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Monitoring and evaluation of horticultural interventions in Indonesia

Results of the vegIMPACT NL program

Johann Bonnand, Siti Nisrina Hasna Humaira, Indah Nuryanti, Huib Hengsdijk

vegIMPACTNL

Improving vegetable production and strengthening private sector development in Indonesia

The vegIMPACT NL program contributes to improved vegetable production and private sector development in Indonesia. The program builds on the results of previous joint Indonesian-Dutch horticultural cooperation projects, especially the vegIMPACT program (2012 – 2017). The program activities of vegIMPACT NL (2017-2020) address Knowledge transfer, Seed potato technology and supply system, Shallot production and post-harvest technology and Young farmers, while digital information and social media are cross-cutting and supporting activities. The vegIMPACT NL program is financed by the Government of the Netherlands and coordinated by Wageningen University & Research in The Netherlands.

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Monitoring and evaluation of horticultural interventions in Indonesia

Results of the vegIMPACT NL program

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Glossary

FGD: Focus Group Discussions

GAP: Good Agricultural Practices

ICT: Information and Communications Technology

IPM: Integrated Pest Management

KT: Knowledge Transfer

M&E: Monitoring & Evaluation

MSC: Most Significant Change

PPE: Personal Protective Equipment

SMK: Sekolah Menengah Kejuruan

TFO: Training Field Officer

ToC: Theory of Change

ToF: Training of Farmers

ToS: Training of Students

ToT: Training of Trainers

YBTS: Yayasan Bina Tani Sejahtera

WUR: Wageningen University & Research

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Executive summary

The vegIMPACT NL program (2018-2021) has the objective to contribute to the development of the horticultural sector in Indonesia. In five different tracks different parts of the horticultural sector and various types of beneficiaries have been supported to innovate and improve knowledge on good agricultural practices (GAP). Specifically, program activities aimed at capacitating sector professionals and farmers through various training interventions and by sharing a wide variety of information and knowledge through various communication channels such as social media and apps.

This report provides a summary of multiple evaluation studies done in the vegIMPACT NL program, specifically addressing activities that have been carried in the track Knowledge transfer (Track 1; Chapter 3), Seed potato technology and supply systems (Track 3; described in Chapter 4) and Digital information & social media (Track 5; described in Chapter 5).

A major limitation of the program activities and evaluation studies was the short time frame of the vegIMPACT NL program, which originally lasted two years. Although the program was extended with one year, this extension coincided with the COVID-19 pandemics hampering the implementation of activities and evaluation studies. However, the compiled evaluation studies of three tracks as reported here provides meaningful information on how interventions have been carried out, received and used by beneficiaries. Findings of the digital information & social media Track were more complex to obtain, analyse and are less clear on their impact compared to the activities in the other two tracks.

In both the Knowledge Transfer track and the track on seed potato technology and supply systems local sector professionals have been trained on GAP. These sector professionals shared this GAP knowledge among farmer communities through field activities. In the track knowledge transfer, more than 38,000 direct beneficiary farmers have been reached, which was about 8,000 more than the original target. 475 sector professionals have been trained on top of 97 staff members from EWINDO (marketing and production) and 20 from Training Field Officers the YBTS foundation. The evaluation studies showed knowledge spill over to non-targeted beneficiaries (i.e. trained farmers that reached out with acquired knowledge to farmer relatives, neighbours, etc.). Trained GAP knowledge was biased toward the topic on seed selection, seedling and nursery, while other major GAP topics (Fertilization; Integrated Pest Management; Spraying techniques and farmers' safety) received less attention in the training of farmers. Anecdotical evidence from Sangihe and North Halmahara suggests that trained farmers have already started to bring the learnings into practice with positive outcomes on crop productivity and income. This observation gives support for the applicability, relevancy and the needs of such knowledge and information for farmers in Indonesia. However, results of knowledge tests conducted among farmers who participated in the training shed light on the necessity to continue with capacitating farmers and professionals to ensure sector improvement.

Increasingly, information and knowledge on GAP will be offered through online tools such as agricultural apps (e.g. MyAgri, SIPINDO) and social media pages on various platforms. However, current use of these digital tools is still low, especially in the outer islands of Indonesia. This is related to the poor internet connectivity, access to smartphones and general low digital literacy as observed in Sangihe and North Halmahera. Many farmers are just not aware that specialised apps are available. For information, farmers still depend mainly on local sources such as peers and relatives, agro-dealers and extension. To make digital tools more interesting for farmers, more market-oriented information such as actual price

information and price trends, agricultural news on innovations, and interactive chat interfaces is important on top of technical GAP information.

The vegIMPACT NL program is a follow-up of a longer-term collaboration between the Netherlands and Indonesia on the development of the horticultural sector. The testimonies of farmers trained during previous programs and vegIMPACT NL confirmed the long-term impacts of knowledge transfer activities in agriculture. They therefore also confirm the contribution of these programs from training of professionals in the sector to improving agronomic and economic performance at the scale of smallholder farmers across Indonesia. Nonetheless, more in-depth data and analyses are required to fully assess the benefits and the contribution of these programs on the improvement of the sector performance, particularly at the farming systems level. Baseline-endline studies, including attention for more enabling factors in farmers' environments, as well as contribution analyses must be performed to understand changes in performance of farmer beneficiaries.

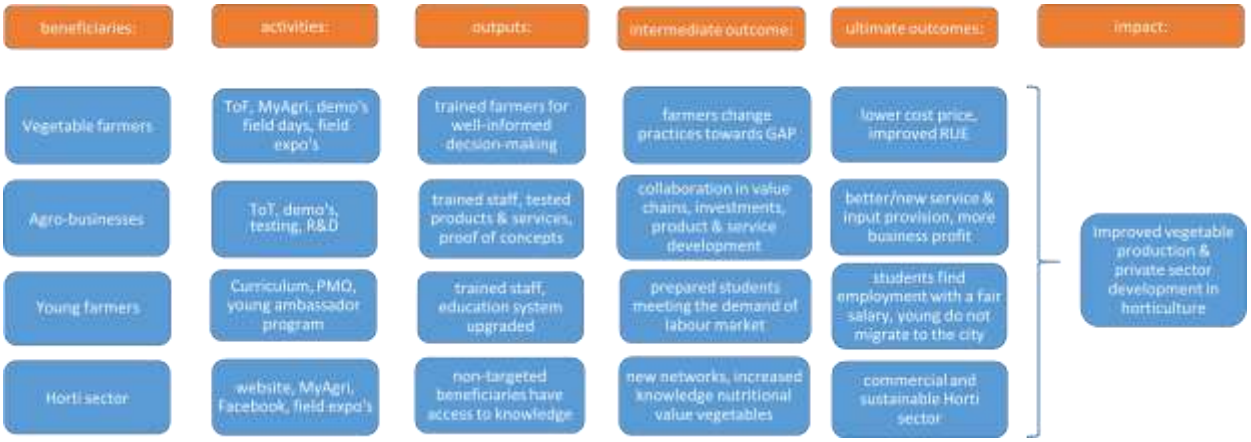
1. Introduction

The vegIMPACT NL program, launched in April 2018, has the objective to contribute to the development of the horticultural sector in Indonesia. VegIMPACT NL is particularly aiming at capacitating farmers and sector professionals through training interventions and by sharing a wide variety of information and knowledge through various communication channels such as social media and apps. In Chapter 2 more details of the vegIMPACT NL program are given including its objectives and activities.

For understanding how and why vegIMPACT NL activities (or interventions) contribute to improving the horticultural sector in Indonesia a Theory of Change (ToC), from activities in the different tracks of the project to large-scale impacts, was developed (Fig. 1). This ToC describes result chains and shows the linkages between the sequence of steps to the desired impacts. From the start of the program, it was clear that the main limitation of program activities was the short implementation time. Originally, the program lasted two years, which is too short to measure quantitative effects of capacity building activities beyond the output level (Fig. 1)[1]. Nevertheless, monitoring activities and outputs of activities as well as developing evaluation studies in the various tracks of the program help to understand the primary results of the interventions.

This report has the objective to provide a summary of findings of multiple evaluation studies done in the vegIMPACT NL program between April 2018 and January 2021. This report deals specially with findings on the "Vegetable farmers" and "Horti sector" results chains as shown in Figure 1, and findings from the Seed potato technology and supply systems belonging to the "Agro business" results chain. As explained before, because of the short time frame in which the interventions took place, findings concern mainly the output and intermediate outcome levels of the ToC as shown in Figure 1.

Figure 1. Theory of change showing the relationship between targeted beneficiaries, program activities, outputs, intermediate outcomes, ultimate outcomes and impact.



[1] During implementation, the vegIMPACT NL program received twice a budget-neutral extension of the implementation period, first with eight months and later with four months. However, planning of monitoring and evaluation activities was targeted at two years and could only be modified to a limited extent. In addition, the COVID-19 pandemics in the last program year was not supportive to carry out evaluation activities. And yet, three years is short to measure changes as explained in section 2.4.3.

