vegIMPACT Report 28

December 2016

Impact assessment of farmers' trainings in Cirebon

Evaluation of Good Agricultural Practices training in the 2013 dry season

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vegIMPACT

Improved Vegetable Production and Marketing for small farmers to Increase the Food Security status and to promote Private Sector Development in Indonesia *vegIMPACT is a program financed by The Netherlands' Government promoting improved vegetable production and marketing for small farmers in Indonesia, contributing to the food security status and private sector development in Indonesia. The program builds on the results of previous joint Indonesian-Dutch horticultural development cooperation projects and aligns with recent developments in the horticultural private sector and retail in Indonesia. The program activities (2012 – 2016) include the Development of Product Market Combinations, Strengthening the Potato Sector, Development of permanent Vegetable Production Systems, Knowledge Transfer and Occupational Health.*

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vegIMPACT Report 28 – Evaluation WP Permveg training

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Evaluation of Good Agricultural Practices training in the 2013 dry season

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vegIMPACT Report 28 – Evaluation WP Permveg training

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Executive summary

Main findings

This report describes, assesses and reflects on the intensive training of small farmers carried out in 2013 within the WP Permveg as part of the vegIMPACT program. The overall finding is that the training has contributed to improved agricultural knowledge and practice among farmers in the Cirebon area, Java, Indonesia.

The objective of the training was to achieve a behavioural change in Good Agriculture Practices (GAP). The intermediate outcomes, i.e. a positive change in agriculture management towards GAP precede the ultimate outcome of the trainings, i.e. higher crop yields and improved resource use efficiencies. The WP Permveg trainings promoted improved spraying techniques that resulted in less pesticide use and better crop health. However, we were not able to attribute differences at the ultimate outcome level (e.g. lower costs and higher yields). A number of external influences have been identified that may have influenced the ultimate outcome indicators ranging from highly fluctuating prices for shallot to the land ownership of farmers in the Cirebon area. The following table summarizes the main effects identified per result level:

Result levels	Result	Description indicators	Measured effect	Influence of intervention
Outputs	Activities: Training interventions such as information, goods and services delivered to farmers.	A. Training materials B. Demo field C. Trainings conducted D. Attendance E. Research reports	A. Training materials developed B. A demo field selected and prepared C. 10 biweekly trainings conducted D. 15 farmers trained E. Various reports published	High
Immediate outcome	Enhanced knowledge on cultivation practices due to the training received	A. Farmer appreciation B. Farmer satisfaction C. Knowledge shared with others D. Knowledge questions on topics of training	A. High farmer appreciation B. High farmer satisfaction C. Majority of farmers shared knowledge with others D. Knowledge questions improved	Medium
Intermediate outcome	Changes in agricultural practices thanks to increased knowledge	A. Spray practices B. Pesticide use C. Fertilizer use	A. Improved spray practices B. Improved pesticide use C. Improved fertilizer use	Low
Ultimate outcomes	Increased vegetable area, improved yield and income, reduced cost price, decreased pesticide use, increased labour use, and reduced occupational health risks thanks to adapted agricultural practices	A. Production B. Productivity C. Production costs D. Profit	A. Neutral production effect B. Neutral productivity effect C. Neutral costs effect D. Neutral profit effect	Lower
Impact	Improved food and nutrition security[1]	A. Higher crop income B. More vegetable production population.	A. No effect B. No effect	Lowest

Method

In total 10 training sessions of each one day were given in 2013 with a 10 day interval from August 15

[1] Not monitored and evaluated.

to December 19. The trainings comprised 'classroom' meetings, field visits as well as practical training in the demonstration field. The training was given east of the city Cirebon, a well-known area for shallot production, and focussed on GAP in vegetable production. In the training assessment we focused on measuring results at various outcome levels. A mixed method was used to measure the outcome indicators. Regular monitoring took place via field visits and frequent contact between the project implementers, annual reports were published and observations shared within the team. In addition, four different data collection methods were used with different time horizons to assess effects of trainings. The data collection methods comprised of:

- Knowledge tests: farmers performed before and after the training a written test.
- Self-recording of management data: data recording by farmers started before the training in the 2013 dry season and comprised in total the management and crop performance information of three dry seasons and two wet seasons.
- Farmer surveys: surveys before and after the training were conducted addressing both dry and wet season production.
- Dedicated interviews with actors which were involved in the implementation of the training, trained farmers, and one farmer who did not participate in the trainings.

1. Introduction

1.1 Background

The vegIMPACT program, short for ‘vegetable production and marketing with impact’, aims to improve vegetable production and marketing of small farmers in Indonesia. VegIMPACT contributes to increased food security and private sector development in Indonesia. The program is financed by the Dutch government and is carried out by Wageningen University and Research Centre (WUR) together with local partners and national and international companies in vegetable production and marketing (2012-2016).

VegIMPACT consists of different intervention strategies. Many of them focus on practical training and capacity building of farmers and other stakeholders in vegetable chains. Also in the Work Package Permveg, which investigates the introduction of permanent vegetable systems in the lowlands of Cirebon, small vegetable farmers have been trained. These trainings involved biweekly training sessions of the same group of farmers during an entire growing season. Under supervision of staff of the Indonesian Vegetable Research Institute (IVEGRI), sometimes supplemented with staff from WUR, this group received trainings on Good Agricultural Practices (GAP) consisting of theoretical information, demonstration of cultivation techniques as well opportunities for farmers to practice new cultivation techniques. As part of these trainings demonstration fields were organized to show the effects of management practices or to provide the farmers with an opportunity to practice management techniques, for example, improved spraying techniques that are being promoted at the trainings.

As part of the overall vegIMPACT program one Work Package (WP) focussed specifically on the monitoring and evaluation of training activities (WP Monitoring and Evaluation - M&E). Based on a broadly accepted conceptual framework, the WP M&E assessed whether training activities in vegIMPACT have changed the behaviour of trained farmers towards GAP and associated performance or program indicators. Many of the performance indicators such as higher crop yields and improved crop income and profit have been defined at program level to assess the contribution of WP activities of vegIMPACT on food security and private sector development in Indonesia.

1.2 Objective of the report

In this report we describe, assess and reflect on the intensive training intervention carried out in 2013 within the WP Permveg. This training was given in a biweekly interval and participants received 10 training sessions on GAP in horticulture. The intervention logic of the trainings was based on the following sequence of effects following the programmes’ theory of change: Major goal of all trainings in vegIMPACT is to achieve a behavioural change of those who are trained towards GAP, which is the intermediate outcome of the trainings. The intermediate outcomes, i.e. change in management towards GAP are a prelude to the ultimate outcome of the trainings, i.e. higher crop yields and improved resource use efficiencies. In the context of the Permveg trainings this means, for example, that the promoted and adopted improved spraying techniques result in both less pesticide use and better crop health and associated higher vegetable yields.

1.3 Reading guide

The intervention and the (selection of) trained farmers is further described in Chapter 2. The theory of change and its result levels including the related indicators to assess the impact of the training intervention is elaborated in Chapter 3. For the assessment of the impact of the training we have used different data types and data sources with different time horizons, which are further described in the Chapter 4 (Approach and method). The information was collected both by the implementers of the Permveg trainings as well as the researches from WP M&E. In Chapter 5 the results are described of the different M&E approaches for the various result levels of the applied theory of change. In the Chapter Discussion and Conclusions the results are discussed and some general conclusions drawn with respect to the training intervention and recommendations for similar types of training interventions in the future.

2. The intervention

2.1 Problem statement

Agricultural land in the Cirebon area is mostly common land and rented out by the local village committee or government. The predominant soil in Cirebon area is heavy clay of alluvial origin and a Cambisol[2]. The clay has low CEC values[3] and more than 80% of the soil particles are smaller than 2 µm. The Cirebon area is well-known for the production of shallots, which is a very profitable but also an extremely (financial) risky crop. Especially shallot seed (bulbs) is expensive when compared to the heavily subsidized seed inputs for rice and maize production. Pest and diseases are hard to control in shallot, while also labour requirements for shallot are much higher than in rice and maize production. An advantage of producing shallot is the relatively short growing season, the crop can be harvested after approximately two months and thus several crops per year can be grown.

Shallot, but also other vegetables in the Cirebon area such as sweet corn, yard long bean, hot pepper and bitter gourd are grown on raised beds of approximately 1 x 14 meter surrounded by 0.5 m wide and 1 meter deep ditches filled with water for irrigation and drainage in times of excessive rainfall. As a consequence of the raised beds only about 75% of the total land is planted with vegetables. Rice is often grown in the wet season on the same fields after flattening the beds. As a result of the submerged conditions under which rice is cultivated the overall soil structure and nutrient content is generally poor for growing vegetables. Consequently, vegetable productivity is much lower than what potentially is feasible.

2.2 Solution provided

The training sessions in 2013 addressed GAP in horticulture and were based on training material developed by IVEGRI and WUR in the capacity building program 'Train the Chain' carried out from 2009 to 2011 in Indonesia. Topics of the training included:

1. Integrated Pest Management (IPM),
2. Raising of vegetable seedlings,
3. Fertilizer management,
4. Spray techniques, and
5. The planning of crop production.

In total 10 training sessions of each one day were given with a 10 day interval from August 15 to December 19 in 2013. The trainings comprised 'classroom' meetings, field visits as well as practical training in the demo field. The classroom meetings were in a building of a farmers' group near a field with a vegetable rotation experiment. A special demo field with shallot was available and specifically used to train farmers in observing crop development, identifying pests and diseases and to instruct farmers on how to control pests and diseases and spraying techniques.

2.3 Timing and location of the intervention

The WP Permveg implemented two training rounds for two different farmer groups. One group was trained in the dry season of 2013 and the other one in 2014. This report focusses on the training of

[2] A Cambisol is a soil with a beginning of soil formation. The horizon differentiation is weak. This is evident from weak, mostly brownish discolouration and/or structure formation in the soil profile (FAO World Reference Base for Soil Resources, 2007)

[3] In soil science, cation-exchange capacity or CEC is the number of exchangeable cations per dry weight that a soil is capable of holding, at a given pH value, and available for exchange with the soil water solution. CEC is used as a measure of soil fertility, nutrient retention capacity, and the capacity to protect groundwater from cation contamination (www.wikipedia.org).

farmers given during the first round (dry season of 2013).

The training was given in the area east of Cirebon near the village Sumberlor in the sub-district Babakan in the district (*Kabupaten*) Cirebon. This area was selected because there is a long history of shallot production, i.e. farmers are used to and experienced in shallot production indicating its' relevance to the farmers and fostering sustainability of the intervention; besides, soil and climatological circumstances have proven to be suitable for shallot production. Important other crops in the area are rice, sugar cane, shallot and sweet corn. Recently (early 2016), the Government of Indonesia has assigned the Cirebon area as major production area for shallot and provides support to farmers through training.

2.4 Trained farmers

Based on available resources and the maximum number of persons that can be trained effectively in one group, 15 farmers were selected to participate. Farmers were selected by the Cirebon Food security and Agricultural extension office and the Gebang Agricultural extension office. Selection criteria for participation of farmers were:

I. Farmers are from one of the four sub districts (*kecamatan*) bordering the training site,
II. Farmers are literate (able to read and write),
III. Farmers mainly grow vegetable crops,
IV. Farmers live close to the training site,
V. Farmers' age is between 25 and 50 years,
VI. Farmers have at least 5 years' experience in vegetable farming, and
VII. Farmers are committed to attend biweekly training sessions during the dry season of 2013.

The 15 selected farmers who fulfilled these criteria were invited for the trainings. Farmers received lunch and travel allowance to attend the training sessions. At the training the farmers received cultivation and crop manuals which they could use during and after the training round.

