Gross margin	14,032	24,723	25,544	25,297	10,517

Table 27b. **Scenario 3: economic results of farmers, per bagian (x IDR 1.000,-)**

	Growers				
	6	7	8	9	10
Yield					
Hot pepper (kg)	2,916	4,374	2,041	2,624	2,916
Shallot (kg)	1,911	1,665	2,664	2,220	1,776
Total income	26,097	25,299	18,907	19,377	22,572
Total variable costs	6,947	4,079	6,471	5,187	5,790
Gross margin	19,149	21,219	12,435	14,190	16,781

Conclusion
When the current cultivation technique is set at 100%. The result for hot pepper show substantial improvements. On average the gross margin comes to 284%. The result for shallot is a gross margin of 147%. When improvements for both, hot pepper and shallots, are followed through, the average increase in gross margin is a substantial 296% compared to the situation in practice.
The effect for both crops is impressive. The hot pepper increase is mainly due to the use of the screen net. The screen net hold limited effect on yield of the shallot, but reduces costs of pesticide use in shallot (also hot pepper).

Recommendation
These results are not tested with farmers in practice. The results are therefore the theoretical possible improvements. The best practice could be tested in practice to find actual improvement percentages instead of theoretical.

8.3. Sweet pepper

Greenhouse
The economic research of sweet pepper was based on the wood-metal type greenhouse. All of the interviewed farmers had the bamboo type greenhouse. Therefore it is decided that only the cultivation effect is calculated.

With the right cultivation system in stem density and variety, the increase in yield is about 8%. The 8% is an average effect per cropping technique. This means there are no or very limited cost effects. The effect is calculated below.

Table 28. **Net farm income calculation farmers, 2007**

	Growers		
	1	2	3
Total income (Rp.)	**93,420,000**	**116,640,000**	**41,472,000**
Total variable costs (Rp.)	32,000,000	24,789,500	14,325,000
Greenhouse (Rp.)	45,000,000	25,858,000	3,333,000
Irrigation (Rp.)	7,128,000	13,777,500	923,000
Total farm costs	**78,528,000**	**53,610,500**	**18,581,000**
Net farm income	14,972,000	63,029,500	22,891,000
Area (m^2)	594	1,000	360
Net farm income (per m^2)	**25,205**	**63,030**	**63,586**
Income effect	188%	116%	554%

The yield effect gives a significant effect in farm income. The yield effect within the same systems of cultivation means no additional costs. The variety used and in combination with a successful cultivation gives promising effects on the net farm income. The result for the third grower is questioned. Due to the low costs the effect is probably too high. As stated in paragraph 3.3 the reliability of the data is questionable.

9. Knowledge transfer activities

9.1. Background

The knowledge transfer of the Quantitative Economic Analysis project is made up out of two parts. First part is the knowledge transfer to Indonesian farmers and extension workers. Second part is the knowledge transfer to Indonesian researchers.

9.2. Indonesian farmers and extension workers

The knowledge transfer to Indonesian farmers and extension workers is based on two goals. First goal is to exchange knowledge on making basic economic farm calculations. Second goal is to exchange knowledge on economic results of the researched improvements in cultivation.
The knowledge transfer to farmers was integrated into the knowledge transfer activities of the technical projects in 2010. This was mainly due to the nature of the Quantitative Economic Analysis research project. The project was subordinate to the three technical research projects. Also budget wise it was not possible to be present during all knowledge transfer activities of the technical research project that were held throughout the year. Within each of the technical projects field demonstrations, lectures and poster presentations were held. Detailed information on these activities can be found in the mission reports and project reports of each of the technical research projects.
Above the actual activities on knowledge transfer to farmers and extension workers is stated. Due to the methodology of the HORTIN-2 project a more indirect way of knowledge transfer took place as well, namely the co-innovation methodology. The technical research took place at or in close proximity of the farms. It is only not clear what the actual effect of the co-innovation is on the knowledge transfer to farmers was. Therefore only the actual knowledge transfer activities are described above.

9.3. Indonesian researchers

The Indonesian researchers are also part of the knowledge transfer. The knowledge transfer is also direct en indirectly transferred. Indirectly knowledge is transferred during the process of working together on the project. During the first two years of the Quantitative Economic Analysis project, especially the method and approach of economic calculations is transferred during numerous discussions on how to go about. For example the explanation of why data is required and how the economic results are calculated, helped to achieve a better insight in making economic farm calculations. Special emphasis was put on economics to support the technical research.
There are more concrete knowledge transfer elements. For each of the crops excel-models were developed to support economic calculations of technical research. The models were an effort to give the Indonesian technical researchers a tool to calculate the economic effect themselves. The models were designed tailor-made to reflect the actual situation in Indonesia. In the design process the goal was to lay down a fixed methodology and approach. Therefore the technical researcher would only have to fill in the agronomical and price data. The financial result is directly given after filling in the data, because the methodology and formulas were predetermined. In the end of the project the models were used by Dutch and Indonesian researchers. An description and user guide was written on the use and methodology of the models to stimulate future use of the models.
The models were made available to all technical researchers involved (Indonesian and Dutch). But the models can be of use to other parties involved crop cultivation as well. The suggestion was to make the models available through the website of IVEGRI or by the dissemination department of ICHORD. The models are available on request.

10. Discussion

10.1. Background

During the course of the QEA project a number of discussion points arose. A number of these discussion points are noted below.