2. Background of the vegIMPACT NL program

Millions of smallholder farmers produce the food for a vast majority of the population of Indonesia. Good agricultural land becomes increasingly scarce while the agricultural knowledge and labour based in rural areas rapidly declines because of aging and migration of the rural young to urban centres where they search for employment and prosperity. These developments jeopardize national food and nutrition security, and the sustainable development of Indonesia. The agricultural economy is the core of the Indonesian society and horticulture is the most dynamic sub-sector, generating high quality nutrition, rural income, and off-farm employment in value chains through input suppliers, service providers, food processing industry, etc. A vibrant horticultural sector with high levels of knowledge and skills inspires other agro-sectors and has the potential to generate much needed off-farm employment opportunities.

Vegetable production is one of the most knowledge-intensive forms of agriculture: vegetable farmers produce a variety of crops in relatively short production cycles, each crop requiring specific knowledge, management and facing crop-specific production challenges (e.g. weather, diseases and plagues) that affect yield, product quality and storability. Vegetable farmers must make multiple management decisions each day to optimize production and product quality that meets consumers' demand.

The activities in vegIMPACT NL have been designed to contribute to the following three main objectives:

- **Stimulate and facilitate innovation for a sustainable and commercial horticultural sector.**
- **Build the human capacity of private sector staff and teaching staff to lead the development of the horticultural sector in the coming decades.**
- **Disseminate knowledge on Good Agricultural Practices (GAP) to vegetable farmers.**

Activities were organized in six tracks and a program management track:

Track 1: **Knowledge transfer** through training of trainers and different forms of training of farmers.

Track 2: **Shallot production and post-harvest technology**: optimization of true shallot seed systems and reducing post-harvest losses.

Track 3: **Seed potato technology & supply system**: building capacity in the seed potato value chain and improving seed potato production.

Track 4: **Young farmers** to improve the lower and middle level human capacity in horticulture by giving support to upgrading two green vocational schools (*Sekolah Menengah Kejuruan* - SMK).

Track 5: **Digital information and social media**: developing and implementing ICT solutions for knowledge dissemination including mobile apps, website and social media pages.

Track 6: **Monitoring and evaluation:** Assessing the vegIMPACT NL activities in terms of reached beneficiaries, outputs and outcomes.

Track 7: **Management and coordination** of the various activities in different tracks.

The tracks contribute differently to the major objectives of vegIMPACT NL (Table 1); some Tracks (Shallot and Potato) contribute predominantly to the Innovation objective, while other Tracks (Knowledge

Transfer and Communication) more to the dissemination of knowledge and GAP information:

Table 1. Program objectives and contribution of tracks to listed objectives.

Program objective	**Track 1** Knowledge Transfer	**Track 2** Shallot	**Track 3** Potato	**Track 4** Young Farmers	**Track 5** Digital information
1. Innovations					
2. Capacity building					
3. GAP dissemination					

Key to the Table:

Strong contribution of Track to objective
Medium contribution of Track to objective
Weak contribution of Track to objective

Three targeted beneficiaries were identified, i.e. (vegetable) farmers, agro-businesses (private sector) and young (potential) farmers. The tracks address partly different types of beneficiaries. In addition, through the digital information, social medias, and public field expos also indirect beneficiaries in the horticultural sector are served, i.e. those that are not directly engaged in trainings or other activities organised by vegIMPACT NL. Table 2 summarizes the type of beneficiaries addressed by the five Tracks that reach out to beneficiaries:

Table 2. Beneficiaries of each track and reach out.

Beneficiaries	**Track 1** Knowledge Transfer	**Track 2** Shallot	**Track 3** Potato	**Track 4** Young Farmers	**Track 5** Digital information
1. (Vegetable) farmers					
2. Agro-businesses					
3. Young farmers					
4. Horti sector					

Key to the Table:

Strong reach out of Track to beneficiary
Medium reach out of Track to beneficiary
Weak reach out of Track to beneficiary

The findings presented in this report concern activities in the following tracks:

- *Knowledge transfer* (Track 1), described in Chapter 3
- *Seed potato technology and supply systems* (Track 3), described in Chapter 4
- *Digital information & social media* (Track 5), described in Chapter 5.

3. Knowledge transfer track

3.1 Introduction

The knowledge transfer track of the vegIMPACT NL program was aimed at capacitation of vegetable farmers to improved farming practices through different interventions. The monitoring activity consisted of measuring the outreach of the performed interventions, i.e. the number of reached farmers with various interventions in this track (section 3.2), assessment of the gained knowledge after the intervention (section 3.3), and a qualitative assessment based on interviews and focal group discussions with beneficiary farmers (section 3.4). The knowledge transfer interventions aimed specifically at the result chain of the 'vegetable farmers' in the ToC (Fig. 1).

A set of slogans on Good Agricultural Practices (GAP) was developed (Annex 1), which were used as learning objectives in the interventions of the Knowledge Transfer Track. The EWINDO vegetable seed company and its corporate social responsibility foundation Yayasan Bina Tani Sejahtera (YBTS), the Indonesian counterparts, were solicited to reach out to local farmers with the GAP slogans. Beforehand, Product Promoters (PPs) of EWINDO and Technical Field Officers (TFOs) of YBTS were trained by a team of agronomists from Wageningen University & Research (WUR).

Six types of interventions were implemented in the knowledge transfer track:

- Training of Trainers (ToT), facilitated by WUR, during which YBTS and EWINDO staff as well as other sector professionals were trained in GAP both through in-field sessions in Indonesia and online sessions after the Covid-19 outbreak in March 2020.
- Training of Farmers (ToF) aiming at reaching commercial vegetable farmers and conveying selected GAP slogans with special emphasis on 1) High yielding varieties; 2) Improved nursery systems to produce high quality seedlings; 3) Responsible use of pesticides and reduction of pesticide use through proper spraying technique; 4) Proper crop nutrition and water management. ToF were organized throughout Indonesia. While YBTS aimed at reaching the less commercial vegetable areas of Indonesia such as pockets of Sumatra (outside Bengkulu), Sulawesi, Kalimantan, Eastern Indonesia and Papua, other training were organized in the more developed vegetable areas such as Java or Sumatra by the EWINDO team (Annex 2).
- Field days being large-scale field events (50 farmers) to promote GAP slogans and to provide an opportunity for peer-to-peer exchange of practices and experiences along with technical demonstrations by YBTS staff (Annex 3).
- Expos organized at regional scale, which are larger-scale field events with a more commercial objective, aimed at reaching around 200-500 farmers per event. During these expos, YBTS trainers pitched and showcased selected slogans related to improved practices such as responsible use of pesticides and fertilizers or improved nurseries to produce strong seedlings (Annex 4).
- Training of horticultural sector professionals, such as staff of the public extension service (Dinas Pertanian), by TFOs of EWINDO and YBTS on GAP.
- Training of Students (ToS) focusing on training students of SMKs on GAP.

3.2 Outreach

Counting method for farmers outreach (ToF, field days and expos)
To count the outreach of the program two different methods were used in EWINDO and YBTS areas. In EWINDO areas, the method is based on attendance. A participant will be counted as many times as he or she joins an event. The estimated "double counting" represents around 20% of the total outreach in

EWINDO areas. Hence, the shown outreach number in EWINDO areas in the following should be reduced with 20% to get the unique number of participants. In YBTS areas, the counting method is different: one participant counts only as one although he or she may have participated in several events.

Outreach

Although field activities and training towards the end of the vegIMPACT NL were impacted by the COVID-19 pandemic, the outreach in the Knowledge transfer track exceeded the objective of training 30,000 farmers of the program. A total of 44,868 beneficiary farmers were reached through the various interventions (including the approximately 20% double counting in EWINDO areas, see before).

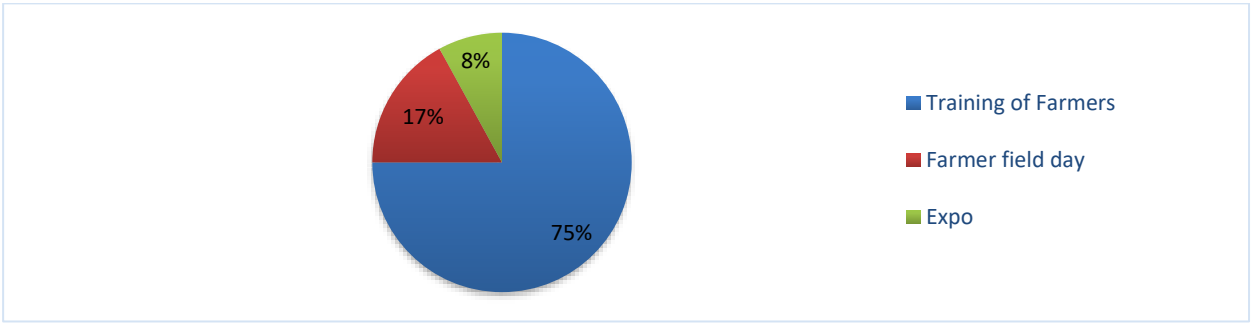
Table 3. Total farmer reach in the Knowledge transfer track through training of farmer, field day and expo interventions.

Area	Male farmer	Female farmer	Total
EWINDO areas	23,471	5,402	28,873
YBTS areas	8,754	7,241	15,995
Total	32,225	12,463	44,868

Most farmers were reached in the more commercial areas of Indonesia by EWINDO, gathering 64% of the outreach, while the less developed areas of YBTS represented 36% of the outreach. More males were reached in the interventions, which was particularly the case in the more commercial areas trained by EWINDO PPs.