As part of the training the participating farmers were requested to keep a logbook of the management of their vegetable fields during the training until September 2015. This data collection activity was primarily focussed at gaining 'real time' quantitative insight in production costs, yields, income and profitability. In addition, this data gave information about the volumes and types of inputs, and provided information on the potential change in management and associated crop performance as a result of the trainings. Results of the logbook recording have been shared with the farmers in May 2016, but were not part of feedback during the training rounds in 2013 and 2014.

3. Program objectives, indicators and result levels

3.1 Theory of change

To understand how and why an intervention is working, there is a need to understand how the activities of the intervention are expected to lead to the desired results: both the pathway or results chain from activities to outputs to a sequence of outcomes to impacts, and why the various links in this pathway are expected to work. Impact pathways describe these result chains, showing the linkages between the sequences of steps in getting to impact (Douthwaite et al., 2007). A theory of change (ToC) adds to the impact logic by describing the result chain, i.e. assumptions and conditions behind the links in the pathways – what has to happen for the causal linkages to be realized (Blamey and Mackenzie, 2007; Leeuw, 2012; Rogers, 2008; Weiss, 1995). A ToC is a tool to make explicit the assumptions underlying the program interventions that result in the intended outcomes and impacts and is used as a basis for defining indicators and objectives.

With the main implementers of vegIMPACT a ToC was developed at vegIMPACT program level (Figure 3.1) and one more specifically for the WP Permveg (Annex 2). The success of an intervention depends not only on the way it is implemented and the skills and capacity of implementers but also on the logic of the ToC as such and within the context.

The implementation of the training was done by the WP Permveg and the effect of trainings further monitored by the WP M&E using various methods and data sources (Chapter 4). The ToC is reflected upon by both WPs using the different data sources and by analysing and discussing the underlying assumptions, risks, the enabling or constraining environment and by revealing the unintended outcomes (where possible of course at this stage).

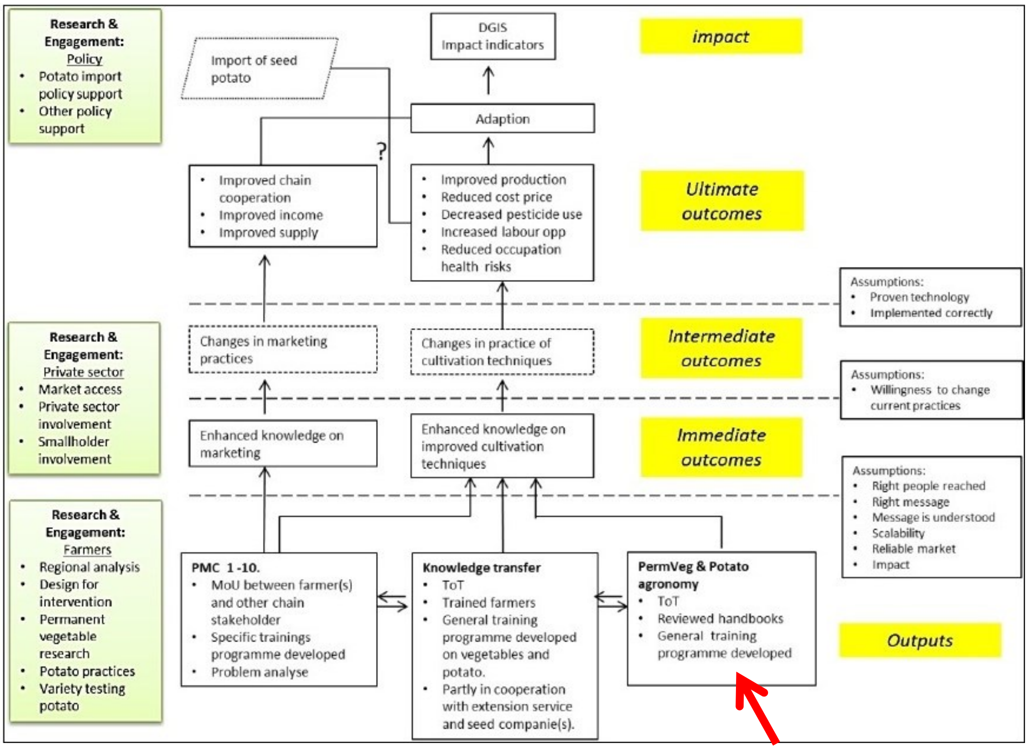


Figure 3.1 The theory of change of vegIMPACT at program level including the result chain of the Permveg training interventions (red arrow).

The result chain shows how the different vegIMPACT interventions contribute to and result in the planned outputs, outcomes and impact. In the result chain the various steps in the causal chain are explained and the interrelationships between the activities of the intervention and the resulting outputs, outcomes and impacts are made explicit. The vegIMPACT result chain includes various assumptions about pre conditions and the external environment and institutions. At each result level assumptions are indicated which became clear during the definition of the ToC. As a process the ToC is continuously subject to change by new insights, learnings and a changing context. Overall, it is assumed that the vegIMPACT interventions and components will lead to an increase in production, an increase in productivity, reduced costs, increased labour opportunities and a reduction of pesticide use (performance indicators). These results contribute to the overarching program goal of food security and private sector development in Indonesia.

Not explicitly mentioned in Figure 3.1 but very important to consider at the start of the training are the external influences: events, actors or institutions and conditions unrelated to the intervention and its causal package that could also contribute to the realization of the intended results. These could include another intervention with similar aims and/or general economic or social trends. External influences can have positive effects on the intended results. For example, a reduction of the price of vegetables could also explain an increase in vegetable consumption that is unrelated to the training intervention. A negative external influence could be a strong and influential PR strategy of a pesticide company or new government policy which is conflicting with the program objectives.

Also important to reveal are the unintended effects, positive or negative unanticipated effects that occur as a result of the intervention’s activities and results. For example, if promotion of vegetable production among women leads to the development of markets for vegetables, men could take control of production and sales. This could have a negative effect on women’s control of income and empowerment, and could indirectly undermine the goal of improving child nutrition. Similarly, if an intervention demands a large amount of a mother’s time, she may have less time to devote to feeding and caring for children, which could affect their nutrition outcomes. Care should be taken to identify and account for these potential indirect impacts when ToCs are developed. Ex-post, unanticipated effects should be actively looked for.

3.2 Scope of control: Result levels

Development effects are the effects on beneficiaries as result of an intervention, and which are in the sphere of interest of the intervention. The ambition of interventions in vegIMPACT is to contribute to the improved food security and improved competitiveness of farmers, as is shown by the ToC result chain (Figure 3.1). However, to show statistical significant net-effects on these areas are unlikely within the scope of influence of this program and the available resources. The effects of interventions on development impact (improved socio-economic status and food and nutrition security) are expected to be small or impossible to measure and control for and, therefore, definitely difficult to measure in a small sample of beneficiaries and in the absence of a comparison group which did has not been targeted by the intervention. As explained in Chapter 2 only a small number of beneficiaries (15) participated in the Permveg training during the dry season 2013 included, which makes an in-depth investment and individual coaching possible. The evaluation of the Permveg training therefore focusses on analysing effects of the training on immediate and intermediate outcomes. The next Chapter explains further the methodology of data collection along the result chain. Table 3.1 gives an overview of the different result levels and indicators used to verify the contribution of the training to the expected results. The influence (or scope of control) of the intervention decreases with higher result levels. Control is high at the first levels of inputs and outputs but control and influence on final results at the impact level is very low.

Table 3.1 Indicators and assumptions at different result levels

Influence of intervention	Result levels	Result	Description indicators and measurement	Assumptions
High	Outputs	Activities: Training interventions such as information, goods and services delivered to farmers.	Training materials developed, demo field selected and prepared, number of trainings conducted, attendance sheets, research reports	Project is relevant and people need the intervention, project is the right solution for the defined problems, enough resources are available, legal grounds for operation
Medium	Outcomes	The effects and changes that occur as a result of the intervention, here labelled as immediate, intermediate and ultimate changes. Effects and the consequences of the actions taken by the farmers thanks to the outputs, frequently focus on behaviour changes which become manifest as changes in practices (adoption).		
Medium	Immediate outcome	Enhanced knowledge on cultivation practices due to the training received	Indicators: appreciation, satisfaction, knowledge shared with others (as indication of relevance and appreciation); knowledge questions on topics of training (e.g. recognition of disease, spraying interval, types of pesticides used)	The right message, people, staff, timing, message is understandable, message is applicable, people want to be trained and willing to learn
Low	Intermediate outcome	Changes in agricultural practices thanks to increased knowledge	A. Improved spray practices: i) Direction of spraying, nozzle replacement, time of spraying, drop size, contributing to efficient and effective use of pesticide. ii) Increased use of personal protective equipment contributing to a reduced occupational health risks. B. Improved pesticide use: i) less use of hazardous pesticides, ii) mix the proper active ingredients, and iii) reduce the volume of pesticide sprayings, which contribute to reduced occupational health and environmental risks. C. Improved fertilizer use: i) better timing of applying basic fertilizer (before planting) resulting in higher yields, ii) proper fertilizer amounts resulting in cost reduction and less pollution.	People are willing to change, people are willing to take a risk, people are willing to trust the new insights and trainers
Lower	Ultimate outcomes	Increased vegetable area, improved yield and income, reduced cost price, decreased pesticide use, increased labour crop, reduced occupational health risks, thanks to adapted agricultural practices	A. Production increases: farmers increase the area under vegetables. B. Productivity increases: Thanks to GAP crop productivity increases. C. Total production costs decrease thanks to reduction in pesticide and fertilizer costs. D. Profit increases: production and yields increase and production costs per unit area decrease leading to higher profitability.	Proven correct technology, implementation, risks are controlled for, no unintended outcomes constraining the intended outcomes
Lowest	Impact	Improved food and nutrition security[4]	A. Higher crop income of farmers resulting in higher food expenditures. B. More vegetable production results in better availability of nutritious food for non-farming population.	Increased healthy vegetable production is consumed locally and financial gains are spent on nutritious foods

A number of performance indicators have been identified at program development in collaboration with the client, the Ministry of foreign Affairs in the Netherlands. These indicators all relate to the outcome level and based on a ToC developed with staff of the WP Permveg and M&E and a selection has been made that is relevant for the Permveg trainings. The M&E methods cover and measure the

[4] Not monitored and evaluated.

following indicators:

- *Target group (n)*
  Selection of target area and group: the number of farmers that have received training on good agricultural practices in vegetables and more specifically on shallot production in WP Permveg.

- *Vegetable area increase (%)*
  Introduction of permanent vegetable systems at farm level will increase the share of vegetable production in the total farm production.

- *Increase in vegetable productivity (%)*
  Training on GAP and implementation of new techniques enables farmers to attain higher crop yields and productivity.

- *Reduction pesticide use per unit of produce (%)*
  Training and demonstrations on GAP enables farmers to produce vegetables with the proper amount of pesticides, which generally will be lower than the current pesticide use by farmers. In combination with higher yields (previous objective), proper pesticide use will result in a reduction of pesticide use per unit of produce.

- *Reduction of nitrogen fertilizer use per unit produce (%)*
  Training and demonstrations on GAP enables farmers to produce vegetables with the proper amount of fertilizers, which generally will be lower than the current amount of fertilizers applied by farmers. In combination with higher yields proper use of fertilizers will result in a reduction of fertilizer use per unit of produce.

- *Reduction of production costs per unit produce (%)*
  Appropriate volumes and use of pesticide and fertilizer will result in reduced production costs.