10.2. Discussion

Nursery

The nursery is calculated separately to the cultivation of the crops. As stated in paragraph 2.3 the nursery is seen as separate activity. Therefore the nursery calculated separately from the production. In practice both activities will take place at the farm. The technical research projects were comparing farm situations and preferred to combine all costs, including nursery costs. A number of times the economic outcome of the technical research was communicated to farmers as combined total, instead of a separate nursery. The combined total represents all cost from the actual purchase of seed to the harvest and sale of the produce. The background in this approach can be found in fact that Indonesian farmers grow crops from their own seed.
As reference to the discussion the Dutch situation on seedling use in vegetable cultivation is given as example. In The Netherlands it is quite common for farmers to buy seedlings of vegetable crops from a specialized plant breeding companies. Although Indonesia is now taking the first steps towards the used of seedlings in vegetable production, the future development towards a similar situation as in The Netherlands is foreseen.
An addition to this discussion is the cost of the nursery. The nursery is not in use year round. Therefore the costs of the nursery are weighing on the actual price of seedlings. Specialization is foreseen as an option to reduce the costs of seedlings. Based on this assumption a number of scenarios can be drawn. The first option is that seed breeding companies will also pick up the seedling breeding. The second option is that a separate company or a farmer will start breeding seedlings.
Not only fixed costs but also all variable costs are calculated separately from the sweet pepper production.

Economic calculations – Record keeping

The execution of economic calculations were more difficult to complete than expected at the start of the project. A number of factor contributed to this difficulties. Record keeping at farms by farmers is one of these factors. Farmers do not keep records of their purchases on fertilizers and pesticides, yield and price. The collected data of farmers is mainly from memory/recollection of the farmer. Another factor is the economic knowledge/awareness on all levels. The lack of record keeping and economic awareness on farm level are two correlating factors.
The execution of economic calculations is not done by farmers and/or researchers. Farmer are not triggered to do economic calculations. The Indonesian researchers are not commissioned to do so either.
The Indonesian researchers have all an agronomical or technical background in plant cultivation. The field of economics is, just as crop cultivation, a specific field of expertise. Therefore it also not their key expertise. Due to the nature of the project (co-innovation), it is seen that farmer are not only interested in technical results but also on economic impact (at farm level).
The discussion therefore can be held on how to incorporate economic in farmers' practice, research and policy making. The farmers can be the most difficult group to reach and effect. This probably depends largely on the education and background of the farmers. The communication of the developed models to the farmers are also an option.
The technical research can be helped by a supporting department or staff member on (farm) economics. The policy maker can be helped by selecting development strategies based on the economic impact on farm economics.

11. Conclusions, recommendations and evaluation

11.1. Background

The conclusion and recommendations are derived from the process instead of economic results per crop. The economic results and conclusion can be found in chapters 4,5 and 6 of this report.

11.2. Conclusions

Based on the experience obtained during this research project a number of conclusions can be drawn.

- Poor economic awareness into farmers practice
  The Indonesian farmers are not keeping records of yields and inputs. The poor awareness and insight in yield and inputs shows that the reference given not reflects the actual situation for the full 100%. The yield is (on average) estimated too high and the costs are estimated too low. The prices of the produce and inputs are also estimates. The economic data of farmer is therefore considered too unreliable for further use in research. The economic farmer data only gives a general picture of the cultivation practice of the crops in Indonesia.
- No clear basis in economic calculations
  The economic calculations started with the development of a useable method of economic calculation. The economic data must be interpreted correctly, in order to come to good conclusions. There are differences in method and basic premises. The consequence of different methods of gross margin calculations is that the results are not comparable.

11.3. Recommendations

Based on the experience of this research project a number of recommendations can be made.

- Increase economic knowledge/awareness
  The basic level of record keeping is lacking at farm level. The lack of reliable records at farm level prevents research and policy making from drawing conclusions and/or impact assessments. A side effect is a low level of economic awareness with farmers. All parties involved should aim for increasing the economic knowledge. Indonesian farmers are driven by economic stimulus. Increasing economic knowledge can therefore be used as driver to stimulate the required change in cultivation techniques. Perhaps the bottleneck is also a problem in Indonesian statistics. It is not known, but this could also be a determinant in statistical analysis.
- Start with an economic evaluation of technical research
  The potential technical cultivation solutions were basic premises of the project. When the economics of the crop cultivation are known, the cultivation improvements can be calculated in advance. The benefit of this approach is that technical research is more cost efficient. Technical research has high costs. Insight, in advance, in promising cultivation techniques provides focus on economic viable cultivation techniques. This saves expensive research time and effort.
- Measurable data
  The collected economic data of farmers was based on the recollection of the farmer. This proved not to be an accurate representation of the reality. The economic results of this project could therefore be poorly projected on the economic data of the farmers. The collection of economic data of crop cultivation of various crops in Indonesia is therefore recommended. The statistics bureau or the Ministry of Agriculture could start with the data collection. Data collection is also required to make the first two recommendations possible.
- Use economic consequence of e.g high pesticide use in policy making
  For example a high pesticide use gives high costs for farmers. The economic costs of pesticides proved to be a stimulus to change current cultivation practice. The government can therefore use this to their advantage. They can highlight the alternative techniques to farmers with an economic explanation. In this way the government is positively stimulating desired behaviour of farmers. By using this approach the control and inspection bodies can be exonerated. The economic stimulus can be incorporated into policy making.

11.4. Project evaluation

An internal evaluation of the project is carried out. Main goal of this self-evaluation is to learn of bottlenecks/problems to prevent them in the future.