The largest part of the outreach was achieved through the ToF accounting for approximately 75% (37,702 beneficiaries) of the total outreach in the Knowledge Transfer track, followed by the farmer field days accounting for 17% (8,479 beneficiaries) of the outreach, expos accounting for 8% (4,062 beneficiaries).

Figure 2. Division of outreach from the Knowledge transfer track interventions



For the three types of interventions various crops were cultivated to showcase GAP in demonstration plots. The geographical distribution of the crops is shown in Annex 5. In total, 11 different crops were listed (Table 4).

Table 4. Crops cultivated in demonstration plots for the Knowledge transfer track during the vegIMPACT NL program.

- Cabbage
- Choy sum
- Cucumber
- Eggplant
- French bean
- Hot pepper
- Kangkong
- Onion
- Spinach
- Sweet corn
- Tomato

Training and information materials were distributed among participants of the activities (Table 5). The complete list of items distributed can be found in Annex 6.

Table 5. Non-exhaustive list of knowledge materials distributed during activities of the Knowledge transfer track.

Material	**Number**
Flipchart	58 sets
Booklet of slogans on GAP	7,000 copies
Booklet on spraying technique	500 copies
Spraying mask	200 units
Crop guide	11,000 copies
Technical guide	9,000 copies
Booklet on identification of pest and disease	3,000 copies

Pictures of farmers receiving the "30 GAP slogans booklet" (on the left) and of a farmer group receiving crop and technical guides (on the right).

Training of farmers

Training of Farmers were organized with groups of farmers identified based on their experience with vegetable farming, their willingness to learn and implement GAP and their capacity as learners. The training developed was divided into three sessions of about two hours each during which one or several of the following topics were broached: 1) Seed selection, seedling and nursery, 2) Fertilization, 3) Integrated Pest Management, 4) Spraying techniques and farmers' safety. Depending on the interest and needs of the farmers, one or more topics were addressed. Overall, 2,088 training sessions have been organized in which 23,020 farmers were trained in the EWINDO areas (61% of total number or farmers

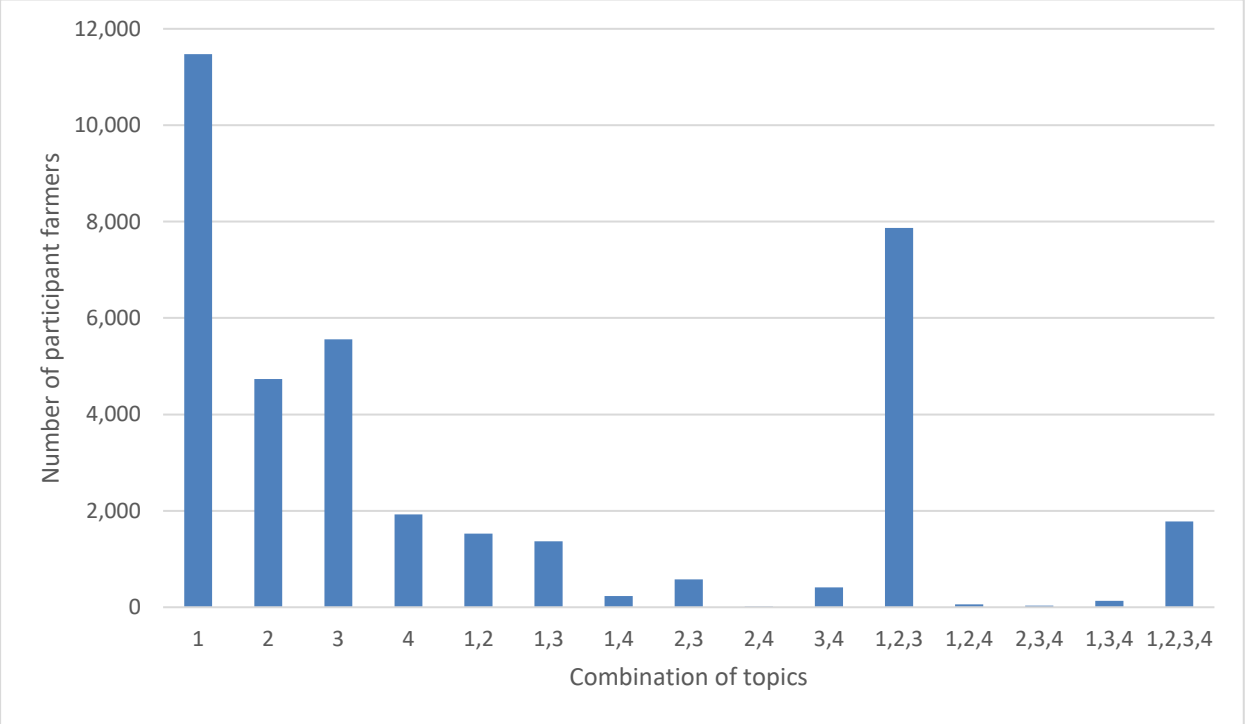
trained) and 14,682 were trained in YBTS areas (39% of total number or farmers trained). More male farmers joined the ToF, i.e. 26,597 male (71%) and 11,105 female farmers (29%) (Table 6). The difference by gender was much larger in the EWINDO areas where 19% of the beneficiary farmers was female, while in YBTS areas female beneficiaries represented 46% of the trained farmers in ToF.

Table 6. Farmers reached in training of farmers per area and gender.

	Total farmers	Male	Female
Farmers trained in EWINDO areas	23,020 **61%**	18,703 **81%**	4,317 **19%**
Farmers trained in YBTS areas	14,682 **39%**	7,894 **54%**	6,788 **46%**
Total farmers trained	37,702 **100%**	26,597 **71%**	11,105 **29%**

Figure 3 shows the number of farmers having received one or more of the four GAP topics: 1) Seed selection, seedling and nursery, 2) Fertilization, 3) Integrated Pest Management, 4) Spraying techniques and farmers' safety (topic numbers on the X axis in Figure 3).

Figure 3. Number of farmers that was trained in one or more GAP topics: 1) Seed selection, seedling and nursery, 2) Fertilization, 3) Integrated Pest Management, 4) Spraying techniques and farmers' safety



From Figure 3, we conclude that 23,693 farmers (63% of all farmers), have been trained in only one topic (topic 1, 2, 3 or 4). In addition, 30% of the total number of farmers trained have attended only the session

on *Seed selection, seedling and nursery*. This is explained by various factors:

- EWINDO is a vegetable seed company to which the YBTS foundation is linked. A "natural" interest from the training providers in the *Seed selection, seedling and nursery* topic emerged.
- Farmers tend to attach a high importance to seeds to explain productivity differences. As a result, farmers are particularly interested in this topic.
- The *Seed selection, seedling and nursery* training topic was usually the first one delivered by field officers. Farmers did not always have time or interest to attend all sessions and did not continue with the next training sessions. Therefore, various beneficiaries only attended the first training session on seed selection, seedling and nursery training.

Respectively, 13 and 15% of the total number of farmers have attended only the training on *Fertilization* and the *Integrated Pest Management*. In addition, 11 and 21% of the farmers received respectively two or three training topics. Only 5% of the farmers recieved training on the 4 GAP topics. About 21% of farmers recieved training on topic 1, 2 and 3. The training topic *Spraying techniques and farmer safety* had only a limited outreach. Details of the outreach per training session, area and gender is shown in Annex 7.

Pictures of Training of Farmers

Farmer field days

Farmers field days are events with demonstration plots during which TFOs promote GAP slogans to farmer groups. These days are also an important opportunity for peer-to-peer exchange of experience and practices. In total, 136 farmer field days were organized, including 82 in EWINDO areas and 54 in YBTS areas (Annex 3). Table 7 shows the attendance to field days.

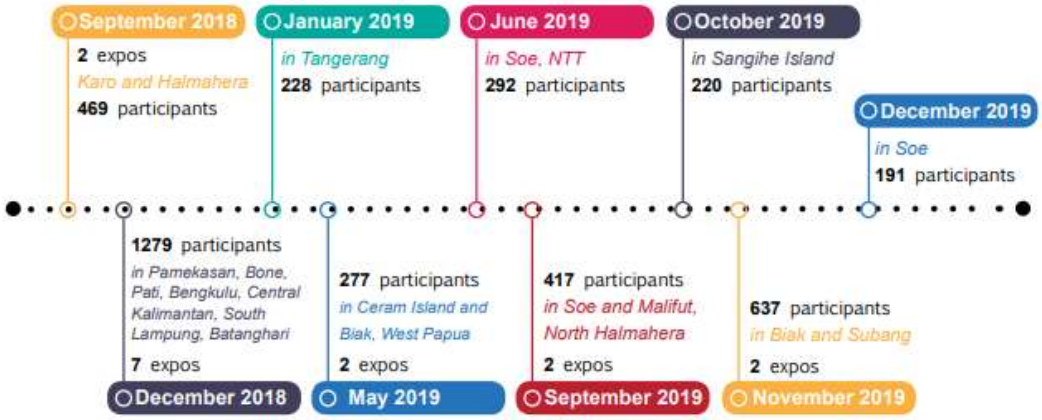
Table 7. Farmers' attendance to farmer field days in EWINDO and YBTS areas according gender.