- *Decrease in occupational health risks (%)*
  Attention in the trainings for proper and safe use of pesticides and for the less toxic pesticide alternatives occupational health risks for farmers and labourers will decrease. This is monitored by the change in pesticide use (volume) and pesticide types (human toxicity) and the he number of occupational health incidents at the farm related to pesticide use before and after the intervention.

Two indicators formulated at the inception phase of the program appeared to be less relevant in the course of the program: The increase in employment, and especially the increase in female employment. On the one hand, development will mean an outflow of labour from rural areas and agriculture (Johnston and Mellor, 1961; Timmer, 2002). This is largely an autonomous process and on-going developments in rural Indonesia are no exception (Allen, 2016). Increasingly, agricultural labour shortages are reported during peak periods in crop production and research and development in rice-based vegetable systems is increasingly paying attention to labour-saving technologies. On the other hand, vegetable production is much more labour demanding than rice production, both in low and high technology systems. Increasing the vegetable area (at the expense of rice area), one of the WP Permveg objectives (see before), will automatically also result in increased employment. Since females perform many tasks in vegetable production (see Chapter 5) it is also expected that female labour employment increases under expansion of the vegetable area. However, overall employment opportunities in agriculture, both for men and women, will decrease with further agricultural development.

4. Approach and method

4.1 Introduction

The main questions from M&E perspective are: does it work, why does it work, for whom and under what conditions, and can it be expected to work in other places and sectors and at scale? The underlying quantitative and qualitative analyses will lead to information on the identified indicators (section 3.3), the indicator changes over time, and better understanding of the change. The next question to be answered is whether the changes can be related to the intervention itself: the attribution of WP Permveg to the perceived changes. The attribution question is a challenging one as the intervention takes place in a complex and changing environment with many actors each with their interventions and objectives.

To be able to answer the attribution question, the so called difference in difference methodology is often used where changes are measured and compared at two levels: i) before and after the intervention and ii) between the treatment group and a control group which does not take part in the project. The latter enables to answer the question: what would have happened in the absence of the Permveg training? Due to limitation in resources this method could not be applied and only a before and after comparison is used. The number of beneficiaries (trained farmers) is very small enabling other methods to be able to answer the attribution question as much as possible. Qualitative interviews have been used to collect individual stories and to gather insights from the beneficiary's perspective on contribution of the intervention. In addition, the WP staff and implementers closely monitored and observed the participants of the trainings and their practices. The involvement of experienced and skilled local staff gives the opportunity to collect contextual data, the vegetable sector and the role of other actors, for example, the government. The used data collection methods are explained in this Chapter and they show a combination of different approaches which not only enables to reveal changes but also to relate these to the intervention itself by a qualitative contribution analysis.

Hence, a mixed method is used to measure the indicators and topics elaborated in Chapter 3. A mixed method stands for a combination of quantitative and qualitative data collection. Regular monitoring took place via field visits and frequent contact between the WP implementers, annual reports were published and observations shared within the team. In addition, four different and formal data types and information sources were collected over different time horizons to assess the effect of trainings on the change of behaviour (management) of farmers and on the ultimate outcome of the intervention, higher yields and improved resource use efficiencies. The objectives of the intervention are analysed at result levels defined in Table 3.1 which relate to the scope of influence further along the result chain. The result levels are output, immediate outcome, and intermediate and ultimate outcome level with specific objectives at each level. Every result level is monitored and evaluated with one or more method(s) implemented by the WP Permveg or WP M&E. Table 4.1 gives an overview of the used methods for each result level. The six main information sources used are:

1. Attendance sheets participants training.
2. Annual reports and field observations.
3. Knowledge tests: before and after the training farmers performed a written test which was organized by IVEGRI.
4. Self-recording of management data: data recording by farmers started before the training in the 2013 dry season and comprised in total the management and performance information of three dry seasons and two wet seasons.
5. Farm surveys: surveys before and after the training were conducted by the WP M&E addressing both dry and wet season production.

6. Dedicated interviews with actors after the training: the WP M&E interviewed the IVEGRI and WUR manager of the intervention, IVEGRI trainers, trained farmers and one farmer who did not participate in the trainings.

Table 4.1 Used M&E methods at different result levels.

	M&E methods					
Result level	Attendance of farmers	Annual reports & observations	Knowledge test	Self-recording	Baseline and follow up survey	Interviews
Output	X	X				
Immediate outcome		X	X	X	X	X
Intermediate outcome				X	X	X
Ultimate outcome				X	X	X
Type of data	Quantitative	Quantitative / Qualitative	Quantitative	Quantitative	Quantitative	Qualitative
Data collector	IVEGRI	IVEGRI, WUR	IVEGRI	IVEGRI, WUR	WUR	WUR

Depending on the applied M&E method different result levels were addressed, while the collected information comprised both quantitative and qualitative data. The information of 'data collector' in Table 4.1 shows the different parties involved in M&E. Data collection was done from the WP Permveg implementers, and the surveys and interviews were done by the WP M&E in the absence of any WP Permveg implementer. Timing and time horizon of information collection differed considerably (Table 4.2). For example, the knowledge tests (information source 3) were taken directly for the first and last training sessions, while the farmer surveys roughly cover a period of two years. Overall, data was collected over a period of four years, covering the periods 1.5 years before and 2.5 years after the training. Table 4.2 gives more detailed information on the used methods and data in relation to the intervention indicators at different result levels. Not all data from can be compared, but the use of different perspectives and methodologies enables us to complement, triangulate and validate findings.

Table 4.2 Information of applied M&E methods and data at different result levels.

Result level	Indicator	Method / data	Timing	Reference year
Output	Selection criteria farmers, location, crop	Reporting	Annually	2013, 2014, 2015
	Training material	Reporting	Annually	2013, 2014, 2015
	Trainings provided	Reporting	Annually	2013, 2014
	Attendance trainees	Attendance list	After every training	2013, 2014
Immediate outcome	Changes in knowledge due to training and demo	Survey	Baseline: July 2014 Evaluation: Jan 2014, June 2014	2012 wet and dry season 2013 dry season, 2014 wet season
		Knowledge test	Pre, mid and post training	2013, 2014
		Interviews & observations	2016	2013 and 2014
Intermediate outcome	Changes in practices due to training and demo (all vegetables)	Survey	Baseline: July 2014; Evaluation: Jan 2014 and June 2014	2012 wet & dry season, 2013 dry season, 2014 wet season
	Changes in practices focussing on shallot	Self-recording, bi-weekly Interviews & observations	2013 – 2015 2016	
Ultimate outcome	Changes in production, productivity, profitability of vegetables	Survey	Baseline: July 2014; Evaluation: Jan 2014; June: 2014	2012 wet & dry season; 2013 dry season; 2014 wet season
	Changes in production, productivity, profitability of shallots	Self-recording, bi-weekly	2013 – 2015	

In the subsequent sub-sections the four data sources are described in more detail, followed by a description of integration of the data sources, timing and the limitations.

4.2 Major data sources

4.2.1 Knowledge tests

Immediately before, mid-term and immediately after the training knowledge tests were held. This method is based on FAO's ballot box test. The ballot box method, which is a diagnostic test developed in the 1980s for IPM training in the Philippines. The results point out weak areas of knowledge (in the case of the pre-test) or the learning needs of participants. The post-test, when compared to the pre-test, can be used to indicate improvements in knowledge among participants and to determine needs for follow-up activities. The knowledge tests used by IVEGRI were provided on paper.

4.2.2 Self-recording

This method consisted of the self-recording of crop management data by farmers, which was initially done for benchmarking purposes and understanding current vegetable production. Here, we use the data for M&E purposes to gain insight in changes in crop management and performance as a result of the Permveg trainings. The data has been systematically collected over a long time horizon in different wet and dry seasons, starting in the season before the training was given (Table 4.2). The predominantly quantitative information collected in this way contributes to gaining insight in the change in ultimate outcome indicators. The used data refers to shallot only as it is the main vegetable crop in this area and most data refer to this crop, which allows analysing time-series of information.

The self-recorded crop management by farmers started in July 2013 before the trainings started, while the last data recording is from the dry season 2015, almost two years after the last training. Out of the 15 farmers participating in the training 10 farmers were randomly selected to record crop management data. The farmers were asked to take daily notes of management activities, (costs of) materials and labour hours and labour costs of the crops grown. Farmers were free in crop choice and the area cultivated with a particular crop.

Farmers received instructions what to record and how to record management activities. Farmers received pre-printed forms in a table structure with to fill out management information (Annex I)

For each crop the following general information was recorded: crop variety, field location, field area and planting date. For harvest data a separate form was used with information on the harvest date, grade of harvested produce, harvested quantity (yield) per grade, yield unit, selling price per unit yield and total income derived from selling the harvest. In September 2013, the accuracy of the farmers' data on field size was checked using a GPS (Trimble Juno Series) device. Because the fields are rectangular in the study area, deviations between farmers' data and measurements were small (Table 4.3).

Table 4.3. Measured and farmers' estimation of field size (ha).

Farmer	Measured	Estimated	Deviation
A	1.6	2.0	-0.4
B	0.3	0.3	0.0
C	1.0	1.3	-0.3
D	0.5	0.5	0.0
G	0.1	0.1	0.0
H	0.2	0.2	0.0
I	0.2	0.2	0.0
E	0.4	0.4	-0.1
F	0.4	0.4	0.0
J	0.4	0.4	0.0
Average	0.5	0.6	-0.1

Finally, general household and farm characteristics were collected:

- Address
- Educational level
- Years of farming experience
- Years of vegetable farming experience
- Total land use (cultivated area)
- Area of rented land
- Distance between living place and field
- Number of male persons in the household > 17 years
- Number of male persons in the household =< 17 years
- Number of female persons in the household > 17 years
- Number of female persons in the household =< 17 years
- Other sources of income

Based on the recorded data the following data was calculated or added:

- Fertilizer use in kg of Nitrogen (N) , Phosphorus (P_2O_5) and Potassium (K_2O)
- Active ingredient use in gram of used pesticides
- Classification of pesticides used based on WHO classification system
- Classification of pesticides based on the Mode of Action presented by the Insecticide Resistance Action Committee (IRAC), Fungicide Resistance Action Committee (FRAC) and Herbicide Resistance Action Committee (HRAC)
- Total labour hours
- Share of casual labour in total labour hours
- Share of female labour in total labour hours

Finally, because field sizes were different per crop all data were converted and expressed per hectare. Based on the growing period of a crop the management data was classified per year and season. Year 0 records present data from before or during the training. Year 1 data refers to the period immediately after the training till one year after the training. Year 2 data refers to the following period till August 2016. In the study area a dry and a wet season can be distinguished which can have an impact on crop performance. More or less the wet season is from early October till the end of April, in between is the dry season. If more than 66% of the cropping period was in the months of the dry or wet season, crops were classified as being either a wet or a dry season crop.

Based on the recorded data fertilizers were classified per application method and the amount of N, P_2O_5 and K_2O were calculated. For pesticides, the application method was classified as spray, seed or soil application. For each pesticide application the type active ingredient was recorded, content of

active ingredient, mode of action of the active ingredient according to the IRAC, FRAC or HRAC, and the WHO classification of the active ingredient was determined. The total active ingredient in gram per hectare was calculated per pesticide application.
Table 4.4 shows the number of shallot records with management and production cost information that was collected in the various years and seasons. Because some farmers sell their product directly from the field to a trader without assessing yield levels, the number of records with information on the physical shallot yields is less than the number of records with management information (Table 4.5). For example, for the dry season in year 0 (=baseline) there was only one record with physical yield data, and two records with management information (Table 4.4). Approximately 66% of all crop management data also contained information on shallot yields (Table 4.4 and 4.5).