- The economic awareness
  An element which was not taken into account as it should have been, was the economic awareness. The basic economic knowledge and the availability of economic data were underestimated.
- Timeframe per project
  The technical projects were carried out for January till December. The HORTIN QEA project had the same timeframe. The data of the technical project became available in December of the project year or even in January or February of the following year.
- Availability of data
  The economic data of the technical project became available with effort. This was due to two elements. The first is the primary focus on the technical projects. Second is the economic awareness. The limited economic awareness contributes to focus on the technical projects. It is tempting to focus on the familiar.

References

- Adiyoga, Witono, Putter, Herman de, Gunadi, Nikardi, Moekasan, Tonny K., Rodenburg, Rien, Influence of substrate, tray choice and variety on transplant raising and yield of hot pepper, HORTIN-II Research Report nr. 6, Lelystad, The Netherlands, Lembang, Indonesia, April 2008
- Adiyoga, Witono, Putter, Herman de, Gunadi, Nikardi, Moekasan, Tonny K., Influence of nursery, Actara drench and variety on transplant raising and yield of hot pepper, HORTIN-II Research Report nr. 8, Lelystad, The Netherlands, Lembang, Indonesia, March 2009
- Adiyoga, Witono, Putter, Herman de, Gunadi, Nikardi, Moekasan, Tonny K., Effect of variety, container, nitrogen and Regent drench on transplant raising and yield of hot pepper, HORTIN-II Research Report nr. 9, Lelystad, The Netherlands, Lembang, Indonesia, March 2009
- Adiyoga, Witono, Putter, Herman de, Gunadi, Nikardi, Moekasan, Tonny K., Effect of variety, container type, Regent drench, transplant depth and transplant age on transplant raising and yield of hot pepper, HORTIN-II Research Report nr. 10, Lelystad, The Netherlands, Lembang, Indonesia, March 2009
- Adiyoga, Witono, Putter, Herman de, Gunadi, Nikardi, Moekasan, Tonny K., Effect of variety, transplant raising, screen net, mulch and cropping system on hot pepper growth and yield, HORTIN-II Research Report nr. 15, Lelystad, The Netherlands, Lembang, Indonesia, November 2009
- Adiyoga, Witono, Putter, Herman de, Gunadi, Nikardi, Moekasan, Tonny K., Effect of variety, transplant raising, screen net, mulch and cropping system on hot pepper growth and yield, HORTIN-II Research Report nr. 25 Lelystad, The Netherlands, Lembang, Indonesia, February 2010
- Sinung Basuki, Rofik, Brink, Lubbert van den, Improvement of shallot supply chains, Summarized research results of 2007-2010, HORTIN-II Research Report nr. 20, Lelystad, The Netherlands, Lembang, Indonesia, November 2010
- Gunadi, Nikardi, Maaswinkel, Ruud, Rodenburg, Rien, Effect of number of stem per plant on the growth and yield of four sweet pepper varieties, HORTIN-II Research Report nr. 23, Bleiswijk, The Netherlands, Lembang, Indonesia, February 2010
- Gunadi, Nikardi, Maaswinkel, Ruud, Rodenburg, Rien, Effect of plant balancing on the growth and yield of two sweet pepper varieties harvested green and colour, HORTIN-II Research Report nr. 24, Bleiswijk, The Netherlands, Lembang, Indonesia, February 2010
- Gunadi, Nikardi, Maaswinkel, Ruud, Moekasan, Tonny K., Prabanungrum, L., Subhan, Adiyoga, Witono, Pengaruh jumlah cabang per tanaman terhadap pertumbuhan dan hasil tiga varietas paprika (capsicum annuum var. grossum), IVEGRI, Lembang, Indonesia, Greenhouse Horticulture, Bleiswijk, The Netherlands, 2008
- Gunadi, Nikardi, Putter, Herman de, Rodenburg, Rien, Moekasan, Tonny K., Everaarts, Arij, Subhan, Adiyoga, Witono, Effect of plastic house construction, stem density, pruning and fruit selection on growth and yield of sweet pepper (PROTVEG1), HORTIN, Indonesian Vegetable Research Institute, Lembang, Applied Plant Research, Lelystad, Research Report 11, 2007
- SAC (The Scottish Agricultural College), The Farm Management handbook 2001/2002, Edinburgh, 2001
- Northern Victoria, Irrigated Cropping, Gross Margins 2005-06, Department of Sustainability and Environment, Department of Primary Industries, 2005
- CIMMYT, From Agronomic Data to Farmer Recommendations: An Economics Training Manual, Completely revised edition, Mexico, D.F., 1988

Annex I.: Example of interview questionnaire

HOT PEPPER QUESTIONNAIRE

I. FARMERS' CHARACTERISTICS

1. Age : years

2. Education :
   - a. No schooling
   - b. Elementary school
   - c. Middle school
   - d. High school
   - e. College
   - f. University

3. Main job/employment
   - a. Farmer
     - a1. Owner, no laborer
     - a2. Owner and laborer
     - a3. Renter
     - a4. Sharecropper
     - a5. Laborer
     - a6. Other, …………………
   - b. Government employee
   - c. Private company employee
   - d. Entrepreneur
   - e. Other, ………………………….