Area	Number of events	Male farmer	Female farmer	Total
EWINDO areas	82	3,429	782	4,211
YBTS areas	54	2,452	1,816	4,268
Total	136	5,881	2,598	8,479

Expos

Figure 4 presents the chronology of expos that have been organized during the vegIMPACT NL program in the YBTS area. In total, 19 expos were organized between September 2018 and December 2019 gathering more than 4,000 participants (Annex 4). Because of the Covid-19 pandemic no expos have been organised in 2020.

Figure 4. Chronology of expos organized during the vegIMPACT NL program.



Training of Trainers

As explained in the section 3.1., YBTS and EWINDO staff as well as other sector professionals were trained both through in-field sessions in Indonesia and online sessions after the Covid-19 outbreak in March 2020 by WUR trainers. Training of Trainers were organized based on the trainers' requirements and needs to deliver advice to farmers on the sustainable production of vegetables. In addition, two sessions have been allocated to Monitoring and Evaluation for the development of the 30 GAP slogans and the development of the Knowledge transfer test for farmers (section 3.3). Table 8 shows a summary of all the Training of Trainers organized in vegIMPACT NL.

Table 8. List of the Training of Trainers organized during the vegIMPACT NL program.

No	Topics	Location	Date	Participants
1	Monitoring and Evaluation (M&E)	Ambon	18 - 19 September 2018	10
2	Integrated Pest Management (IPM)	Ambon	20 - 21 September 2018	17
3	Soil Fertility Management	Kupang	29 - 30 October 2018	16
4	Monitoring and Evaluation (M&E)	Kupang	31 October 2018	7
5	Soil Fertility Management	Jember	1 - 2 November 2018	25
6	Soil Fertility Management & Spraying technique	Sumbawa	6-8 November 2018	14
7	Integrated Pest Management (IPM)	Cirebon	3 - 4 December 2018	21
8	Integrated Pest Management (IPM)	Medan	11 - 12 February 2019	22
9	Integrated Pest Management (IPM)	Palembang	14 - 15 February 2019	21
10	Integrated Pest Management (IPM)	Remote, online	8, 11, 14, 16 December 2020 and 16 January 2021	6
Total	**3 different topics**	**7 locations + online training**		**159**

On top of the TFOs of YBTS and the PP's of EWINDO, other staff and actors were able to join the ToT (Table 9).

Table 9. Summary of trained staff through training of trainers.

No	Company/ Institution	Staff	Male	Female
1	Marketing EWINDO	72	71	1
2	Production EWINDO	25	25	0
3	YBTS	20	14	6
4	University of Pattimura Ambon	4	1	3
5	Input dealer Inti Harapan Kupang and others	17	17	0
Total Participants		**138***	**128**	**10**

**21 YBTS staff participated in both M&E training and Technical Training (IPM or Soil Fertility) explaining the difference with the 159 participants in Table 8.*

Pictures of Training of Trainers.

September 2018

2 ToT
topic M&E and IPM
with Trainers from Wageningen University & Research (WUR) Huub Schepers and Mout de Vrieze
in Ambon
27 participants
(YBTS field staffs, University of Pattimura Ambon staffs, Marketing EWINDO)

October 2018

2 ToT
topic **Soil Fertility and Monitoring and Evaluation Management**
with Trainers from WUR, Henk Van Reuler, Diep Phan and Johann Bonnand
in Kupang

23 participants
(YBTS field staffs, Marketing EWINDO, Product Promoters EWINDO, Agronomist staffs of Inti Harapan Kupang)

Nov and Dec 2018

2 ToT
topic **Soil Fertility Management**
Nov 2018 with Henk Van Reuler and Diep Phan from WUR *in Cirebon*
Dec 2018 with Huub Schepers and Mout de Vrieze from WUR *in Jember*

46 participants (Production EWINDO, Quality Assurance EWINDO, Marketing EWINDO)

February 2019

2 ToT
topic **IPM**
with Trainers from WUR Huub Schepers and Mout de Vrieze
in Medan and Palembang

43 participants (YBTS field staffs, Product Promoters EWINDO)

Training of horticultural sector professionals

In addition to the ToT provided by WUR staff, the trained staff of EWINDO and YBTS trained 475 local sector professionals, 264 males and 211 females, on GAP. The trained professionals included staff from the private sector and public extension. Training of these sector professionals helps to gain local support for YBTS activities, secures continuous support to farmers in the implementation of GAP, and is part of the exit strategy of the vegIMPACT NL program as knowledge will spill over from trained YBTS officers to sector professionals and, finally, to farmers. In the text box below is a story of one public extension officers in West Timor who was trained by YBTS staff. She described how her work helps in spreading knowledge on GAP among farmer communities and particularly women, and how this helps to improve

the livelihoods of farming families.

Mrs. Debora Duru (44), has been working as a field extension officer (PPL) for 16 years at the Agriculture Service of Timor Tengah Selatan, West Timor, Indonesia. In Karang Siri village of Soe township she motivates women to improving their knowledge and skills on farming to increase their income. Mrs. Debora attended a training of the YBTS team in 2018-2019. Since then, she has more practical knowledge to support women farmers' work. Her personal objective is being realized: women are playing an important role in farming to support family livelihoods.

Training of students

The EWINDO and YBTS staff also trained 338 SMK students on GAP (189 males and 149 females). The training was divided between in-class and in-field sessions.

Pictures of Training of Students about seedling raising.

3.3 Knowledge Transfer test

3.3.1 Introduction

To evaluate the knowledge level of trained farmers, students and public extension on GAP in vegetable farming, a knowledge transfer test has been designed. This test, related to the result chain 'Vegetable farmers', did not aim at testing changes in knowledge before and after ToF but assessed the level of understanding that trained farmers, public extension officers and students have on GAP in vegetable farming after training. In the ToC (Fig. 1), the knowledge transfer test is situated between the output and intermediate outcome levels.

3.3.2 Methods

The multiple-choice questionnaire, composed of 16 questions, was translated in Bahasa and given on paper to participants of ToF after the last training session. A TFO from YBTS was on site to assist farmers in case clarifications were needed. Questionnaires were collected and the data was entered in Excel for analysis.

In total, 776 questionnaires were collected of which 649 were analysed. Excluded questionnaires were only partly answered or coming from farmer groups with similar answers suggesting that the questions had been answered collectively. Each question was analysed according to the share of each proposition chosen by the respondents (Annex 7) and the share of correct answers compared to the total number of respondents (Annex 8).

3.3.3 Results

Among the 649 respondents, 37 were students, 15 public extension officers and 597 farmers. No significant differences in the test score were observed between the groups.

Overall, the average score was 9.7 out of 16 which is equal to 61% of good answers. Out of the 649 respondents, 451 respondents (69%) had a score higher than 50% of good answers and 133 respondents (20%) had a score higher than 70% of good answers. 38 respondents out of 649 (6%) had a score lower than 25% of good answers.

Five questions had an average score of good answers below 50%:

- *What are the ideal conditions for transplanting?*
- *Nitrogen is required for...*
- *Phosphorus is essential for...*
- *Potassium is essential for...*
- *What can I do to prevent pests and diseases infestation based on IPM approach?*

In addition, four other questions had a low score (lower than 70% of good answers):

- *One week before transplanting, seedlings should...*
- *What should I do before spraying?*
- *What are good conditions for spraying?*
- *What are the characteristics of a good spraying practice?*

3.3.4 Discussion

These results demonstrate that respondents have on average a fair knowledge on GAP after training. Nevertheless, they are still facing difficulties to understand the role of nutrients, even the main nutrients (nitrogen, phosphorus and potassium) and are not able to clearly identify suitable conditions (mainly timing and weather) for certain interventions such as transplanting or spraying pesticides. Crop protection and IPM remain complex topics.

Although the sample of public extension officer is not representative as it is too small, the data suggests that their knowledge remains suboptimal for providing accurate recommendations to vegetable farmers.

Ferowati Tamalawe is a woman farmer who lives in Sangihe, North Sulawesi. She has been cultivating tomatoes in her field. Before, she could only harvest 2 kg/ plant with a selling price below IDR 10,000/kg, as she did not understand to arrange the planting schedule according to the market. However, with the help of our Technical Field Officer, she now understands how to maximize her cultivation and harvest. The productivity of her field increased to 3 kg/plant with a selling price of IDR 20,000/kg.

Low results in the test might partly arise from the fact that the questionnaire was based on multiple choice questions requiring sometimes multiple answers to be considered as answered correctly. For example, regarding the role of the main nutrients, nitrogen, phosphorus and potassium, many respondents were able to give a right answer but not the combination of all correct answers. In addition, most farmers did not receive training on all GAP topics, while the knowledge test addressed all GAP topics (Figure 3).

Although the knowledge test provides information on the challenges in understanding GAP of the respondents, there are limitations to truly depict the contribution of training to farmers' capacitation on GAP. A baseline-endline questionnaire with the same groups of farmers would have been required to observe changes in farmers' knowledge. Limitations also emerge from the organization of the test: some groups of farmers worked together in filling out the test making results less meaningful. In addition, extension officers might have helped the respondents to understand the questions, for example, by providing hints or even the right answer. Eventually, for a further analysis, more information of the respondents would be needed to observe differences, for example, between age cohorts of respondents, location of respondents, and the number of years of experience in vegetable farming. This type of data was not collected with the test performed.