Table 4.4 Number of shallot records per farmer aggregated per year and season (20.

	year/season					
	0		1		2	Total
farmer	Dry	wet	Dry	wet	dry	
1		2	1	2		5
2		3	1	2		6
3	1	1	2	2	1	7
4		1				1
5		2	1	2	1	6
6	1	2	2	2	1	8
Total	2	11	7	10	3	33

Table 4.5 Number of shallot records with physical yield data per farmer aggregated per year and season.

	year/season					
	0		1		2	Total
farmer	Dry	wet	Dry	wet	dry	
1		2		1		3
2		1		2		3
3		1	2			3
4						
5		1		2	1	4
6	1	2	2	2	1	8
Total	1	7	4	7	2	21

Table 4.6 shows weather characteristics over the years and seasons. The dry season of year 0 was wettest, while the dry season of year 2 was extremely dry. Both wet seasons were not much different in terms of rainfall characteristics.

Table 4.6 Number of days with more than 2 mm precipitation, total precipitation and mean temperature per season and years in Gebang, West Java.

#	Year	season	Period		Number of days	number of days with > 2 mm	cumulative mm	Mean Temperature (^oC)
0	2013	Dry	1-7-2013	30-9-2013	91 [1)]	13	457	32.6
0	2014	Wet	1-10-2013	30-4-2014	211	72	1264	29.6
1	2014	Dry	1-5-2014	30-9-2014	152	19	376	31.3
1	2015	Wet	1-10-2014	30-4-2015	211	80	1474	30.1
2	2015	Dry	1-5-2015	30-9-2015	152	9	151	31.5

[1)] The data is based on three months instead of five months as in the other dry season data.

Self-recording has the advantage that farmers write down daily what has been done and what inputs have been used. Compared to recall surveys which rely on the recollection of information the farmer self-recording potentially results in more accurate crop management data. Especially for frequent management operations such as pesticide applications regularly recording of the relevant information (e.g. labour use, pesticide type and amount) may result in more accurate information than a recall method. In addition, this method allows assessing more easily spraying and fertilization schedules that were actually applied. The management records can therefore be used to cross check and validate the survey data. However, the record method has its limitations too. First, the data represents only crops grown in the specific time frame in which the records were taken. Secondly, the method takes up a lot of time and with a same budget only a limited number of farmers can be involved in taking records as compared to surveys. A potential risk of this method is that farmers are not really motivated to take daily records which may result in inaccurate date collection. There is also a risk of bias since only farmers can participate that are literate. This might result in selection of more advanced farmers.

4.2.3 Farmer surveys

The farmer surveys (Annex II) are based on a 'before' and 'after' evaluation of the knowledge, practices and performance of participants. As such, effect measurement is done based on the changes in verifiable outcome indicators before and after the trainings with baseline and follow-up survey, respectively. The questionnaire for the baseline survey was pretested.

The survey data has been collected by a local enumerator using a structured baseline and follow-up questionnaire. A recollection (or recall) approach is used, meaning that farmers have been asked about past production seasons. For the baseline survey this relates to the dry and wet season prior to the training intervention. The baseline survey involved the recall of data from two seasons. Information on two seasons was asked because management and performance of vegetable crops potentially differs because of the differences in rainfall between wet and dry seasons (Table 4.7).

Timing of data collection in relation to the trainings is essential for two reasons. First, farmers need sufficient time to implement learned practices. There was one year between the baseline study and the follow-up survey. This time span is minimally required for farmers to implement new practices in their cropping system in similar agricultural periods. Second, M&E data need to be collected at the right moment when farmers are still able to recall farm management and marketing details, for example, immediately after the harvest. See Table 4.5 for information on the timing of data collection with farmer surveys. The start of the training was postponed with several months and this was not clear to the M&E team conducting the follow-up survey. As a result, the follow-up survey of the dry season was unfortunately too soon after the training itself. The farmers did not have enough time to change the cultivation practices from field preparations to harvest as they were still cultivating at the time of the follow-up. The follow-up results of the dry season should therefore be interpreted with care, see also section 4.3.

The major risk in the recall method is that it can be difficult for farmers to remember the correct facts and figures on costs, specific inputs and revenues. The majority of farmers are not used to keep records or logbooks although it appeared that the majority keeps the receipts from their purchases at the input shops. Another issue challenging accurate yields is common practice that farmers receive a bulk contract price for their harvest before actual harvesting. They are not aware of the actual yield and quality (different grades) of their harvest, the specific prices per kg / grade and the trader includes the transportation costs in the contract (bulk) price. Data is gathered as soon as possible after completion of harvest to limit recall inaccuracy and it was compared with the self-recorded management information (section 4.2.2) as a reference and benchmark to check for validation of data. As will be explained below, it is not possible to compare both data collections one on one. The quantitative data collection is therefore supported with qualitative data.

Table 4.7 Timing of the M&E data collection and type of information collected through farmer surveys.

	Month	year	Information on season (wet/dry)	year	No of farmers
Baseline	July 17 – 22	2013	Dry and wet season	2012	15
Follow-up	January 24-26	2014	May - October (dry season)	2013	15
Follow-up	June 17-18	2014	November - April (wet season)	2013/2014	14

*One farmer passed away

The trained group in 2013 consisted of only 15 farmers. Because of the low number of observations differences in indicators cannot be statistically tested for significance. For the same reasons, causality assumptions cannot be tested with regression models. It is therefore not the objective of the surveys to claim significance and to generalize results. The small number of farmers offers the possibility to present individual behavioural characteristics of each participant. The advantage of a small number of observations is to analyse every observation in detail and to treat each behaviour individually as relevant and valuable. The survey results need to be interpreted in a modest but valid way and they provide in-depth insights and understanding of individual farmers when combined with other data sources.

For each result level the following data is presented of the survey questions related to that level, mean, maximum, minimum, standard deviation and the number of observations (n). For analyses of the survey results data is only used when available for both the baseline and follow-up. As such, identical groups are compared. As one farmer passed away presented are the results of 14 instead of 15 farmers.

4.2.4 Interviews

The interviews are a qualitative methodology which is used to:

I. Interpret and support results of quantitative data;
II. Trace the process of the interventions to draw conclusions on the contribution of the training towards the program objectives of vegIMPACT and;
III. Find the underlying mechanisms for success and constraints in the case of non-achievement.

Several Permveg farmers who received training in 2013 were interviewed. One farmer participated in both trainings of 2013 and 2014. Another farmer participated in a training of 'Train the Chain', which was a project prior to vegIMPACT. In addition, the WP manager, the trainer of IVEGRI and a non-beneficiary farmer were interviewed. Staff of the M&E Work Package conducted theses interviews in April 2016.

Data was collected and analysed based on the analytical framework presented in Chapter 3 and conducted alongside the following assessment elements: *effectiveness* (how effective is the intervention in achieving the program targets); *relevance* (how relevant is the intervention according to participants considering program goals and the actual situation of the participants); *contribution* (how can perceived changes be attributed to the interventions); and *sustainability* (what is the long term perspective of the intervention and can and will it last after withdrawal of the intervention (OECD, 1991). The program objectives and the assessment elements were translated into semi-structural interview guides covering the topics presented in Table 4.8.

Table 4.8 Theoretical framework interviews.

Criteria	Definition criteria	Detailed description of criteria	Assessment criteria
Relevance	Is the intervention suited to the priorities and policies of the target group, recipient and donor?	To what extent are the objectives of the program still valid? Are the activities and outputs of the program consistent with the overall goal and the attainment of its objectives? Are the activities and outputs of the program consistent with the intended impacts and effects?	Appreciation and satisfaction of the training and demo plots; Relation WP Permveg objectives and vegIMPACT objectives Verification ToC WP Permveg and result chain
Effectiveness	How effective is the intervention in attaining its objectives?	To what extent were the objectives achieved / are likely to be achieved? What were the major factors influencing the achievement or non-achievement of the objectives?	Concrete lessons learnt Changes in cultivation practices (adoption) and production of vegetables Drivers of change Barriers in non-achievement of objectives
Impact	The positive and negative changes as a result of the intervention, directly or indirectly, intended or unintended. This involves the main impacts and effects resulting from the activity on the local social, economic, environmental and other development indicators.	What has happened as a result of the program or project? What real difference has the activity made to the beneficiaries? How many people have been affected?	Concrete benefits as a result from the training (yields, productivity, profitability, farm financial management, healthier produce , healthier farmers, and other unintended changes) Attribution of achieved objectives to the intervention Direct and indirect target group
Sustainability	Do the benefits of the intervention continue after it stops?	To what extent did the benefits of a program or project continue after donor funding ceased? What were the major factors which influenced the achievement or non-achievement of sustainability of the program or project?	Will benefits / achievements last after closure of the intervention Chance of continuation of adoption and changed practices (including farm recording) Conditions and drivers for sustainability

All interviews took place in a quiet setting with interviewee and interviewers only. There was no participation of involvement of the Permveg implementers. The extension officers facilitated in selecting and finding the farmers places where the interviews took place; the extension officers did not participate in the actual interviews. Some farmers could not be interviewed as they temporarily moved to another place. The interviews were translated instantaneously and typed out within 24 hours.

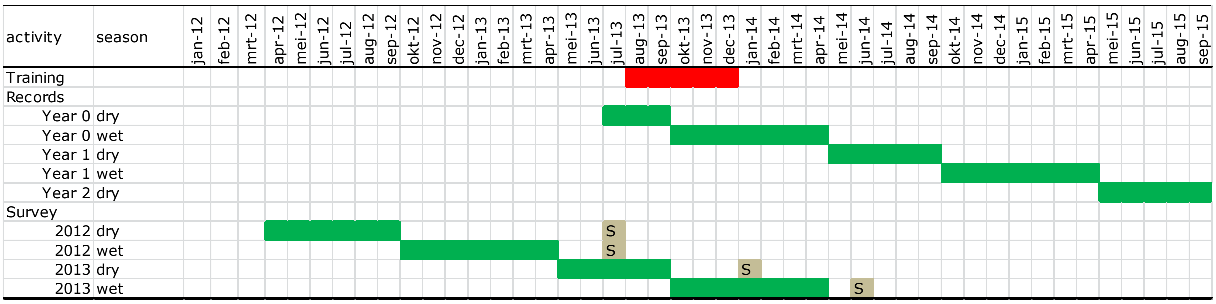
4.3 Comparison of management records and survey data

Both the management recordings (section 4.2.2) and farmer surveys (section 4.2.3) quantified management practices, production, productivity and profitability. The original idea was to compare both data sources to be able to cross check and to validate collected information. However, different collection methods were applied limiting the combined data analysis. There are three major reasons:

- First, the Permveg training took place from August to December 2013 (Figure 4.10). The plan was to start the trainings earlier, May 2013 at the start of the dry season. The farmer follow-up survey in January 2014 collected information of dry season of 2013 starting in May. Due to the fact that the training was postponed the follow-up moment was too early. Farmers hardly had the chance to change and implement new knowledge and skills. It is possible though to monitor changes in knowledge and pesticide strategies and practices. Yield, costs and revenue analysis must, however, be interpreted with caution and expectations for changes in this dry season must be tempered. The farm management recording by farmers started at the implementation of the project itself, at the start of the trainings.
- Second, the farmer survey collected aggregated production and management data independent of the grown vegetable crop in a given period. In the farm management recordings the information per type of crop was collected. It is not possible to split the data of the survey and to analyse the data per crop type as farmers may have produced several crops at the same time. The survey structure was based on the overall objective of the WP Permveg to stimulate the production of vegetables in permanent systems.
- Thirdly, and the last reason why the data collection methods differ is that the farm management recordings have been done by 10 farmers and the surveys addressed all 15 farmers trained.