4. Experience of growing hot pepper intercropped with shallot : years

5. Size of land that ever been utilized :
   - a. Minimum : m^2 or ha
   - b. Maximum : m^2 or ha

II. CROPPING PATTERN

1. In 2007, how many times did you grow hot pepper?
   - a. One times, planted on (month):
   - b. Two times, planted on (month):

2. Do you always grow hot pepper in intercropping with shallot?
   - a. Always, why?
   - b. Not always, why?

3. How is the common cropping pattern that you practice in one whole year?

Jan :
Feb :
Mar :
Apr :
May :
Jun :
Jul :
Aug :
Sep :
Oct :
Nov :
Dec :

III. SEED

1. What variety did you use in your last planting?

   Hot pepper :
   Shallot :

2. Please mention all varieties that you have been experiencing to use in the last 5 years!

   Hot pepper :

   Shallot :

3. Are you differentiating the use of variety by season?

	Dry season	Wet season
Hot pepper		
Shallot		

4. Please describe seed treatments that you carry out before planting!

   Hot pepper :

   Shallot :

5. How much time (hours) is needed per treatment?

IV. LAND PREPARATION

1. Please mention all steps of land preparation when you grow hot pepper + shallot!

   a.
   b.
   c.
   d.
   e.
   f.
   g.
   h.
   i.
   j.

2. Please mention the differences in land preparation for growing hot pepper + shallot, during dry season and wet season!

Dry season	Wet season
•	•
•	•
•	•
•	•
•	•
•	•

3. How much time (hours) is needed for land preparation? hours per ha

4. Is the land preparation carried out by the farmer of hired labour?

V. PLANTING

1. Please describe the planting distance commonly used in growing hot pepper + shallot!

	Hot pepper	Shallot
Within row		
Between row		

2. Are there any differences in planting distance between dry and wet season? Explain!

3. How much time (hours) is needed for planting? hours per ha

4. Is the planting carried out by the farmer of hired labour?

VI. FERTILIZATION

1. What, how many and when do you use fertilizer in growing hot pepper + shallot?

	Fertilizer	Quantity	When
Basal fertilization			
1st fertilization			
2nd fertilization			
3rd fertilization			
4th fertilization			

2. Please explain how you apply the fertilizer!

3. Please mention if there are some differences in fertilizer application between dry and wet season!

4. How much time (hours) is needed for application of fertilizer? hours per ha

5. Is the application of fertilizer carried out by the farmer of hired labour?

VII. WEEDING

1. How do you carry out the weeding activity?
   a. Manually
   b. Chemically

2. In average, how many times do you carry out the weeding? times

3. How much time (hours) is needed for weeding? hours per ha

4. Is the weeding carried out by the farmer of hired labour?

VIII. CROP PROTECTION

1. Please describe pests and diseases in growing hot pepper + shallot, and how to control them chemically!

Pests & diseases	Pesticides	Concentration	Frequency/week
Hot pepper			
Shallot			

2. Do you practice pesticide mixing (cocktails)?
    a. Always
    b. Sometimes
    c. Never

3. What are the reasons for mixing pesticides?
    a. More efficacious
    b. More labor saving
    c. Less costly
    d. Copying other farmers
    e. Other, explain……

4. When do you carry out the last spraying? days before harvest

5. How much time (hours) is needed for spraying? hours per spray
   (time incl. mixing, spraying and cleaning)

6. Is the spraying carried out by the farmers of hired labour?

7. How often is sprayed per cropping season? times

IX. WATERING

1. How frequent do you water your plants?

2. Do you use fresh water or water collected from canals?

3. How much time (hours) do you need per watering?

4. Is the watering done by the farmer or hired labour?

5. How often is watered per cropping season? times

X. HARVEST AND PRODUCTION

1. When is the harvest time for hot pepper?

2. When is the harvest time for shallot?

3. What is the average production per ha?

	Dry season	Wet season
Hot pepper		
Shallot		

4. Do you save some harvest for next season planting seeds?

Hot pepper	a.	Always	%
	b.	Sometimes	
	c.	Never	
Shallot	a.	Always	%
	b.	Sometimes	
	c.	Never	

5 How much labour (time) is used on harvesting?

Own labour : Hours
Hired labour : Hours

6. What materials or costs are made during (in behalf of) harvest activities?

Packaging materials?
Transportation costs?
Other?

XI. COSTS AND REVENUES

Land size: ....(m2 or ha)

Input dan output	Quantity	Unit Price	Value
A. Seed			
1. Hot pepper			
2. Shallot			
B. Fertilizer			
1. Urea			
2. ZA			
3. TSP			
4. KCl			
5. NPK			
6. Foliar fertilizer			
7.			
8.			
C. Pesticides			
Insecticides			
1.			
2.			
3.			
4.			
5.			
6.			
Fungicides			
1.			
2.			
3.			
4.			
5.			
6.			
D. Hired labor			
1. Land preparation			
2. Preparing shallot seed bulbs			
3. Planting shallot			
4. Planting/direct sowing hot pepper			
5. Fertilizing			
6. Spraying			

7. Weeding			
8. Watering			
9.			
10.			
E. Other costs			
1. Land rent			
2. Irrigation fees			
3.			
4.			
5.			
F. Production			
Hot pepper			
Total production			
Saved for seeds			
Total production sold			
Other			
Shallot			
Total production			
Saved for seeds			
Total production sold			
Other			
G. Total revenues			
Hot pepper			
Shallot			

XII. PRODUCTION CONSTRAINTS

1. Please state the order of importance of confronted production constraints!

No	Factors	Rank of Importance
a.	Degradation of soil fertility	
b.	Pest and disease incidences	
c.	Costs for good quality seeds	
d.	Costs for fertilizers	
e.	Costs for pesticides	
f.	Hired labor availability	
g.	Costs for hired labor	
h.	Land availability	
i.	Costs for land renting	
j.	Output price fluctuation	
k.	Irrigation	

Annex II. Sweet pepper questionnaire

SWEET PEPPER QUESTIONAIRE

Date of interview : ……. /….. .. /….. ..