3.4 Qualitative assessment of ToF and adoption of GAP

3.4.1 Introduction

In addition to the knowledge test conducted within a large sample of farmers who participated in the ToF (section 3.3), a qualitative assessment of the ToF was conducted. In North Halmahera and Sangihe, two areas where YBTS trained farmers, interviews with trained farmers and stakeholders were conducted to gain insights in the ToF implementation and to assess potential spinoffs, such as peer-to-peer advice. Testimonies of farmers shed light on the relevancy of ToF with respect to farmers' needs.

3.4.2 Methods

Data was collected through focus group discussions (FGD's) and semi-structured interviews of trained farmers (from present to two years before the interview), YBTS trainer and selected stakeholders such as non-trained farmers and public extension staff. The data collection was performed in two areas, North Halmahera and Sangihe, and is presented in Table 10. The content of the ToF and training approach in North Halmahera and Sangihe were similar as described in section 3.2.

Table 10. Description of qualitative data collection activities in North Halmahera and Sangihe.

Location and time of data collection	Activities	Actors reached	Category of actors
North Halmahera, North Moluccas (13-21 January 2020)	Focus group discussion	9 farmers	Finished ToF in November 2019
		16 farmers	Finished ToF in April 2019
		6 farmers	Finished ToF in April 2018
	Interview	16 farmers	Trained farmers (15 active, 1 non-active in horti farming)
		13 farmers	Non-trained farmers
		1 person	Chief of Dinas Pertanian (local extension
		1 person	Chief of Extension Dept in Dinas Pertanian
		3 staff	PPL staff
Sangihe Islands, North Sulawesi (6 - 17 Mar 2020)	Focus Group Discussion	10 farmers	Finished ToF in August 2019
		15 farmers	Finished ToF in Sept 2019
		3 farmers	Finished ToF in Aug 2019
	Interview	11 farmers	Trained farmers (10 active, 1 non-active in horti farming)
		11 farmers	Non-trained farmers
		1 person	Chief of Dinas Pertanian
		4 staff	PPL staff
		5 sellers	Vegetable sellers in a traditional market

3.4.3 Results

Firstly, approaching the farmers to participate in the training is a critical step. The TFO from YBTS in North Halmahera targeted predominantly local farmers with moderate to no experience in horticultural farming in contrast with trans-migrants (coming from more developed areas of Indonesia) having, on average, more farming skills.

Previous Dinas' programs (public extension) have disappointed many farmers who expected technical assistance instead of free seeds and urea. Consequently, farmers in Sangihe were sceptical and not easily approachable. So, the TFO needed to approach influential people such as religious community leaders or agri-kiosk owners to gain farmers' trust to join the training. In addition, to motivate more farmers, TFOs had to approach the most influential farmer of the area to subscribe more farmers to the training or to form a farmer group. The choice of farmers to enter the group was also suggested by the local public extension officers and village leaders. Eventually, solidarity and strong communication among group members helped to ensure more commitment in the training.

TFOs' skills were also crucial to ensure the commitment of the trainees and the trust in the GAP slogans in the training. TFOs must be able, first, to motivate the group to join the training and possess confidence in GAP knowledge as farmers tend to defy messages provided by external actors. During training, TFOs must show a good time-management and pedagogical skills (especially in creating a learning environment that is open and engaging) to develop good training sessions. Eventually, TFOs should be able to minimize language barriers by incorporating local language terms and use simple words instead of a complex scientific language.

If ToF can increase farmers' knowledge in vegetable production, adoption of improved practices and its benefits are longer-term outcomes. Learning and adoption depend on various factors such as beliefs of the farmer in the benefits of demonstrated GAP, availability of and access to improved agricultural inputs and technology, and back up support of the local TFO in case questions arise during implementation of GAP. In both areas, the uptake of trained GAP knowledge seemed to happen more likely after the ToF, more precisely after the demonstration plot's harvest. Assessments of the results of the demonstration plots, visual and in quantity (harvest), are crucial to convince farmers to adopt GAP. This partly explains the delay between training and the actual adoption and implementation of learnings by farmers. The delay is also explained by the fact that trained farmers are not yet feeling confident to adopt GAP without the support of the TFO. Farmers need 2 to 3 seasons

In the village of Lenganeng, North Tabukan, in the Regency of Sangihe Islands, North Sulawesi, 40% of horticultural farmers are women as their husbands work as fishermen, copra workers, construction workers and blacksmiths. For this reason, some women formed a farmer group of 15 "mothers" to grow vegetables and spices. A part of their harvest is home-consumed and the rest is sold to support their household income.

Mama Rosmin Harinduanggi is the head of the Lestari 2 Farmer Group, and one of the mothers who is actively growing vegetables and tubers, especially leafies such as choy sum, contributing to an increased availability of nutritious leafies in Sangihe Island. This received the attention of the Sangihe Regency Government. In 2019, Mama Rosmin received a token of appreciation for her achievements as a farming mother.

"I can't sit at home, so when my husband works as blacksmith, I go to the field. The Choisum harvest from this 800 m^2 field can give me a net income of IDR 3-4 million per month."

support to be fully confident and to implement GAP without external support. Farmers in Sangihe often ask the TFO to suggest them a pesticide product name directly without having the interest to learn about the pests/diseases. Farmers need time to experiment with the learnings to get convinced of the potential benefits for their own enterprise. Therefore, farmers' willingness to learn and implement GAP is strongly influenced by TFO's regular visits and continued guidance through visits and phone calls after the ToF as well as results shown in demonstration plots. Likewise, stakeholders in both areas considered that large exhibition events, farmer field days and farmers' demonstration plots have a positive effect on the acceptability and adoption of GAP.

Pak Katijo is a farmer in Tanjung Palas Village, Bulungan District, North Kalimantan. Currently, he cultivates leafy vegetables such as mustard, kale and spinach. The COVID-19 pandemic does not stop Pak Katijo from farming. In order to get optimal harvest, he has been actively asking and following the guidance from the local YBTS Technical Field Officer. Another challenge for him is the peat soil that dominates the area. The low pH and low micro and macro-nutrient levels cause poor soil conditions limiting crop yields. Fortunately, Pak Katijo joined the training on nutrition management. Regular monitoring and YBTS activities have also motivated him to keep farming.

Not all GAP introduced and demonstrated by the YBTS staff are adopted immediately because of the limited financial capacity of farmers for expensive agri-inputs (i.e. commercial seeds, plastic mulch, and pesticides). Although easy-to-implement changes in cultivation practices are observed in the trained farming groups, uncertainty remains whether more difficult-to-implement and costly GAP will be adopted in the future.

In addition to the limited finances of farmers, other factors may limit the adoption of GAP. Firstly, elderly and illiterate farmers face difficulties understanding the TFO's presentation slides and in-class sessions are sometimes found too theoretical. Hence, reaching farmers in training sessions with messages that they can understand remains a challenge. Secondly, GAP adoption is also limited by the fact that many farmers did not attend all training topics (Figure 3). Therefore, they are still unaware of various GAP. In practice, TFOs faced difficulties to gain the trust of farmers and to motivate them to attend the training sessions (see also before) as farmers prefer to wait to know if these GAP work before getting more

involved.

Specific issues arise in the different regions where TFOs were working as well. A major challenge for horticultural farmers in North Halmahera is the limited water availability, due to the poor irrigation infrastructure. Consequently, new vegetable farmers tend to get demotivated easily when their crops fail during the dry season. Whereas in Sangihe, experienced farmers seem still motivated in horti-farming and GAP adoption despite price drops due to vegetable imports from the nearby main island Manado. Some new farmers still prefer part-time off-farm employment in the collection of coconuts or moto-taxi activities.

Matios, a young farmer in Layeni Village, Teon Nila Serua, Central Maluku, used to work as construction worker with an uncertain income. After he attended a training at a demonstration plot held by YBTS, Matios decided to start farming. He then learned to grow cucumbers on his own field. On his first season, he harvested approximately 200 kg at a selling price of IDR 5,000/kg, his benefit was IDR 1M. With this successful experience, Matios is planning to expand his land and to commit to farming in the coming years.

Learning spill overs were reported by trained farmers who shared knowledge and materials to other farmers, relatives and other family members. Older trained farmers stated that farm visits to more experienced vegetable farmers are most effective to facilitate discussion and exchange of experiences among farmers as peers generally trust each other.

Adoption of GAP in these areas has contributed to increased vegetable production in the region, including supply to neighbouring islands. Trained farmers stated that with GAP as well as advice from the TFO they were able to increase their income from vegetable production. Based on farmer testimonies, increased income was either reinvested in the farm, or in their livelihoods: livestock, fulfilment of secondary/tertiary needs (e.g. TV, fridge, rice cooker, cars, motorbikes) and housing. Main sources of income such as coconut picking, and motorbike taxi driving have now become secondary income sources for some vegetable farmers during lean periods and in dry seasons. Eventually, the financial gains from vegetable production

contributed to improve the social situation of former school dropouts and believed to prevent them for committing crimes.