Because of these three reasons, comparisons between farm survey data and real-time evaluation data is unfortunately not possible.

Figure 4.10 The timing of trainings (interventions), timing of crop data registration and farmer surveys. Green marked cells indicate the periods of which data was collected. S=survey date to collect information regarding the period marked green.



5. Assessment per result level

5.1 Output level

Participating farmers were on average 45 years old, ranging from 29 to 62. There is considerable variation in the education level of farmers: although the majority of the participating farmers finished elementary school, 20% received no education, while two farmers (13%) had a university degree (highest educational level). From the follow-up survey it became clear that some farmers were still studying as at that time two additional farmers finished their high school degree. One of the criteria set was that farmers were literate[5].

All farmers lived near Cirebon with a majority in the sub district Babakan. The remaining 20% lived in the sub district Gebang. The average cultivated land of farmers differed each year. In general, the farmers did not own land, but rented land for a maximum of one year. The rented land area and the quality of the land (e.g. soil type) can differ each year and depends on the land availability and financial resources of the farmer. Shallot is the major crop for a majority of the farmers in this area. Farmer knowledge on shallot production is transferred from generation to generation and not or hardly supplemented or updated with new information sources.

On average the attendance rate of farmers to the trainings was 97% (Table 5.1). Sometimes a participant could not be present due to personal circumstances. There were no drop-outs and all participants finished the training in 2013. Farmers received at the end of the training a certificate and did the knowledge test (section 5.2).

Table 5.1 Attendance of farmers to the Permveg training in the dry season of 2013.

Date	# of participants attending	%
15-aug-13	15	100
29-aug-13	15	100
12-sep-13	14	93
26-sep-13	15	100
10-okt-13	14	93
24-okt-13	14	93
7-nov-13	15	100
21-nov-13	13	87
5-dec-13	15	100
19-dec-13	15	100
Mean		97

Selection of farmers and decision why some participated twice is not very clear. According to the farmers, it is very relevant to be trained more frequently to understand and assimilate the training materials.

Farmers were asked how they experienced the training (*relevance*). All farmers would recommend the training to a neighbouring farmer. In practice 75% mentioned to have shared the newly obtained knowledge with other farmers that did not participate in the trainings. Key identified conditions for knowledge sharing are a high level of confidence about the gained knowledge and whether trained farmers perceive the other farmer as a competitor.

[5] This means that not all criteria set to the target group are met indeed although it could be that non educated farmers can read and write.

Sharing knowledge is no specific program objective but it is an indication how the training was received by the participants. Interviewed farmers indicate that only a small share of these ‘other’ farmers are thought to have implemented the knowledge already by changing their practices. The trained farmers have also been asked about possible reasons why other farmers didn’t changed their practices; some farmers argued that it was hard to convince other farmers about changing the way of applying pesticides and fertilizers.

According to the interviewed farmers, the trainings were very relevant and important to them. They were enthusiastic about the initiative and the training offered, but the books received were difficult to study individually. They received some information from the extension workers but they lack knowledge and up to date information. The common opinion of the farmers was training needs repetition if it wants to be effective. One training semester is:

a) Only sufficient for improving knowledge on the basics of crop production (e.g. application of fertilizer before planting or replace spraying nozzle) but not sufficient to make farmers aware and understand the more difficult topics (e.g. calculating the right fertilizer doses for a field, pesticide mixing practices);
b) Insufficient to convince farmers of the importance, relevance and credibility of the provided knowledge and trained practices. Learning requires repetition and farmers need to build trust in the trainer and assess the results of the learned material in practice (e.g. demonstration plot, Text box 1).

Text box 1: An implementer on the use of the demonstration plot

“We had a demo for 2.5 years and invited farmers to see the results but we need more time for dissemination and to convince farmers. Four years is not enough to convince them that the soil is improved due to vegetable cropping. Soil conditions will not improve within a short period of time. And there is more time needed to convince farmers that cropping vegetables is more profitable.” and “....maybe 40% followed the recommendations. Farmers are afraid of applying, they are not yet convinced. Therefore, it is very good to train often, every year, to repeat and to guide farmers. The first training, a farmer trusted only a part of what was said. But after the 2nd training in 2014 and the demo plot, he was convinced.”

In response to the observed difficulty of farmers to absorb theoretical knowledge the second training round in 2014 contained more practical exercises and video footage.

5.2 Outcome level

5.2.1 Immediate outcome: Change in knowledge

Table 5.2 shows the results of knowledge tests carried out by IVEGRI before, during and at the end of the training semester. Results of the tests showed that the theoretical knowledge on horticulture of the participants increased after having received the training.

Table 5.2 Results of theoretical knowledge tests of farmers at the start, halfway and at the end of the training round. Numbers indicate average percentage (good) scores on questions related to five major production topics, and the percentage increase between the start test and end test.

		Early	Mid	End	Increase %
1	IPM, ICM, and GAP	58	87	90	57
2.	Fertilization/cultivation/cultural practices	39	53	58	50
3.	Pests, diseases and natural enemies	45	76	78	73
4.	Pesticides and pest/disease control	49	67	78	60
5.	Spraying techniques	38	67	78	108
	Average	46	70	76	70

Table 5.3 shows the change in practical knowledge of the participating farmers, which was assessed twice during the training semester, at the start and end.

Table 5.3 Results of practical tests of farmers at the start and end of the training semester. Numbers indicate the average percentage (good) scores on questions related to five major production topics, and the percentage increase in score between start and end test.

		Pre-test score	Post-test score	Increase %
1	IPM, ICM, and GAP	51	74	44
2.	Fertilization/cultivation/cultural practices	34	60	78
3.	Pests , diseases and natural enemies	50	56	12
4.	Pesticides and pest/disease control	56	58	3
5.	Spraying techniques	49	84	72
	Average	48	66	42

Change in knowledge was also measured in the farmer surveys and was one of the topics of the in-depth interviews. With the data of the survey, a four-point scale was developed to measure an increase in knowledge on agricultural practices. The scale is composed of two questions related to effective pest management and disease identification and two questions related to pest and disease control strategies. The maximum score is 4 when all knowledge questions are answered correctly and the minimum score is zero if no answer is correct.

Picture 5.1 shows diseases and pests that often occur in shallot production. We only asked the farmers who produced shallots. During the baseline survey only 50% of the farmers identified the Picture A as leaf miner and 50% identified Picture B correctly. In the follow-up survey all farmers identified Picture A as leaf miner and 4 out of 6 identified Picture B correctly as purple blotch.

Picture 5.1 Pictures A (left) and B (right) of the pest leaf miner (a) and the disease purple blotch (b) used in the knowledge tests of the M&E survey. Source pictures: IVEGRI

For leaf miner about half of the shallot farmers only recommended to use insecticides. After the training all farmers recommended the correct control approach. About 6% of the trained farmers had no control strategy for purple blotch at the time of the baseline. After the training 86% of the farmers recommended correctly spraying with insecticides for leaf miner and fungicides for purple blotch.

We used the above results for input in the knowledge index. Farmers were able to score 4 points if all questions were answered correctly. If farmers identified the pest or disease wrongly, they did not score any point to the question on recommendation. The Index shows that the farmers scored significantly better compared to the Baseline (Table 5.4).

Table 5.4 Knowledge Index at baseline and follow-up and their difference

	N	Average score	Standard deviation
Baseline	6	1.5	1.4
Follow-up	6	3.3	1.0
Difference	6	1.3*	

*) Significant at 0.05 confidence interval

Various farmers perceived the training as beneficial (Text box 2). In the interviews, farmers gave concrete examples of the correct frequency and timing of spraying, the direction of spraying, the importance of mixing less types and that mixing depends on specific active ingredients, the importance of application of basic fertilizer before planting, how to measure soil and water pH, the correct doses of fertilizer, the identification of various diseases and to decide upon the right treatment. They also explained why the use of personal protective equipment was important and what the consequences are of pesticides exposure.

Text box 2: Farmer on the newly gained knowledge.
"I was opposing them. But then, I saw the demo plot and I believed after seeing that they had a message to share. And I now share with others. I am the leader of an active farmer group of 20 members. We meet each other frequently to receive the extension worker or pest agent and as a group we recently bought a pH meter."

5.2.2 Immediate outcome

In the evaluation workshop in 2016, a part of the farmers endorsed the self-recording of management data, especially related to finances and crop protection. However, there is no proof that farmers continued with recording of management data after the training at a wide scale, except for one farmer who showed records during the interview with M&E staff. Other farmers indicated to use the records of 2013 as a source of information and were not convinced of the relevance of seasonal updates.

5.2.3 Intermediate outcome: changes in production practices

The intermediate outcome level focusses on changes in production practices. The management recording, farmer surveys and M&E interviews provide sources to assess such changes.

Change in pesticide use
Table 5.5 compares the use of different types of pesticides between the baseline and follow-up survey. The farmers were asked for pesticide types and volumes applied which are categorized according to the actual World Health Organization (WHO) toxicity classification. This classification system for pesticides addresses the acute toxicity of the active ingredients contained in the pesticides. The following toxicity classes are defined:

- Class Ia: extremely hazardous
- Class Ib: highly hazardous
- Class II: moderately hazardous
- Class III: slightly hazardous
- Class U: unlikely to pose an acute hazard in normal use

- Class NL: not listed

The amount of pesticides used per ha by farmers was on average higher in the wet season than in the dry season which is not uncommon as the occurrence of pest and disease is commonly higher in the wet season. The amount of pesticides used per ha decreased though both in the dry and the wet season after the trainings. The total quantity of pesticides used showed a decrease of 15.3 kg per ha in the dry season and of 7.6 kg per ha in the wet season. None of the farmers indicated the use of category Ia products, which are officially banned in Indonesia. However, most farmers still use category Ib pesticides, which are less toxic but still dangerous for human health. The share of category Ib and II in total pesticide use even doubled in the dry season and tripled in the wet season between the baseline and the follow-up.

Table 5.5 Average use of pesticides and pesticide types (Ib and II) in dry and wet season in baseline and follow-up.

	Dry season		Wet season	
	Baseline	Follow-up	Baseline	Follow-up
Kg per ha	33.4	18.1	23.3	15.7
Category Ib (%)	13	52	5	27
Category II (%)	25	24	19	40

The number of pesticide applications per week depends on the prevalence of pests and diseases in a particular season. As indicated above, commonly, pest and diseases are more prevalent in the wet season. Correspondingly, we observed a higher spraying frequency in the wet season compared to the dry season (Table 5.6). Some farmers sprayed on a daily base in the Baseline but after the intervention we observed a lower spraying frequency in the wet season. However, the number of pesticide applications in the dry season increased slightly in the follow-up compared to the Baseline. In general, farmers have reduced the number of pesticide applications and none of the farmers sprayed daily in the follow-up (Table 5.6).

Table 5.6 Number of pesticide applications per week during the dry and wet season in the baseline and follow-up.

	Dry season		Wet season	
	Baseline	Follow-up	Baseline	Follow-up
Mean	1.8	2.0	3.1	2.6
Minimum	1.0	1.0	1.0	2.0
Maximum	3.0	2.0	7.0	4.0

The majority of the farmers always used a cocktail of pesticides. Only 14% both in baseline and follow-up used one single pesticide at a time. The trainings promoted the use of single pesticide applications to improve the effectiveness of pesticides. Despite this advice the majority of farmers (85%) maintained mixing practices in the Follow-up survey. The in-depth interviews revealed though that the farmers do mix less pesticide types on average: Instead of mixing five or more types they still mix but only 3-4 different pesticide types. The main reasons for farmers to mix pesticides are that they are not convinced of the improved effectiveness of using single pesticide applications and most importantly, applying single pesticides requires much more (costly) labour as the spray frequency increases considerably.