Name of Enumerator : ....…………..

Name of village / sub-district / district / city: ……………………………

I. FARMERS' CHARACTERISTICS

1. Name of farmer :

2. Age : years

3. Education :
   a. No schooling
   b. Elementary school
   c. Middle school
   d. High school
   e. College
   f. University

4. Main job of farmer :
   a. Farmer
   b. Government employee
   c. Private company employee
   d. Entrepreneur
   e Other, ………………………….

5. Other job of farmer/owner :

6. Experience of growing sweet pepper in the plastic house : years

7. Number of plastic house owned : ………………………

8. Area and capacity of each plastic house you have?

No.	Area of each plastic house (m x m)	Capacity of each plastic house (number of total plant)
1		
2		
3		
4		
5		

9. Status of land: own or rent? ....

II. CROPPING PATTERN

1. How long (number of months) do you grow the sweet pepper in general? months

2. In 2007, what are the area and number of plants you grew?
   a. Area: m^2
   b. Number of plants: plants

3. Do you have a fix time (month) to grow the sweet pepper?
   a. No
   b. Yes, …………….

III. SEED

1. How many varieties did you grow in 2007?

2. What variety did you grow in 2007?
   a.
   b.
   c.
   d.
   e.

3. Please mention all varieties that you have been experiencing to use in the last 5 years!
   A
   B
   C
   D
   E

4. Media for sowing?

5. Please describe how you sow the seed!
   a.

   b.

   c.

5. Please describe other treatments (including irrigation) that you carry out before planting!
   a.

   b.

   c.

IV. PREPARATION BEFORE PLANTING

1. Please mention all steps of cleaning the plastic house and irrigation system!
   a.
   b.
   c.
   d.
   e.

2. Please mention all steps of preparation before planting sweet pepper!
   a.
   b.
   c.
   d.
   e.

V. PLANTING

1. Media for growing the sweet pepper?

2. Media container for growing the sweet pepper?
   Polybag (size?)
   Slba (slab?)

3. Please describe the planting distance commonly used in growing sweet pepper
   - Between row
   - Within row
   - Plant population per m^2
   - Stem number per plant
   - Stem population per m^2

4. Are there any other different planting systems in growing sweet pepper? Explain!

VI. FERTILIZATION / FERTIGATION

1. What fertilizer do you use in growing sweet pepper?

2. Please explain how you apply the fertilizer!
   - Manual irrigation
     Frequency of irrigation per day

   - Drip irrigation
     Frequency of irrigation per day

   - EC at planting
   - pH at planting

   - EC at flowering/fruiting
   - pH at flowering/fruiting

   - Do you measure drain?

VIII. PRUNNING

1. Please describe the pruning system in growing the sweet pepper!
   a.

   b.

   c.

2. Frequency of pruning?

3. Treatment at pruning to avoid virus spreading?

4. Are there any differences of pruning between two stems and three stems?

IX. CROP PROTECTION

1. Please describe pests and diseases in growing sweet pepper, and how to control them chemically!

Pests & diseases	Pesticides	Concentration	Frequency/week

2. Do you practice pesticide mixing (cocktails)?
    a. Always
    b. Sometimes
    c. Never

3. What are the reasons for mixing pesticides?
    a. More efficacious
    b. More labor saving
    c. Less costly
    d. Copying other farmers
    e. Other, explain……

4. Other treatments to control pest during the growing season?

X. HARVEST AND PRODUCTION

1. When is the first harvest conducted for sweet pepper? weeks after planting

2. What is the indication for harvesting the sweet pepper? % of red / yellow

3. Frequency of harvesting per week?

4. What grading do you use?

Class
A
B
C

5. What is the average production per m^2 or per plant?

6. How many times do you harvest per growing season?

7. What are the criteria of good quality sweet pepper fruit?
   a.

   b.

   c.

XI. COSTS AND REVENUES

A. Plastik house (Area = m²)

Input	Quantity	Unit Price	Value
Land rent per area			
Bamboo small size (bambu tali)			
Bamboo big size (bambu gombong)			
Plastic UV			
Screen net			
Polynet			
Sewing cost			
Sand			
Cement			
Brick			
Nail			
Plastic slab			
Metal wire			
Nylon string			
Pencil			
Rubber			
Plastic hose			
Rope			
Hinge			
Cost for labour			

B. Irrigation system (Area of plastic house =   m²)

Input	Quantity	Unit Price	Value
Selang PE 13			
Selang PE 5			
Pipa paralon diameter 1 inci			
Pipa paralon diameter 3/4 inci			
Pipa paralon diameter 1/2 inci			
Pipa paralon :			
Saringan udara 1 inci			
Saringan udara 3/4 inci			
Saringan udara 1/2 inci			
Stop kran 1 inci			
Stop kran 3/4 inci			
a. Stop kran 1/2 inci			
b. Stop kran :			
c. Kran air			
d. Stik			
End plug			
Take off			
Elbow			
Nepple			
Toren air kapasitas 3.000 liter			
Toren air kapasitas 1.000 liter			
Toren air kapitas 500 liter			
Menara air			
Drum plastik kapasitas 120 liter			
Selang air			
Pompa air dengan daya : Watt			
Kabel listrik			
Other materials :			
▪			
▪			
▪			
▪			
▪			

C. Sowing

Input	Quantity	Unit Price	Value
Seed			
Sowing trays			
Media			
Polybag			
AB Mix			
Pinset			
Hand sprayer (penyemprot tangan)			
Knapsack sprayer (penyemprot punggung)			
Drum plastik kapasitas 120 liter			
Pesticides:			
a.			
b.			
c.			
d.			
Other materials:			
a.			
b.			
c.			