3.4.5 Discussion

Farmers confirmed that their knowledge and capacity have increased, thanks to the training sessions organized by YBTS and EWINDO staff, as well as the experience gained on the demonstration plots and by putting theory into practice. A well-thought organization of the training, pedagogical skills from TFOs and the proper management of demonstration plots are key to allow farmers to change practices towards GAP. Practicing the learnt knowledge in demo plots as well as try-outs in farmer fields are also crucial for convincing farmers to adopt GAP on the long term.

The interviews showed that the KT activities have contributed to the actual needs of farmers in North Halmahera and Sangihe. According to the interviewed farmers, the trained GAP knowledge and skills have helped them to improve the vegetable production and productivity and consequently, their income. Farmers were able to reinvest the extra money earned from vegetable farming into their farming business and livelihoods. In addition, vegetable production offers farmers a frequent source of income, particularly of leafy greens such as kangkong or choy sum that can be harvested and sold after a very short growing period. Successful experiences have also contributed to convince young farmers or farmers with secondary income activities and businesses that farming is a sustainable income generating business.

Nevertheless, for certain GAP including crop protection, farmers still require the support of the TFO after training. In both areas, farmers still face difficulties to identify pests and diseases or select the proper pesticide product and calculate the proper dosage.

Besides, to overcome capital constraints for expensive agri-inputs, farmers need to learn financial management (e.g. bookkeeping, insight in investment-yield relationships, etc.). Financial literacy is important to gain insights in costs-benefits of their enterprise, build savings and to invest soundly in new technologies safeguarding horti-farming in the long-term.

The learnings from interviews and farmer testimonies must be reinforced by more quantitative understanding of GAP adoption and GAP impact on crop income. In addition, potential spill over effects of the training program to other farmers must be further investigated. Studies on the trialability (a given practice can be tried out), the observability (results are observable), the complexity (difficulty of correct adoption), the relative advantage (compared to no adoption agronomically and financially) and the compatibility (compatible with the circumstances and farming system into which it will be adopted) of GAP would provide clear insights on the process of adoption.

Simson Warnares, commonly called Mr. Simson, is a YBTS key farmer in Afefbo village, East Biak subdistrict, Biak Numfor regency and is the leader of a farmer group. He originally only planted taro plants but is now growing vegetables being today his main source of income. In the last season, he was able to produce about 200 kg of cabbage and 50 kg of celery. He and his group now have a 1,500 m^2 land to grow celery and cabbage.

*This 46 years old man is coordinating and leading his farmer group to grow crops in a modern way. On top of giving directions to his group, he, along with the YBTS officer and the government field staff, also initiated the establishment of a "*farmer reading hut*" where extension materials such as books, crop guides and posters from the vegIMPACT NL program can be consulted and where farmers can exchange and support each other. Mr. Simson is committed to contribute to the welfare of the community: "*With the establishment of a special reading hut for farmers, I hope other farmers can learn and eventually improve their livelihoods*."*

This facility is supported by YBTS, vegIMPACT NL and the local agriculture department. The reading hut will later function as a learning hub for all farmers in the Eastern Biak subdistrict. Besides extension materials, in the reading hut, farmers can consult TFOs when they are on site.

According to him, implementing GAP has a large economic impact for the community including his family and the existence of agricultural programs and the provision of books will continue greatly helping him and other farmers to improve knowledge about GAP in the future.

4. Seed potato technology and supply systems track

4.1 Introduction

Within the track Seed potato technology and supply systems, a training on potato production was carried out in Indonesia from October 2018 to July 2019. This training consisted of three theoretical training sessions in the form of classroom lectures, three in-field sessions and a demo-field day targeted at key companies, lead farmers and related institutions in the Indonesian potato industry. Trainees were responsible for the organisation of the demo-day, which was part of a training assignment. The potato training aimed specifically at the result chain of the 'agrobusinesses' in the ToC (Fig. 1).

The overall training objective was to expand the knowledge and skills of a diverse group of sector professionals on potato production in Indonesia. Participants consisted of lead seed potato farmers, private sector (agricultural input companies) staff, public sector researchers, and vocational school teachers. Training topics included optimizing potato crop production, diagnosing the crop, growing potato crops from land preparation to harvesting, post-harvest, value chain and business, and setting up demonstration plots.

Here, we evaluate the outcomes of the potato training intervention. The outcomes are changes in trainees' knowledge, skills, attitude and practices resulting from their involvement in the training. Findings presented in this section are based on two reports, Humaira (2019) and Humaira et al. (2020), which provide more information.

Pictures of training on potato production

4.2 Methods

The first M&E study (Humaira, 2019) was conducted during the implementation of the training (April to July 2019). The objective of the study was to evaluate the outcomes resulting from a set of activities implemented in the training intervention. The theory of change (ToC) and the Most Significant Change (MSC) approaches were used as evaluation frameworks. ToC is a theory that explains how activities are understood to produce a chain of results that contribute to achieving the final intended impacts. As a complementary framework, MSC is a dialogical, story-based approach for searching for significant unexpected outcomes and then providing a process for determining the meaning of these outcomes. The data collection involved interviews, surveys, and the MSC exercise.

The second M&E study (Humaira et al., 2020) consisted of a consultation of trainees one year after the training. Because of Covid-19 the consultation took place by phone and was aimed at 1) understanding the main learnings by the trainees ('what remained after one year') and 2) how many people (farmers, colleagues, etc.) had been reached by the trainees with the new learnings. Twelve trainees, randomly selected, agreed to anonymously take part in the telephone interviews conducted in June – July 2020. The selected trainees provided a representative sample of professional backgrounds of the entire training

group.

4.3 Results

In general, the theory of change used (Fig. 1) had a valid impact logic and the given training activities have contributed to the targeted outcomes. The training increased the trainees' capacities to improve the quality of potato seeds by giving the explicit and tacit knowledge that they need in their daily work, particularly on seed selection, soil measurement, planting distance, pesticide formulation, and fertilizer formulation.

The training improved the trainees' capacities for mobilizing knowledge and skills by enhancing the trainees' knowledge and skills on optimizing potato crop production. This further built the trainees' confidence in providing detailed advice for their respective ultimate target groups. During the training, trainees reported to have already mobilized the obtained knowledge and skills to the ultimate target group. However, the transfer of knowledge among peer farmers and professionals was not (yet) successful in some cases. The barriers to knowledge transfer to other actors included the institutional environment, little stimulating working environment, limited interaction and networks, and individual constraints.

The most significant change for the trainees was on how the trainees experienced applying the obtained knowledge in practice ('manage'). This confirms that the training achieved the learning goals of developing a double loop learning cycle.

There were some unintended positive and negative outcomes. Positive outcomes include the application of (learned) knowledge and collaboration in other crops, changes in attitude of trainees, and communication on background organization's interest. An unintended negative outcome faced by one trainee was that the use of a hand tractor affected the social relationship, i.e. employment opportunities of the local population. External factors that influenced desired outcomes of the training included the fluctuation of potato market prices, natural disasters, governmental regulations and support for other prioritized crops such as rice, corn, and soybean.

A year later, interview results demonstrated that the main learning points from the training developed by WUR were seed selection, cultivation techniques, teaching methods and post-harvest management.

Interviewed participants were also asked to share the knowledge that was mostly used in their daily work as well as transferred by trainees to colleagues and other actors. These topics were mostly technical for potato production among which there were planting distance, land preparation, seed selection, fertilization and pest and disease control.

Approximately 2,600 people including farmers, SMK students and fellow colleagues had been reached with learnings by the interviewed trainees in one year after the last training session by the 12 interviewed participants. More people have been reached by the trainees who were not interviewed. Trained participants engaged with these beneficiaries through informal bilateral contact, field visit, farmers' meetings, training or school classes, and social media (WhatsApp and Facebook). Seven out of 12 participants reported informal bilateral contact as the main method of transferring knowledge. In addition, seven trained participants could not confirm that the transferred knowledge has benefited the recipient of the information, mainly because the potato harvest had not yet taken place at the time of the interview. Nevertheless, the other five participants, among the 12 interviewed, said that beneficiaries reported progress, healthier crops (bigger potatoes, controlled pests and diseases) and increased yield.

4.4 Discussion

Overall, the trainees agreed that the training developed by WUR brought a lot of new knowledge and skills on potato production particularly, but also with respect to pedagogical training methods. The

obtained learnings are different and unique for each trainee due to the diversity in daily work, expertise and profession level, educational background, age, and English proficiency. In addition, the role of trainees in their own organization is a factor that determines whether the learnings could be applied; some trainees had changed position since the last training session. Although having a multi-stakeholder group posed a challenge for the trainers to make the learning process easy to understand by those who were low educated and not fluent in English, e.g. the lead farmers, it was found to be positive overall for the learning as trainees supported each other and could share their personal knowledge (peer to peer knowledge transfer). The training resulted in broadening the knowledge network of the participants, that resulted in bilateral contacts and knowledge exchange after the training.

Barriers to knowledge transfer to other actors and particularly farmers included farmers' traditional behaviour, changes in job position by the trainees and the COVID-19 pandemic limiting exchanges and travel for further outreach.