Almost all the farmers used pesticides as a preventive strategy, i.e. pesticides were applied before disease or pest symptoms became visible in the crop. Farmers did not change this strategy after the training towards a more curative spray strategy.

Major changes in spraying practices were related to the spray nozzle and the spray angle. About half of the farmers increased the spraying angle increasing the efficiency of spraying, and hardly any farmer used nozzles with big drops after the training. Farmers also changed the timing of spraying to the most effective spraying time which depends on the type of pesticide and target. Farmers also used lower spray volumes leading to a reduction in pesticide input costs. The section *production and productivity* elaborates more on the production costs aspect.

Table 5.7 gives information on some of the characteristics of pesticide use in shallot across seasons and years based on the real-time monitoring of management information. In general, the amount of different pesticide types used by farmers increased over the years, and pesticide use is considerably higher in the wet season compared to the dry season in a similar year (except for herbicides). The share of hazardous pesticides tended to decrease over the seasons and years. The average spray interval decreased in the dry season and remained the same in the wet season. There was a tendency that the spray interval of the dry season approaches the interval length of the wet season. This is in line with the increased use of pesticides during the dry season. The increased frequency of spraying in the dry season seems to correspond with survey information (Table 5.6), but the clear decrease in spray frequency in the survey data is not reflected in the real-time monitoring data (Table 5.7). Remarkably is that pesticide use was lowest in year 0 dry season, while it was the wettest of all dry seasons (Table 4.5). This indicates that rainfall and humidity are not the only factors that drive pesticide use.

Table 5.7 Pesticide use in shallot expressed as use in gram active ingredient (g a.i./ha) and interval between pesticide applications (days).

	dry			wet	
	0	1	2	0	1
Total fungicide use (g a.i. / ha)	3,770	5,014	17,524	6,880	13,219
Total insecticide use (g a.i./ha	688	1,050	1,222	2,080	1,502
Total herbicide use (g a.i./ha	480	452	53	292	505
WHO category Ib & II (% of total a.i. use)	24	29	10	30	16
Maximum spray interval (day)	5.3	5.3	5.8	6.2	5.8
Minimum spray interval (day)	5.1	2.6	2.8	2.0	1.4
Average spray interval (day)	5.2	4.3	4.0	3.5	3.6

Occupational health

The follow-up survey suggests that all farmers increased the use of Personal Protective Equipment (PPE) after the intervention. Especially, the overall and the hat are used by all farmers, reducing the risk of skin contact with pesticides significantly. These results are promising but should be interpreted with care: Most farmers do not spray themselves, but contract external labour that in general does not use PPE (which were not targeted by the intervention). Often, the argument for not using PPE by labourers was “It is not in our culture”, which appeared to relate to practical issues. For example, almost all male labourers smoke and it’s difficult to smoke with a mask, the use of PPE hampers the smooth work and the heat makes wearing of PPE very unpleasant under tropical conditions. In short, the trained farmers were aware of the dangers and the benefits of PPE but a) they often do not spray themselves, and b) they and their labourers have practical arguments for not using PPE.

The number of incidents that required medical attention among farmers and workers decreased if we compare the baseline and follow-up. In the Baseline 47% of the farmers reported one accident and 40% no accident. In the follow-up only 14% reported one accident while 78% reported no accident. We are not able to conclude whether the training contributed to this difference but it is a positive finding. It might be farmers are more aware of the dangers and risks of the field work but the occurrence of an incident cannot always be controlled for.

5.2.4 Ultimate outcome: Contribution to objectives

An external influence on the ultimate outcomes is the prevailing weather condition. Therefore, we asked the respondents their perceptions on weather conditions in the dry and wet season in the baseline and follow-up period. In the wet season, weather conditions were scored a bit less favourable by farmers in the follow-up. Farmers were more positive of the dry season as they perceive improved weather conditions in the follow-up (Table 5.7).

Table 5.7 Weather conditions in the dry and wet season as perceived by farmers (in % farmers).

		Dry season		Wet season	
		Baseline	Follow-up	Baseline	Follow-up
Weather condition	Good	43	73	25	17
	Average	5	18	25	35
	Bad	52	9	50	48

Vegetable area

Results confirm that the majority of farmers produced shallots both in the dry and the wet season. The number of shallot farmers decreased in the dry season follow-up (from 13 to 6 farmers) but increased in the wet season follow-up (Table 5.8). Not only is the number of farmers important but also the size of the vegetable area. The average area with shallot in the follow-up of the dry season decreased with 2.28 hectares but it increased considerably in the wet season (+ 8.98 hectares). This could be a consequence of the training and the lessons learned but it could also be related to the highly fluctuating market price of shallot (Figure 5.1). Shallot farmers follow highly fluctuating market prices, and they adjust their production to these market price. The wet season follow-up was just after price hike in the dry season of 2013 (Figure 5.1) and thus may have stimulated the planting of shallot in the wet season.

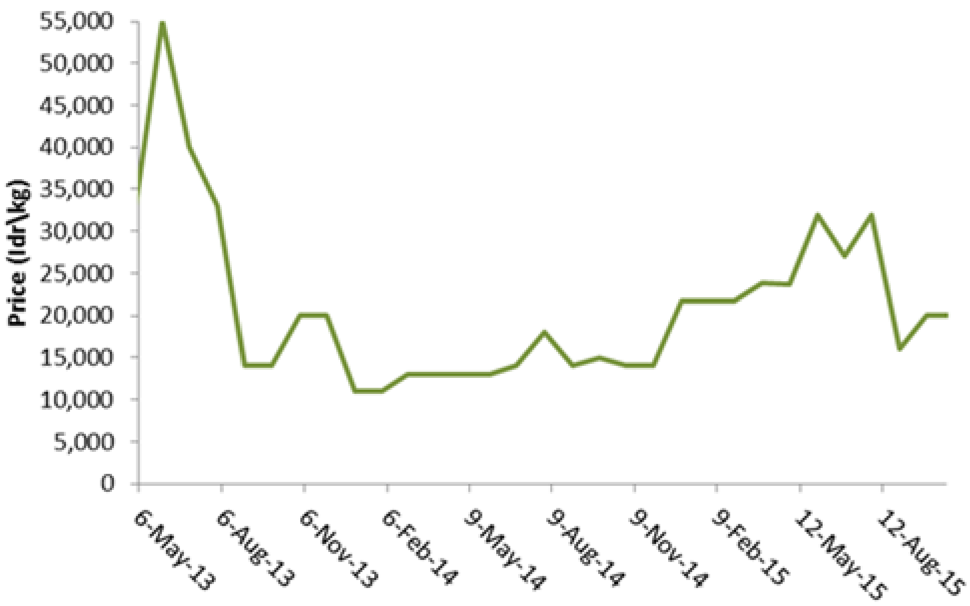


Figure 5.1 Shallot wholesales market price at the Kabupaten Cirebon. Source: vegIMPACT data

Table 5.8 Overview of crops produced by farmers in the baseline and follow-up during the dry and wet season.

		Dry Season				Wet Season			
		Baseline		Follow-up		Baseline		Follow-up	
#	Crop	N	ha	N	ha	N	ha	N	ha
1	Shallot	13	8.38	6	6.10	1	4.70	14	13.5
2	Maize	6	3.50	5	1.85	6	3.50	3	1.6
3	Rice	2	0.19					3	0.6
4	Hot pepper	1	0.35			1	0.25		
5	Oyong	1	0.25						
6	Bittergourd					1	0.50	2	0.6
7	Eggplant								
8	Waterspinach					1	0.12		
9	Long bean					1	0.50	1	0.2

Production and productivity

Maize, or sweet corn, is still produced in both seasons in the baseline and follow-up but the total area decreased in both seasons from 12.67 to 9.57 ha. Rice was not produced anymore in the dry season follow-up but three farmers started to grow rice in the wet season follow-up. A number of other vegetable crops were grown but they formed only a minority of the cropped area both in the baseline and follow-up.

Table 5.9 and 5.10 give an overview of the physical and financial production data, and of yields of different vegetable crops in the dry (Table 5.9) and wet season (Table 5.10) of the trained farmers before and after the intervention. The farmers produced different crops in one season and often have different plots with the same crop. The data not only indicates that farmers grow different crops in the wet and dry season but also shows that farmers may have produced different vegetable crops and crop areas before and after the intervention.

The Tables 5.9 and 5.10 give insight in production behaviour of the farmers and is not used to draw any conclusions on vegetable acreages and changes in averages. The ID number refers to a specific farmer participating in the survey.

Dry season production (Table 5.9)

Data shows that the majority produced shallot and hot pepper, while oyong, maize and rice are other common crops. Only one farmer cultivated rice in the Baseline on a relatively small plot of 0.19 hectare. Rice, hot pepper and oyong is no longer produced in the dry season follow-up and farmers focussed on maize and shallot. Two farmers out of 12 stopped production in the follow-up.

Table 5.9 Physical and financial characteristics of crops cultivated in the dry season before and after the intervention based on the farmer surveys.

		Baseline				Follow-up					
			Yield						Yield		
ID	crops	ha	ton	IDR x 1,000 per ton	ton/ha	ID	crops	ha	ton	IDR x 1,000 per ton)	ton/ha
62	Hot Pepper	0.35	6.48	5,450	18.51	62	Maize	1.12	18.50	3,700	16.52
63	Shallot	1.00	12.00	17,916	12.00	63	Shallot	0.50	7.00	14,000	14.00
64	Shallot	0.28	4.50	1,500	16.07	64	Shallot	0.28	12.00	5,830	42.86
67	Shallot	0.70	16.00	14,500	22.86	67	Shallot	0.48	8.00	18,000	16.67
68	Maize	1.00	6.00	1,800	6.00	68					
69	Rice	0.19	2.20	8,700	11.58	69					
70	Maize	0.50	1.90	3,400	3.80	70	Maize	0.36	5.50	1,400	15.28
71	Maize	1.00	8.80	4,100	8.80	71	Maize	0.21	1.40	5,235	6.67
	Oyong	0.25	3.70	3,000	14.80						
72	Shallot	2.40	43.00	31,500	17.92	72	Shallot	1.25	12.00	22,916	9.60
74	Shallot	2.00	33.00	1,500	16.50	74	Shallot	3.00	12.00	43,750	4.00
75	Shallot	1.00	17.00	12,600	17.00	75	Shallot	0.50	1.00	6,250	2.00
76	Shallot	1.00	24.00	5,000	24.00	76	Maize	0.16	2.00	2,000	12.50
	Maize	1.00	15.00	2,500	15.00						
	Total	12.67					Total	7.86			

Wet season production (Table 5.10)

In the wet season follow-up more farmers had plots with shallot, rice, maize, bitter gourd or long bean. Not only the number of farmers increased from 9 in the Baseline to 14 in the follow-up, they also produced different crops. Rice was still produced in the wet season follow-up by three farmers but vegetable production increased considerably. This is striking as vegetable production in the wet season is usually more risky considering the high occurrence of pest and diseases. See Table 5.10 for more specifics.

Table 5.10 Physical and financial characteristics of crops produced in the wet season before and after the intervention based on the farmer surveys.