D. Planting

Input	Quantity	Unit Price	Value
Polybag diameter 15 cm			
Polybag diameter 45 cm			
Slab diameter 25 cm			
Arang sekam			
Pupuk AB Mix			
Rock wool			
Insektisida :			
▪ Furadan 3 G			
▪ Agrimec			
▪ Confidor			
▪ Regent			
▪ Decis			
▪ Tracer			
▪ Buldok			
▪ Monitor			
▪ Insektisida lainnya :			
-			
-			
-			
Fungisida/ bakterisida :			
▪ Score			
▪ Anvil			
▪ Rubigan			
▪ Bactocine			
▪ Agrep			
▪ Previcur N			
▪ Fungisida/ bakterisida lainnya :			
-			
-			
-			

E. Production and Revenue

Input	Quantity	Unit Price	Value
Production and Revenue (Area: m^2):			
Grade A			
Grade B			
Grade C			
Non-grade			

XII. PRODUCTION CONSTRAINTS

1. Please state the order of importance of confronted production constraints!

No	Factors	Rank of Importance
a.	Pest and disease incidences	
b.	Costs seeds	
c.	Availability of seeds	
d.	Costs for fertilizers / nutrition	
e.	Availability of fertilizers / nutrition	
f.	Costs for pesticides	
g.	Hired labor availability	
h.	Costs for hired labor	
i.	Land availability	
j.	Costs for land renting	
k.	Output price fluctuation	
l.	Water / Irrigation	
m.	Production facilities availability	
n.	Technical information availability	

Annex III. Hot pepper gross margin scenarios

Table 29. Results of scenario 1 (Open field, direct sowing OP) per bagian, in IDR (x 1000,-)

	per bagian	Hot pepper	%	Shallot	%
Yield		840 kg		1,150 kg	
Total income	17,025				
Seed costs		121	1%	4,350	52%
Fertilizer costs		799	9%	455	6%
Pesticide costs		4,228	46%	958	12%
Additional materials		-	-	540	7%
Labour costs		4,057	44%	2,010	24%
Sub total costs	17,521	9,206	100%	8,314	100%
Land rent	1.050				
Total variable costs	18,571				
Gross margin	**-1,546**				

Table 30. Results of scenario 2 (Open field, transplant, hybrid) per bagian, in IDR (x 1000,-)

	per bagian	Hot pepper	%	Shallot	%
Yield		860 kg		1,150 kg	
Total income	17,225				
Seed costs		626	6%	4,350	52%
Fertilizer costs		799	8%	455	6%
Pesticide costs		4,228	43%	958	12%
Additional materials		-	-	540	7%
Labour costs		4,076	42%	2,010	24%
Sub total costs	18,046	9,731	100%	8,314	100%
Land rent	1.050				
Total variable costs	19,096				
Gross margin	**-1,871**				

Table 31. Results of scenario 3 (Screen net, direct sowing OP) per bagian, in IDR (x 1000,-)

	per bagian	Hot pepper	%	Shallot	%
Yield		2240 kg		1,100 kg	
Total income	30,650				
Seed costs		121	1%	4,350	59%
Fertilizer costs		799	5%	455	6%
Pesticide costs		1,337	9%	311	4%
Additional materials		7,078	47%	540	7%
Labour costs		5,499	37%	1,666	22%
Sub total costs	22,158	14,835	100%	7,322	100%
Land rent	1.200				
Total variable costs	23,358				
Gross margin	**7,291**				

Table 32. Results of scenario 4 (Screen net, transplant, hybrid) per bagian, in IDR (x 1000,-)

	per bagian	Hot pepper	%	Shallot	%
Yield		2450 kg		1,100 kg	
Total income	32,750				
Seed costs		626	4%	4,350	59%
Fertilizer costs		799	5%	455	6%
Pesticide costs		1,355	9%	311	4%
Additional materials		7,078	45%	540	7%
Labour costs		5,748	37%	1,666	22%
Sub total costs	22,931	15,608	100%	7,322	100%
Land rent	1.200				
Total variable costs	24,131				
Gross margin	**8,618**				

Annex IV. Shallot gross margin calculations 2008-1

Table 33. Results of experiment T1 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		4,944 kg		
Total income	24,720			
Seed costs			2,270	16%
Fertilizer costs			539	4%
Pesticide costs			3,734	26%
Additional materials			-	-
Labour costs			6,892	48%
Land rent			888	8%
Total variable costs	14,325			
Gross margin	**10,394**			

Table 34. Results of experiment T2 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		5,792 kg		
Total income	28,960			
Seed costs			3,405	22%
Fertilizer costs			539	3%
Pesticide costs			3,734	24%
Additional materials			-	-
Labour costs			7,094	45%
Land rent			888	6%
Total variable costs	15,662			
Gross margin	**13,298**			

Table 35. Results of experiment T7 hy per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		6,352 kg		
Total income	31,760			
Seed costs			2,942	20%
Fertilizer costs			539	4%
Pesticide costs			3,415	24%
Additional materials			-	-
Labour costs			6,706	46%
Land rent			888	6%
Total variable costs	14,492			
Gross margin	**17,267**			

Table 36. Results of experiment T8 hy per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		6,800 kg		
Total income	34,000			
Seed costs			4,413	27%
Fertilizer costs			539	3%
Pesticide costs			3,415	21%
Additional materials			-	-
Labour costs			6,908	43%
Land rent			888	5%
Total variable costs	16,165			
Gross margin	**17,834**			