Several recommendations were given to improve the training session developed by WUR:

- Have a shared expectation with the program implementer. This could be done preferably during the initial stage or before organizing the training. By having a shared expectation, the trainer is able to communicate better with the participating organizations on who to delegate, what to do when the training schedule conflicts with staff availability, how to support staff in attending all training sessions, and how to facilitate them in sharing the obtained knowledge and skills to their peers in the workplace.
- Selection of participants in the training could be improved, for example, based on willingness to learn, availability for training, potential future contribution in the potato sector in Indonesia and fluency in English.
- Trainees asked for more knowledge on post-harvest management, analysis of seed quality, and marketing, including the use of more field activities instead of theoretical knowledge.

5. Digital information and social media

5.1 Introduction

Many websites, social media pages and apps on farming are already available, but vegIMPACT NL has developed in the track Digital information & social media own communication channels: a Facebook page, an Instagram account, a YouTube channel and a website. Several times per week, content has been shared on these media, such as technical instruction videos, crop manuals, e-learning modules, etc. Webinars were also organized by the YBTS team, and during the Covid-19 pandemics live Facebook sessions were organised. Eventually, content was also created to maintain a good interaction with the online community and increase the visibility of the program online, for example, through organizing photo contests. Paid and "organic" advertisement campaigns were also organized contributing to increasing the digital outreach.

VegIMPACT NL also has supported the MyAgri app for smartphones, launched by BALITSA, with information on vegetable varieties' characteristics, crop manuals, input recommendations, weather and market information, pest identification and crop protection advice, fertilizer information, etc. In addition, during the program, vegIMPACT NL generated knowledge was made available in another app, the SIPINDO app. The activities in the digital information and social media track aimed specifically at the result chain of the 'horti sector' in the ToC (Fig. 1).

Understanding is still limited about the relevancy of the content, frequency of social media use, and ultimately, the impact of the provided information and messages on productivity, sustainable farming practices and farmer income. A better understanding of the users' (i.e. farmers and sector professionals) preferences and needs for digital content, social media and apps is needed.

The objectives of the study were:

- Understand the usage of social media and apps by Indonesian farmers and sector professionals.
- Understand farmers and sector professionals' appreciation for the content offered by social media and apps in farming.
- Assess the use of vegIMPACT NL social media, MyAgri and SIPINDO app.
- Understand the preferences and needs for content offered by social media and apps for farmers and sector professionals.

5.2 Methods

Three main studies were conducted in this track. Firstly, data was collected through semi-structured interviews of selected stakeholders such as YBTS field officers, trained farmers, non-trained farmers, students and public extension staff, and through FGD's with various farmer groups regarding the content of the social media pages of the vegIMPACT NL program. Secondly, online surveys were performed to estimate the appreciation of the online tools and communication platforms developed by vegIMPACT NL. These surveys were not only open to farmers but to all online users of the platforms. Thirdly, six dedicated FGD's at Java have been organized with users and non-users of agricultural apps to understand barriers in their current use. Additional information was collected during FGDs and individual interviews of farmers and extension staff in East-Indonesia (North Halmahera and Sangihe). In the FGDs, non-users got introduced to MyAgri and the opportunity to explore the app.

5.3 Results

5.3.1 Access to online platforms and apps

Overall, it was observed that farmers in East Indonesia do not use much digital information or apps on horti-farming. Some of the identified barriers in using agri-apps are beyond the influence of agri-app developers, such as the poor mobile infrastructure experienced in the outer islands. The usage of smartphones in East Indonesia is still limited to wealthier/lead farmers. The major barriers that users face in using agri-apps are:

- The lack especially in Sangihe and North Halmahera, of a good internet access. Only the wealthiest farmers own smartphones but most farmers have non-android mobile phones. For the few farmers with smartphones, internet bundles are a cost factor refraining them from looking for more information online. Farmers are not always aware of the offline version of apps such as MyAgri.
- A poor knowledge on how to use smartphones and the storage device capacity. In Java island, smartphone ownership is higher, but the devices often have limited storage capacity. In combination with the unawareness on free cloud data storage solutions (e.g. Dropbox, Google drive) or cleaning of phone storage, farmers tend to remove large apps, such as MyAgri, quickly from their devices.
- Related to the previous issue, farmers forget to reinstall MyAgri after having a new phone as they do not frequently use it.
- Awareness about the availability of agri-apps. Many stakeholders with smartphones are unaware about the availability of MyAgri or SIPINDO apps.

The low awareness of agri-apps was also observed when MyAgri was promoted in a TV commercial campaign, and the downloads more than doubled. Recent promotion campaigns of SIPINDO also resulted in increased downloads. Development of apps should go together with well-thought over strategies to cover the last mile.

5.3.2 Use of online platforms and apps

To obtain advice and recommendations or simply whenever farmers have a question, they prefer calling directly the TFOs with whom they have a trusted connection. As observed in other research studies, smallholder farmers prefer direct contact, phone calls or instant messaging apps such as WhatsApp and Facebook to connect with local advisors rather than looking for information on apps. Their online behaviour is also linked to the personal connection with fellow farmers: they prefer to join farmer groups discussions and groups they know.

But interestingly, some farmers also show interest in EWINDO crop guide videos (given by the TFO) while lead farmers use YouTube to look for crop guides videos. In general, frequent provision of new information/notifications may entice users to open and use features of MyAgri or SIPINDO more often. According to public extension staff at Java, the “more critical” farmers like to compare different information sources browsing online instead of depending on one information source such as MyAgri.

Farmers and sector professionals may be enticed to download free apps, such as MyAgri, but user engagement may remain low because users feel little commitment as with paid apps. Farmers tend to download MyAgri, check it out once or few times, do not use it regularly, and finally remove it from their phone.

Alternatively, the possibility to charge a fee for (part of) the provided information could be considered to increase user commitment in combination with extended interactive features. In general, interactive features may improve the user experience and increase perceived usefulness. In response, recently MyAgri has added WhatsApp functionality enabling to chat with researchers of Balitsa.

5.3.3 Content of online platforms and apps

Users and non-users of MyAgri found most of the content reliable and easy to understand and covering many of the users' needs, but:

- Price information was not accurate and up to date.
- More crops, such as leafy vegetable and flowers could be covered.
- More regionalized information would add value for users.
- There is a demand for news articles addressing topics such as post-harvest issues, hydroponics, farmers' success stories, farm business analyses of specific crops.

Recommendations by the interviewed actors were also suggested including up to date information provision to give them more visibility on their crop choice such as the seeds availability in each region, regional information on the current area planted with a specific vegetable. In addition, they requested more opportunities to connect with other farmers through apps as well as the creation of an online marketplace feature where farmers could buy agri-inputs and sell their production.

5.3.4 Evaluation of online platforms

The online survey had the objective to better appreciate the relevancy of the content shared so far on the vegIMPACT NL platforms and understand the preferences and needs for content offered by social media and apps for farmers and sector professionals. In total, the survey compiled the results of 441 respondents including many students (30% of the respondents) but also entrepreneurs, civil servants, private sector staff, students and teachers. Lastly, 13% of the respondents were farmers.

Survey results demonstrated that the content on vegIMPACT NL's social media was found to be easy to understand (by 97% of the respondents), convincing (77% of the respondents) and attractive overall. They found the information relevant (respectively 37% and 32% considered the content *very relevant* and *relevant*) while less than 5% found the information poorly or not relevant. The content was considered beneficial and applicable (79% considered it *applicable* and *very applicable*) to the daily work and needs of the respondents.

Information on seed selection and nursery were most appreciated by the respondents, followed by IPM, fertilization and occupational health and security being in line with findings in the section 3.1.2.

Videos, either technical or a testimony, with real footage or animated, are the most preferred formats to share information and knowledge. Technical material such as crop guides or posters were also appreciated. Eventually, more interactive activities such as quizzes were also appreciated.

5.4 Discussion

The main barriers to farmer adoption of online tools are the limited exposure to ICT, the poor internet connection, the lack of experience with online tools and platforms for farming. For advice, farmers tend to rely on relatives, agro-input dealers, and extension/TFOs which can be contacted directly or by phone. Most farmers are not yet fully aware of the capacities of apps or other digital tools. Browsers are mostly used to look for agricultural information online.

In the current situation, farmers still prefer direct discussions with peers and TFOs. Nevertheless, new technologies including smartphones, are spreading fast and are expected to be widely used, including by farmers in more remote areas. Quality apps should not only have an appealing design, easy to use and

credible, but they must be up-to-date and perceived as useful by farmers. Interactive features may improve the user experience and increase perceived usefulness. From online reviews of MyAgri, users are not only looking for technical information but also for prices of commodities, including at a regional level.

6. General discussion and conclusion

In a bit more than two years' time, the vegIMPACT NL program was able to develop a variety of activities aimed at supporting the development of the horticultural sector in Indonesia. Due to the COVID-19 crises, not all M&E activities could be carried out as planned. However, the compiled M&E information on three tracks, Knowledge Transfer, Seed potato technology and supply systems, and Digital information & social media as reported in this report provides insightful information on the reached number of beneficiaries, how interventions have been carried out and received by beneficiaries within the overall theory of change framework of the program. The activities in the three tracks targeted different result chains in the overall ToC of the program (Fig. 1). Findings on the Horti sector result chain are more complex to obtain and analyse, are less clear compared to the KT and potato result chains which have demonstrated intermediate results in the ToC.