		Baseline					Follow-up				
			yield						yield		
ID	Crops	ha	ton	IDR x 1,000 per ton	ton/ha	ID	Crops	ha	ton	IDR x 1,000 per ton	ton/ha
62						62	Bitter Gourd	0.35	11.90	3,500	34.00
63						63	Shallot	1.50	2.70	9,200	1.80
64						64	Shallot	0.28	3.80	9,000	13.57
65	Shallot	1.26	9.00	2,450	7.14	65	Shallot	1.50	9.50	25,000	6.33
66						66	Rice	0.20	1.00	4,000	5.00
67	Shallot	0.88	11.17	19,713	12.77	67	Shallot	0.96	17.40	11,185	18.13
68	Maize	2.00	11.00	1,600	5.50	68	Maize	0.50	6.74	2,130	13.48
	Shallot	0.16					Shallot	0.80	8.10	16,500	10.13
69	Water Spinach	0.20				69	Rice	0.50	0.15	4,000	0.30
70	Maize	0.50	3.20	3,300	6.40	70	Maize	0.36	0.15	1,500	0.42
							Rice	0.36	1.60	4,500	4.44
71	Maize	0.50				71	Bitter Gourd	0.21	3.74	2,000	17.81
	Hot Pepper	0.25	7.40	3,000	29.60						
72	Shallot	1.70	14.50	46,000	8.53	72	Shallot	3.96	17.60	27,521	4.44
74	Shallot	0.70	5.70	19,410	8.14	74	Shallot	4.00	32.60	14,935	8.15
75						75	Shallot	0.50	6.50	7,500	13.00
76	Maize	0.50	4.50	1,500	9.00	76	Maize	0.70	5.00	3,000	7.14
	Long Bean	0.50	8.40	2,000	16.80		Long Bean	0.16	2.29	1,200	14.31
	Bitter Gourd	0.50	1.70	2,50	3.40						
	Total	9.65					Total	16.84			

Shallot production and productivity

As it is difficult to compare the actual yields, prices and productivity at aggregated level due to the different crops, Table 5.11 shows the result of shallot production only as the majority of the farmers produced shallot, which was the major crop for the trained farmers. The number of farmers producing shallots was six in the dry and the wet season survey. However, the farmers growing shallot sometimes differed in the baseline and follow-up. The average area with shallots decreased in the dry season and also the productivity decreased. However, the average price received for shallots also increased in the follow-up also greatly. The wet season follow-up shows that both the average area with shallots and productivity (t/ha) increased sharply but the average received shallot price by farmers decreased.

Table 5.11 Average farmer characteristics of shallot production in the dry and wet season in the baseline and follow-up based on the farmer surveys.

	Dry season			Wet season		
	N	Baseline	Follow-up	N	Baseline	Follow-up
Average area (ha)	6	1.2	1.0	4	1.1	2.6
Productivity (t/ha)	6	20.9	8.7	4	10.1	19.3
Average price/kg in IDR	6	5,690	12,035	4	9,259	6,245

Costs and profitability

In the dry season input and labour costs decreased compared to the Baseline (Table 5.12). All major costs decreased: for chemical fertilizer, pesticides, planting material and other inputs. Farmers made the highest cost for planting material, about 66% of the total costs. In the follow-up the cost of planting material was lower, but still 51% of the total costs. Text box 3 illustrates the observed costs decrease with a quote of a trained farmer.

In the wet season, the production costs (per ha) increased mainly due to an increase in costs for various inputs. The costs for labour decreased. Planting material was also in the wet season the most important cost driver (Figure 5.2).

Table 5.12 Input, labour and total production costs of shallot in IDR x1000 (per ha) in de wet season baseline and follow-up.

	Dry season			**Wet season**		
	n	Baseline	Follow-up	n	Baseline	Follow-up
Input costs	10	35,409	15,313	9	18,495	22,251
Labour costs	10	24,056	12,015	9	10,385	8,139
Total	10	59,465	27,329	9	28,880	30,391

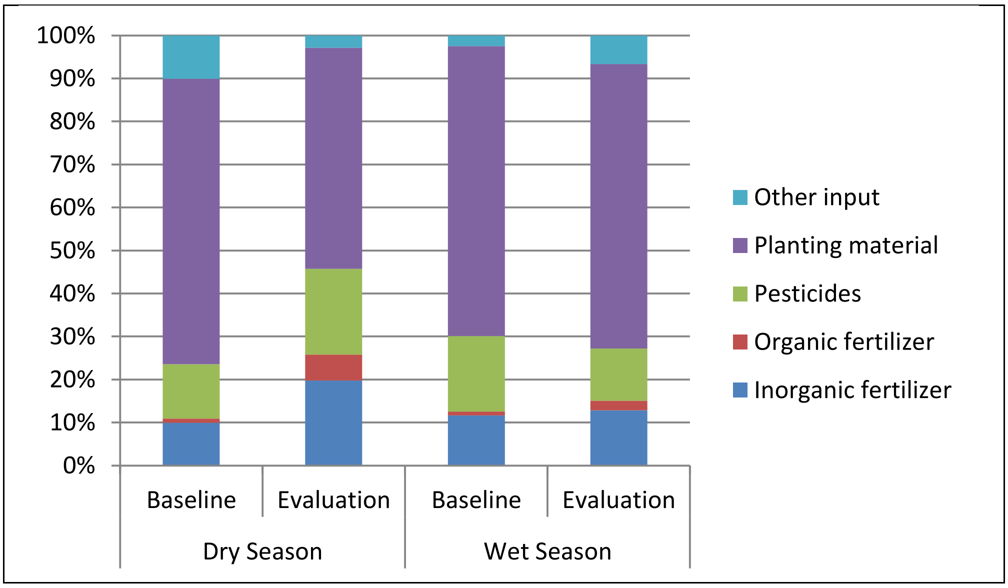


Figure 5.2 Share of the different costs components in shallot production in the dry and wet season baseline and follow-up.

Table 5.13 gives an overview of the average production costs and profitability of different vegetable crops in the dry and wet season, respectively, of the trained farmers before and after the intervention. As described in section 4.3 input and labour costs concern all vegetable production, these variables cannot be specified for shallot production.

In the dry season, the production value per hectare remained the same and combined with a decrease in production costs per ha profitability per ha increased significantly (Table 5.13).

The wet season follow-up shows different results: the production value decreased, due to the lower prices received by the farmers (Table 5.11). The average production costs decreased slightly in the wet season follow-up compared to the Baseline. The overall result is a large decrease in profitability (per ha) in the wet season.

Table 5.13 Company results in IDR x1000 in the dry and wet season in the Baseline and Follow-up based on the farmer surveys.

	Dry season			**Wet season**		
	Baseline	Follow-up	Difference	Baseline	Follow-up	Difference
Revenue	105,677	134,397	+28,720	81,113	49,893	-31,220
Total costs	59,465	27,329	-32,136	28,880	30,391	+1,510
Calculated profits	46,212	107,068	+60,856	52,233	19,503	-32,730

Text box 3: A farmer on the costs of production

"I am happy because my costs for pesticides and fertilizer decreased, with 40%. Fertilizer cost reduction is higher than the pesticide reduction. The last season I did not have a profit because of the low shallot price (7,000 IDR/kg) but now I am happy again because the price is better at this moment 20,000 IDR/kg."

Table 5.14 shows the farmers' self-reported cost components, yields and profits of shallot production in different years and seasons. Both in the dry and wet season crop profits decreased over time, which is mainly related to the much lower yields. Especially shallot yield in the dry season of year 0 was very high, but only based on one observation. The other two dry seasons show average yields that are comparable with the yields obtained in the wet season. In general, most costs in the dry seasons of year 1 and 2 are higher than in year 0. Also here it is emphasised that the costs in the dry season of year 0 are based on only two farmers. Costs in the dry and wet season are quite comparable and appear to increase over time in both seasons.

Table 5.14. Productivity (kg/ha), cost price (IDR /kg), total material costs, crop protection costs, fertilization costs and profit (all in IDR x 1,000/ha).

Season			Dry						Wet		
	Average	SE	Average	SE	Average	SE	Average	SE	Average	Year	0
N [1)]	2 / 1		7 / 4		3 /2		11 / 7		10 / 7		
Yield (kg/ha)	20,000		12,696	2,714	8,884	1,211	12,902	3,890	9,298	2,940	
Total costs of materials	40,015	3,015	72,057	6,059	62,113	8,529	75,056	22,630	53,038	16,772	
crop protection costs	4,261	335	6,543	1,071	7,427	1,061	7,149	2,156	7,431	2,350	
fertilization costs	8,383	303	7,803	779	6,392	1,527	8,058	2,430	7,679	2,428	
Labour costs	15,177	1,254	22,670	3,124	22,793	4,438	21,925	1,353	26,473	2,353	

1) Number of farmers with financial data / Number of farmers with physical yield data

2) Based on the n farmers that provided physical shallot yields.

Figure 5.3 gives an overview of the cost structure of shallot production in the dry and wet seasons based on the farm management records. Labour costs were calculated based on hourly labour input by both farm family members and hired casual labours and multiplied by the average wage paid to casual labours. This was done for reasons of comparison among farmers because some farmers (especially those with small fields) use more family labour than others with large cropping areas. The costs of planting material and labour are by far the most important cost components in shallot production (Figure 5.3).

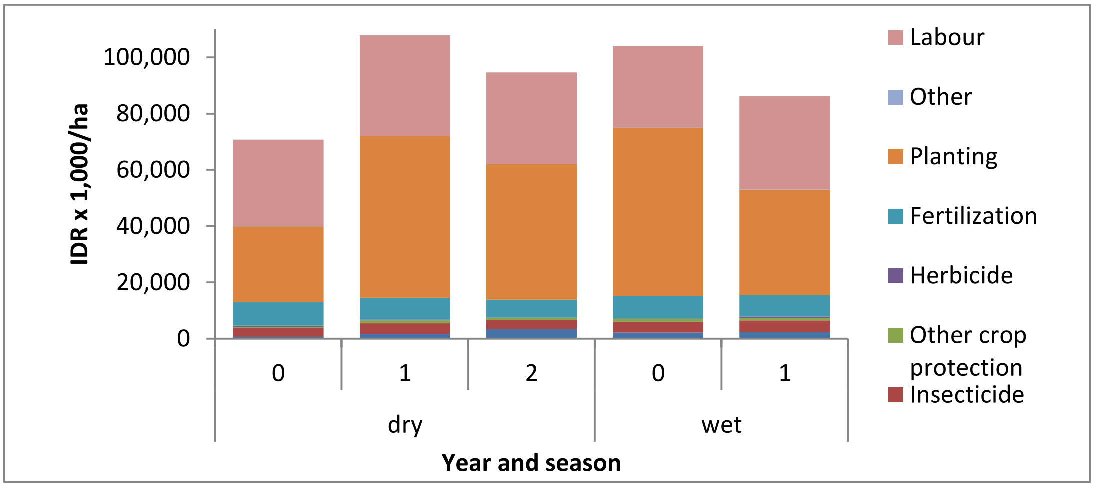


Figure 5.3 Cost structure of shallot production in the dry and wet season across years based on the farm management data.

Table 5.15 shows the performance indicators for objectives defined at vegIMPACT program level in the different years and dry and wet seasons. In three out of the five seasons a financial loss was calculated when all labour (including family labour) was valued against wage costs (see before). However, financial losses were relatively small compared to the profits in other years. Also results of the baseline and follow-up surveys suggest that farmers did perceive financial losses probably because all labour was valued in our calculations, while in reality part of the labour requirements were provided by family members (Table 5.13).

In general, performance indicators do not improve over time. As described before, this may be partially related to the few observations in dry season of year 0. The only yield observation of that season was the highest of all 21 yield observations during five seasons and obviously affected the benchmarking of all performance indicators based on yield (e.g. N-efficiency). Also the costs in the dry season of year 0 were lower, but only based on two observations (Figure 5.3).