Table 37. Results of experiment T11 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		2,288 kg		
Total income	11,440			
Seed costs			4,890	33%
Fertilizer costs			539	4%
Pesticide costs			2,596	17%
Additional materials			-	-
Labour costs			5,990	40%
Land rent			888	6%
Total variable costs	14,903			
Gross margin	**-3,463**			

Table 38. Results of experiment T12 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		3,712 kg		
Total income	18,560			
Seed costs			8,420	46%
Fertilizer costs			539	3%
Pesticide costs			2,550	14%
Additional materials			-	-
Labour costs			5,982	33%
Land rent			888	5%
Total variable costs	18,380			
Gross margin	**-179**			

Table 39. Results of experiment T13 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		2,736 kg		
Total income	13,680			
Seed costs			1,817	15%
Fertilizer costs			539	5%
Pesticide costs			2,596	22%
Additional materials			-	-
Labour costs			5,986	51%
Land rent			888	8%
Total variable costs	11,827			
Gross margin	**1,852**			

Annex V. Shallot gross margin calculations 2008-2 & 3a

Table 40. Results of experiment D2 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		3,499 kg		
Total income	17,495			
Seed costs			1,290	7%
Fertilizer costs			5,421	31%
Pesticide costs			4,993	28%
Additional materials			-	-
Labour costs			5,118	29%
Land rent			888	5%
Total variable costs	17,710			
Gross margin	**-215**			

Table 41. Results of experiment D9 IL per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		5,476 kg		
Total income	27,380			
Seed costs			6,420	45%
Fertilizer costs			330	2%
Pesticide costs			3,227	23%
Additional materials			-	-
Labour costs			3,469	24%
Land rent			888	6%
Total variable costs	14,335			
Gross margin	**13,044**			

Table 42. Results of experiment D10 BC per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		3,766 kg		
Total income	18,830			
Seed costs			1,764	18%
Fertilizer costs			330	3%
Pesticide costs			3,227	33%
Additional materials			-	-
Labour costs			3,469	36%
Land rent			888	9%
Total variable costs	9,636			
Gross margin	**9,193**			

Annex VI. Shallot gross margin calculations 2009-Fertilization

Table 43. Results of experiment T120 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		2,726 kg		
Total income	13,630			
Seed costs			3,405	22%
Fertilizer costs			539	3%
Pesticide costs			3,598	23%
Additional materials			-	-
Labour costs			7,014	45%
Land rent			888	6%
Total variable costs	15,445			
Gross margin	**-1,815**			

Table 44. Results of experiment T180 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		2,923 kg		
Total income	14,615			
Seed costs			3,405	22%
Fertilizer costs			574	4%
Pesticide costs			3,598	23%
Additional materials			-	-
Labour costs			7,014	45%
Land rent			888	6%
Total variable costs	15,480			
Gross margin	**-865**			

Table 45. Results of experiment T240 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		2,469 kg		
Total income	12,345			
Seed costs			3,405	22%
Fertilizer costs			609	4%
Pesticide costs			3,598	23%
Additional materials			-	-
Labour costs			7,014	45%
Land rent			888	6%
Total variable costs	15,515			
Gross margin	**-3,170**			

Table 46. Results of experiment T300 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		2,410 kg		
Total income	12,050			
Seed costs			3,405	22%
Fertilizer costs			644	4%
Pesticide costs			3,598	23%
Additional materials			-	-
Labour costs			7,014	45%
Land rent			888	6%
Total variable costs	15,550			
Gross margin	**-3,500**			

Table 47. Results of experiment H120 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		3,864 kg		
Total income	19,320			
Seed costs			4,413	27%
Fertilizer costs			539	3%
Pesticide costs			3,598	22%
Additional materials			-	-
Labour costs			7,014	43%
Land rent			888	5%
Total variable costs	16,453			
Gross margin	**2,866**			

Table 48. Results of experiment H180 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		4,120 kg		
Total income	20,600			
Seed costs			4,413	27%
Fertilizer costs			574	3%
Pesticide costs			3,598	22%
Additional materials			-	-
Labour costs			7,014	43%
Land rent			888	5%
Total variable costs	16,488			
Gross margin	**4,111**			

Table 49. Results of experiment H240 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		4,504 kg		
Total income	22,520			
Seed costs			4,413	27%
Fertilizer costs			609	4%
Pesticide costs			3,598	24%
Additional materials			-	-
Labour costs			7,014	42%
Land rent			888	5%
Total variable costs	16,523			
Gross margin	**5,996**			

Table 50. Results of experiment H300 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		4,971 kg		
Total income	24,855			
Seed costs			4,413	27%
Fertilizer costs			644	4%
Pesticide costs			3,598	22%
Additional materials			-	-
Labour costs			7,014	42%
Land rent			888	5%
Total variable costs	16,558			
Gross margin	**8,296**			

Table 51. Results of experiment F-B per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		2,277 kg		
Total income	11,385			
Seed costs			4,890	32%
Fertilizer costs			574	4%
Pesticide costs			2,823	19%
Additional materials			-	-
Labour costs			6,057	40%
Land rent			888	6%
Total variable costs	15,233			
Gross margin	**-3,848**			

Table 52. Results of experiment F-IL per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		1,894 kg		
Total income	9,470			
Seed costs			6,520	39%
Fertilizer costs			574	3%
Pesticide costs			2,823	17%
Additional materials			-	-
Labour costs			6,057	36%
Land rent			888	5%
Total variable costs	16,863			
Gross margin	**-7,393**			

Annex VII. Shallot gross margin calculations 2009-Plant density

Table 53. Results of experiment T75 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		1,501 kg		
Total income	7,505			
Seed costs			1,702	12%
Fertilizer costs			539	4%
Pesticide costs			3,780	28%
Additional materials			-	-
Labour costs			6,819	50%
Land rent			888	6%
Total variable costs	13,729			
Gross margin	**-6,224**			

Table 54. Results of experiment T125 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		2,210 kg		
Total income	11,050			
Seed costs			2,837	19%
Fertilizer costs			539	4%
Pesticide costs			3,780	25%
Additional materials			-	-
Labour costs			7,020	47%
Land rent			888	6%
Total variable costs	15,066			
Gross margin	**-4,016**			

Table 55. Results of experiment T175 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		3,102 kg		
Total income	15,510			
Seed costs			3,972	24%
Fertilizer costs			539	3%
Pesticide costs			3,780	23%
Additional materials			-	-
Labour costs			7,221	44%
Land rent			888	5%
Total variable costs	16,402			
Gross margin	**-892**			

Table 56. Results of experiment T225 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		3,184 kg		
Total income	15,920			
Seed costs			5,108	29%
Fertilizer costs			539	3%
Pesticide costs			3,780	21%
Additional materials			-	-
Labour costs			7,422	42%
Land rent			888	5%
Total variable costs	17,738			
Gross margin	**-1,818**			

Table 57. Results of experiment H75 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		2,894 kg		
Total income	14,470			
Seed costs			2,206	16%
Fertilizer costs			539	4%
Pesticide costs			3,507	25%
Additional materials			-	-
Labour costs			6,659	48%
Land rent			888	6%
Total variable costs	13,801			
Gross margin	**668**			

Table 58. Results of experiment H125 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		3,250 kg		
Total income	16,250			
Seed costs			3,677	24%
Fertilizer costs			539	3%
Pesticide costs			3,507	23%
Additional materials			-	-
Labour costs			6,860	44%
Land rent			888	6%
Total variable costs	15,473			
Gross margin	**776**			

Table 59. Results of experiment H175 per bagian, in IDR (x 1000,-)

	per bagian	Shallot		%
Yield		3,666 kg		
Total income	18,330			
Seed costs			5,148	30%
Fertilizer costs			539	3%
Pesticide costs			3,507	20%
Additional materials			-	-
Labour costs			7,061	41%
Land rent			888	5%
Total variable costs	17,145			
Gross margin	**1,184**			

Table 60. Results of experiment H225 per bagian, in IDR (x 1000,-)

	per bagian	Shallot	%
Yield		3,669 kg	
Total income	18,345		
Seed costs		6,620	35%
Fertilizer costs		539	3%
Pesticide costs		3,507	19%
Additional materials		-	-
Labour costs		7,996	39%
Land rent		888	5%
Total variable costs	18,817		
Gross margin	**-472**		

Table 61. Results of experiment D-B per bagian, in IDR (x 1000,-)

	per bagian	Shallot	%
Yield		2,179 kg	
Total income	10,895		
Seed costs		4,890	31%
Fertilizer costs		539	3%
Pesticide costs		3,104	20%
Additional materials		-	-
Labour costs		6,243	40%
Land rent		888	6%
Total variable costs	15,665		
Gross margin	**-4,770**		

Table 62. Results of experiment D-IL per bagian, in IDR (x 1000,-)

	per bagian	Shallot	%
Yield		2,277 kg	
Total income	11,385		
Seed costs		6,520	33%
Fertilizer costs		539	3%
Pesticide costs		3,104	18%
Additional materials		-	-
Labour costs		6,243	36%
Land rent		888	5%
Total variable costs	17,295		
Gross margin	**-5,910**		

Annex VIII. Sweet pepper - Economic effect of stems per plant

Table 63. Fixed costs wood-metal greenhouse, 307m², in IDR (x 1000,-)

Item	Total investment	Lifespan	Fixed cost per year Total	per m²
Greenhouse structure	25,381	10	2.538	8.3
Plastic roof construction	5,150	3	1.716	5.5
Metal wire for trellising	960	5	192	0.6
Bamboo for sulphur	150	2	75	0.2
Plastic mulch	375	3	125	0.4
Sowing trays	300	2	150	0.4
Shading net	210	5	42	0.1
Wooden sowing tables	180	5	36	0.1
Nylon wire	400	3	133	0.4
Total				16.3

Table 64. Fixed costs irrigation, 307m², in IDR (x 1000,-)

Item	Total investment	Lifespan	Fixed cost per year Total	per m²
Drippers	907	5	181	0.6
Bricks	423	10	42	0.1
Total				0.7

Table 65. Cultivation greenhouse, 307m², in IDR (x 1000,-)

Item	Amount	Fixed cost per year Unit price	Total costs
Durable goods			
Greenhouse	277 m²	16.3	4,518
Irrigation	277 m²	0.7	201
Seedlings			6,483
Other			2,111
Fertilizer			6,290
Pesticides			4,119
Labour			11,425
Variable costs			30,667

Table 66. Gross margin greenhouse, 307m², in IDR

	Amount	Price	Value
Yield grade A	4.231 kg	8,243	34,876,334.-
Yield grade B	528 kg	4,297	2,269,472.-
Yield non-grade	2 kg	-	
Gross income			37,145,817.-
Variable costs			30,667,436.-
Gross margin			6,468,436.-
Net farm income			
Overhead costs			4,720,721.-
Net farm income			1,747,659,-