Table 5.15 Performance indicators defined at vegIMPACT program level in different years and dry and wet seasons based on the farm management data.

	dry						Wet			
	0		1		2		0		1	
	average	SE	average	SE	average	SE	average	SE	average	SE
Profit (million IDR /ha) 1)	219.3	50.7	-5.6	27.0	-10.4	11.0	5.5	15.3	-2.7	7.6
Cost price (IDR/kg) 2)	3,447	-	12,778	4,184	12,960	718	7,580	1,011	10,416	1,412
N use (kg/ha)	262	31	296	29	161	38	174	22	250	25
N efficiency (kg yield/ applied kg N)	65	-	48	16	46	1	74	15	40	5
Tot AI g/kg product	0.30	-	0.79	0.24	1.47	0.50	0.70	0.18	1.36	0.19

1) Based on valuing all labour input

2) Based on only those farmers that provide yield data

6. Discussion and conclusion

6.1 Discussion

In this report we have described, assessed and reflected on the intensive training intervention carried out in 2013 within the WP Permveg. This training was given in a biweekly interval and participants received 10 training sessions on GAP in horticulture. The trained farmers showed in the follow-up survey a positive attitude towards the training received. The majority of the farmers attended all sessions and showed a high level of appreciation, especially with respect to the practical aspects of the training. In particular the demonstration field was mentioned by farmers as a key asset of the intervention. Farmers appreciated the repetition of materials during training. Therefore, several farmers participated in more than one training, which helped them to be more confident about the knowledge and how to apply this in practice. Farmers indicated that the reference books provided by the intervention team are difficult to understand and did not use them after the training.

The major objective of all trainings in vegIMPACT is to achieve a behavioural change of those who are trained towards GAP, which is the intermediate outcome of the trainings. The intermediate outcomes, i.e. change in management towards GAP are a prelude to the ultimate outcome of the trainings, i.e. higher crop yields and improved resource use efficiencies. In the context of the Permveg trainings this means, for example, that the promoted and adopted improved spraying techniques result in both less pesticide use and better crop health and associated higher vegetable yields.

During our research we focused on measuring output at the different outcome levels. The main Immediate and intermediate outcome indicators give a positive indication that the knowledge level and various GAPs have been changed positively. However, as anticipated in the design we were not able to attribute registered differences at the ultimate outcome level. Also, we faced difficulties to retrieve exact yields and returns due to lump sum contract prices received by farmers for all production on their plot. Also we faced problems since we used recall data that might result in measurement errors. Next to that, there were various external influences that may have influenced the success of the intervention and profitability of trained farmers:

- High fluctuation of shallot market prices, which is beyond the control of the farmers and the program implementers.
- Role of pesticide shops and agents with strong promotion activities and rewards on purchase.
- Farmer leaders and extension workers that strongly influence the behaviour of farmers to buy more pesticides;
- No governmental (restrictive/protective) policy and regulation on distribution of pesticides;
- Government supports and favours other crops like rice and maize through input subsidies;
- Farmers rent land for short periods in the Cirebon area and therefore might be less interested in GAP, which for example also takes into account short-term environmental effects of production and long-term effects of management and inputs on soil quality;

Unintended outcome

Some positive and negative unintended outcomes are observed:

- Unintended positive outcome related to the group dynamic.
    - In Indonesia most farmers are organized in farmer groups, only a small number of these groups are functional. Farmers do not have a tradition in joined knowledge development and knowledge sharing. However, the trained farmers shared newly obtained agricultural knowledge also with other farmers. Key conditions for knowledge sharing are a high level of confidence about the gained knowledge and whether trained farmers perceive the other farmer as a competitor.

- We also observed that group dynamics and collective action within the group have been enriched. For example, the farmers' group bought jointly a pH meter.

6.2 Conclusions

Despite methodological limitations described in Chapter 4 the overall impression is that the trainings intervention has contributed to improved agricultural knowledge and practice among farmers in the Cirebon area.

The intervention was according the farmers relevant and addressed key bottlenecks among shallot farmers in the Cirebon area. Not all training topics, were well-targeted, for example, the impact of the training on occupational health aspects is probably low for two reasons: First, many PPE's are not very practical for sprayers and, second, not all farmers spray themselves but hire external labour for pesticide spraying. However, it seems that farmers have limited control over how external labourers perform their work.

On the sustainability of the intervention are some doubts, because most farmers are reluctant to change behaviour and there is a possibility that they might switch back to traditional farming techniques in the future. The self-recording of production costs by farmers showed that the major costs incurred by farmers were related to seed and labour. However, the major part of the trainings was focussed on costs reductions in pesticide and nutrient management. These costs for pesticide and nutrient management are only minor compared to seed and labour, and highly influenced by climatic conditions. The incentives for farmers to improve pesticide and nutrient management, therefore, may be low. Closely monitoring and is needed in the future to assess this assumption. Although the government declared the area as the major shallot area of Indonesia there is no indication that other actors will start follow-up activities to secure and further expand the knowledge base of the trained farmers and other farmers in the region. In the Permveg training of 2013 (and 2014) only a limited number of farmers have been trained in GAP. Considerable investments in training materials, training methods and experience can only be earned back if farmer trainings are scaled up by others, for example, the *Dinas Pertanian*.

Success of an intervention depend on the logic of the theory of change defined, its' applicability in the specific context and the way it is implemented. Based on the results and the outcomes we can conclude that the theory of change has a valid impact logic and leads to the expected short-term effects. There are though some contextual constraints for its effectiveness which are elaborated upon in the previous paragraph. These are worth to consider in future programs and link immediately to the organization and implementation of the intervention. Some practical recommendations for future interventions:

- Introduce stricter criteria to select farmers or farmer groups. Like being member of an active farmer group to enable mutual sharing and learning and spill-over effects;
- More training with practical orientation, with texts that are easy to understand for the low educated farmers;
- Frequent repetition of training topics so that farmers are able to understand and 'digest' the key message of the training provided;
- Demo plots are essential to convince farmers of newly introduced techniques and they should be preferably located near the farmers' plots and under responsibility of a colleague farmer or extension worker they know and trust;
- Align the interventions with governmental policies. An implementer stated: "we cannot work alone". There must be an enabling environment with a supporting policy from the government, not the least in order to replicate and scale the innovations to a larger group of farmers.

In line with the last bullet point is to consider another important aspect related to the efficiency and scalability perspectives. The ratio between allocated resources and the outreach is unbalanced considering the small number of farmers reached. The question is how to reach out to more farmers without losing in-depth training and monitoring and as such without losing quality. A quality – quantity balance between outreach and realistically to-be-expected effects must be ensured when discussing scalability. Important is to find suitable partners and stakeholders to collaborate with and to join forces and resources for upscaling and in addition for guarantee of certain sustainability after withdrawal of the project team. The local *Dinas* is a stakeholder to seriously consider as it is the first responsible party for extension services to farmers. The intervention has had a project approach with limited resources and small number of farmers targeted. The trainings approach had a strong participatory and innovative component with the farmers' self-recording of management information, which generated important and relevant insights and knowledge. Dissemination of the used approach and gained knowledge is crucial to feed future interventions and project designs.

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Annex 1 Headings of record form

Headings of record form		English translation
No.		sequential number
Tanggal		Date
Kegiatan yang dilakukan		Activitydescription
Bahan dan alat yang digunakan	Jenis bahan/alat	Material used
	Kandungan Bahan	Content or active ingredient
	Jumlah bahan/alat	quantity
	Satuan	unit
	Harga satuan bahan/alat	price per unit
Jumlah biaya bahan		total material costs
Tenaga kerja yang digunakan	Waktu yg digu-nakan (jam)	Time spend on activity
	TK klg Laki-laki (orang)	Male Family labour number
	TK sewa Laki-laki (orang)	Male Casual labour number
	Upah (Rp.)	Wage (IDR/day of 5 hours)
	TK klg Perem-puan (orang)	Male Family labour number
	TK sewa Perem-puan (orang)	Male Casual labour number
	Upah (Rp.)	Wage (IDR/day of 5 hours)
	Borongan (Rp)	Piece labour costs

Annex 2 ToC WP Permveg

ACTIVITY-IMPACT FRAMEWORK WORKPACKAGE PERMANENT VEGETABLE SYSTEMS

ACTIVITY-IMPACT FRAMEWORK WORKPACKAGE PERMANENT VEGETABLE SYSTEMS

1. ACTIVITIES

1.1. Weekly monitoring and collection of management practices of 15 rice-based farmers in Cirebon during three years, including household data.

1.2 Weekly monitoring and collection of management practices of 15 shallot farmers in Cirebon during three growing seasons, including collecting household data.

1.3 Testing of eight crop rotations with vegetables during three years in collaboration with EWINDO.

1.4 Biweekly training of 15 different vegetable farmers each year during three years.

1.5 Dissemination of results for farmers participating in different WP activities and for local extension agents (Dinas, EWINDO) through workshops.

1.6 Dedicated experimental tests of Dutch private sector products (e.g. Groot & Slot, Si Technologies International BV)

Assumptions/risks:
Right message, message is understood, experiments well carried out, no unforeseen events during experiments

2. OUTPUTS

2.1 Progress reports and final report on collected management practices of 15 rice-based farmers in Cirebon (A1.1).

2.2 Annual reports on the collected management practices of 15 shallot farmers in Cirebon (A1.2).

2.3 Analysis of and report on the crop rotation experiment (A.1.3).

2.4 Training material for farmers and extension (ppt's, manuals) and three demonstration fields with farmers practice, best practices and net house (A1.4 and A1.5).

2.5 Reports on the performance of Dutch private sector products (A1.6).

Assumptions/risks:
Message is accepted, little turnover of extension and R&D staff, Dutch private sector accepts results

3. IMMEDIATE OUTCOMES

3.1 Enhanced knowledge and skills of 45 vegetable farmers in Cirebon.

3.2 Enhanced knowledge and skills of approximately 20-30 extension agents in the Cirebon area.

3.3 Enhanced knowledge and skills of approximately 5 IVEGRI staff.

3.4 Quantitative knowledge on the performance of permanent vegetable systems.

3.5 Dutch private sector companies provided with evidence-based information on the performance of their products under conditions prevailing in Indonesia.

Assumptions/risks:
Willingness to change current practices, enabling environment allows change in practices, Dutch private sector companies do not change market strategy

4. INTERMEDIATE OUTCOMES

4.1 Change in management practices of 45 vegetable farmers in Cirebon.

4.2 Change of 45 farmers from rice-based system to permanent vegetable system.

4.3 Change in expertise and skills of 20-30 extension staff.

4.4 Change in R&D agenda, approaches and methods of approximately 5 IVEGRI staff.

4.5 Tested Dutch private sector products introduced at the Indonesian market.

Assumptions/risks:
Willingness to change current practices, enabling environment allows change in practices, no accidental high pest pressure/outbreak or natural disasters

5. ULTIMATE OUTCOMES

5.1 Reduction in pesticide use (%) of 45 farmers per unit of produce

5.2 Reduction in N fertilizer use (%) of 45 farmers per unit of produce

5.3 Vegetable yield increase (%) of 45 farmers

5.4 Reduction in production costs (%) of 45 farmers per crop per produced unit

5.5 Increase in the vegetable area as a result of increased cropping intensity

5.6 Increased female employment opportunities associated with increased share of vegetables in the crop rotation of 45 farmers.

5.7 Increased availability of tested Dutch private sector products.

5.8 Improved R&D and extension services (20-30 Dinas extension staff)

5.9 .Reduce occupational health problems and risks

Assumptions/risks:

Scalability of permanent vegetable systems to different situations in Indonesia, market demand, extension budget and infrastructure

6. IMPACT

6.1 Contribution to improved competitiveness and more sustainable vegetable production in Indonesia.