VegIMPACT NL was particularly aimed at building the capacity of farmers and sector professionals with GAP by developing knowledge transfer interventions and by sharing on a large scale, a wide variety of GAP information through various communication channels such as social media. The knowledge transferred to sector professionals was then shared among farmer communities through field activities and have exceeded the targeted number of beneficiaries. On top of that, signs of knowledge spill over among non-targeted beneficiaries (i.e. other farmers either relatives of beneficiaries or neighbours of participating farmers, social media followers) were observed.

The short time frame of the program, being the main issue for Monitoring & Evaluation activities, hindered assessing the longer-term outcomes and benefits from the program. Anecdotical evidence suggests positive intermediate and ultimate outcomes of the interventions as horticultural farmers in Sangihe and North Halmahara seem to have adopted GAP contributing to improved productivity and income. This observation gives support for the applicability, relevancy and the needs of such knowledge and information for farmers in Indonesia. Income generated by farmers was either reinvested in their farming business for the purchase of improved inputs or livestock or in farmers' livelihoods. Hence, adoption of improved practices contributes to the creation of income and employment generation, even in less developed areas of the country. In addition, increased vegetable production and sales contribute to the healthy diet of millions of consumers throughout the country. However, more studies must be conducted to fully understand the longer-term outcomes of the activities of the vegIMPACT NL programs. Comparison in agronomic and financial performance of trained farmers and non-trained farmers as well as GAP adoption are helpful to understand the full benefit of the program. Nevertheless, results of the knowledge transfer test and the current limited adoption of GAP among vegetable farmers shed light on the necessity to continue with capacitating farmers and sector professionals, including public extension officers, students and (young) farmers to ensure sector improvements. If farmers have adopted the low-cost and low-knowledge GAP, more advanced GAP on fertilization and crop protection were adopted by a smaller share of beneficiaries. This was also because farmers had not attended all GAP topics. A major part of the farmers only showed interest in the topic seed selection, seedling and nursery that may have been fostered by trainers affiliated with a seed company. Convincing farmers to shift towards more sustainable and commercial farming, requires investments and time and is not straightforward: results of demonstration plots (particularly visually), changes in mindset towards learning, risks of try-outs of new practices and confidence in implementing GAP are clear barriers from accelerated adoption and related benefits of sustainable farming practices.

vegIMPACT NL will continue disseminating GAP and other relevant information through its counterparts in Indonesia. This will be done in the field by the champion trainers of EWINDO, YBTS and other trained professionals by vegIMPACT NL program but also, and more importantly in the future, through online tools such as agricultural apps (i.e. MyAgri, SIPINDO) and social media pages on various platforms. With the development and the future large scale spread of ICT in Indonesia, including in low social classes such as farmers, as well as limited mobility of people due to the COVID-19 pandemic, the knowledge delivered

during the program will continue being spilled over to more beneficiaries. Currently, the physical interaction and the possibility to obtain personal advice from TFOs and trained sector professionals was still regarded as the most favoured option by the farmers to obtain information. This may be well related to the poor internet connectivity, access to smartphones and general low digital literacy as observed in Sangihe and North Halmahera. If knowledge and information is available online, it is still restricted by the poor infrastructure and digitalization of rural areas. Farmers are still not used to look for information online or on apps. More market-oriented information such as prices and trends are of interest for the farmers on top of technical farming knowledge.

The vegIMPACT NL program is a follow-up of a longer-term collaboration between the Netherlands and Indonesia on the development of the horticultural sub-sector. The testimonies of farmers trained during previous programs and vegIMPACT NL confirmed the long-term impacts of knowledge transfer activities in agriculture. They confirm the contribution of these programs from training of professionals in the sector to improving agronomic and economic performance at the scale of smallholder farmers across Indonesia. Nonetheless, more in-depth data and analyses are required to fully assess the benefits and the contribution of these programs to improvement of the sector performance, particularly at the farming systems level. Baseline-endline studies, including attention for enabling factors in farmers' environments, as well as contribution analyses must be performed to understand changes in performance of farmer beneficiaries.

7. References

Humaira 2019. Evaluation of vegIMPACT NL Capacity Building of Potato Value Chain Professionals. Available at: https://vegimpact.com/wp-content/uploads/2019/11/Evaluation-of-vegIMPACT-NL-Capacity-Building-of-Potato-Value-Chain-Professionals_Internship-Report.pdf

Humaira et al, 2020. Learnings from vegIMPACT NL Capacity Building of Potato Professionals. Available at: https://vegimpact.com/wp-content/uploads/2020/12/vegIMPACT-NL-report-3-Potato-training-ME.pdf

8. Annexes

Annex 1. GAP slogans used in Knowledge transfer track

1. Seed Selection, Seedling and Nursery

1.1. Good seeds are characterized by several indicators, such as;
- High germination rate,
- Good purity,
- High resistance to pest and diseases, and
- High productivity

1.2. Good seeds are neatly packed, and the product label contains seed quality information and expiration date.

1.3. A good seedling media consists of soil + rice husk/sand + compost (1:1:1). Clean up the soil before used in order to be free of pest, disease, and weed.

1.4. Nursery process is important for some types of vegetable, so the growth is better.

Types pf vegetables	Nursery (Seed bed)	Direct sowing
Chilli	X	
Egg plant	X	
Cucumber	X	X
Tomato	X	
Spinach		X
Kangkong		X
Caisim	X	
Pak choy	X	
Lettuce	X	X
Leek	X	X
Shallot		X
Shallot with TSS	X	

1.5. Nursery house is recommended to provide optimal conditions for growing healthy and uniform seedlings.

1.6. A week before transplanting, seedlings should be increasingly exposed to field conditions (to get used to sunny conditions). Transplanting should be done during cool conditions preferably in the afternoon (15.30 – 18.00).

2. Fertilization

2.1. Plants need both macro (N, P, K, S, Ca, Mg) and micro (B, Mo, Cl, Co, Mn, Zn, Cu, Fe, Ni) nutrients to grow and produce.

2.2. Nitrogen (N) is essential for photosynthesis and stem growth, it is present in ZA and urea fertilizer.

2.3. Phosphorus (P) is important for root growth, formation of flower, fruit and seed. The Phosphorus can be found in Triple Super Phosphate (TSP) and Double Super Phosphate (SP36).

2.4. Potassium (K) is important for repairing cell walls, spurring root growth, and affecting fruit quality. It can be found in KCl and KNO_3.

2.5. Secondary macro nutrients; Magnesium (Mg), Calcium (Ca), and Sulphur (S) which are also needed by plants.
- Mg : Encourage absorption of other nutrients and produce chlorophyll
- S : Encourages the propagation of root nodules in nuts and helps in root development and seed formation.
- Ca : Increases fruit formation and increases disease resistance

2.6. Some micronutrients that play a role in plant growth;

Micronutrients	Function
Cl (Chlorine)	Improve quality and production, and play a role in regulating root growth
Fe (Iron)	Essential for the formation of chlorophyll
B (Boron)	Improve the quality of leaves and the plants (vegetables and fruits)
Cu (Copper)	Important in regulating plant enzyme systems and chlorophyll formation

2.7. Choose the right fertilizer and amounts to maximize plants' growth and yield.

2.8. Application of organic fertilizers is essential because it improves the soil structure and fertility and stimulates soil microbial growth.

2.9. Fertilizer application depends on the types of soil and plant (mixing, spreading, and spraying).

3. Integrated Pest management

3.1. Frequent crop monitoring is important for timely identification of pest and disease presence. It is also important to decide the right measures (preventive or curative).

3.2. Pest control before an attack (preventive); environmental modification, treating seeds, treating soil, trapping pest, and spraying fungicides.

3.3. Pest control after an attack (curative) can be done through:

- Prune the infected part of plants
- Use traps and natural enemies
- Apply appropriate pesticides spraying

3.4. Changing crop's families every season is advised to break pest and disease cycle.

3.5. The use of pesticides is based on 6 principles: right target, right quality, right type of pesticides, right dosage, right time, and right way.

3.6. The type of pesticide applied must be appropriate with the type of pest attacked.

OPT yang menyerang	**Jenis pestisida yang dianjurkan**
Insect	Insecticide (Agrimec, Buldok, dll)
Mite	Acaricide (Omite, Rotraz, dll)
Fungi	Fungicide (Amistartop, Dithone, dll)
Bacterial	Bactericide (Agrep, Bactocyne, dll)
Weed	Herbicide (Gramoxon, Goal, dll)
Rat	Rodenticide (Klerat, dll)
Mollusca	Molluscicide (Siputok)
Nematode	Nematicide (Furadon)

3.7. Alternation of pesticides from different Mode of Action group is essential to prevent the creation of pest and disease resistance to specific pesticides.

4. Spraying technique and Farmer Safety

4.1. Right spraying technique;

- Check the quality of knapsack sprayers and nozzles regularly
- Use the right nozzle type and pressure when spraying
- Use clean water to mix pesticides (pH 5,5 – 7)

4.2. Spray in cool temperatures, dry and non-windy conditions, preferably early in the morning or late in the afternoon.

4.3. An even distribution of the spraying solution and small droplets are more efficient than a solution dripping from the plant.

4.4. Reading the pesticide label is essential to ensure the right application (information on dosage, plant, and type of pest and disease).

4.5. Mixing different chemicals in spraying solutions is not recommended if it is not advised on the label.

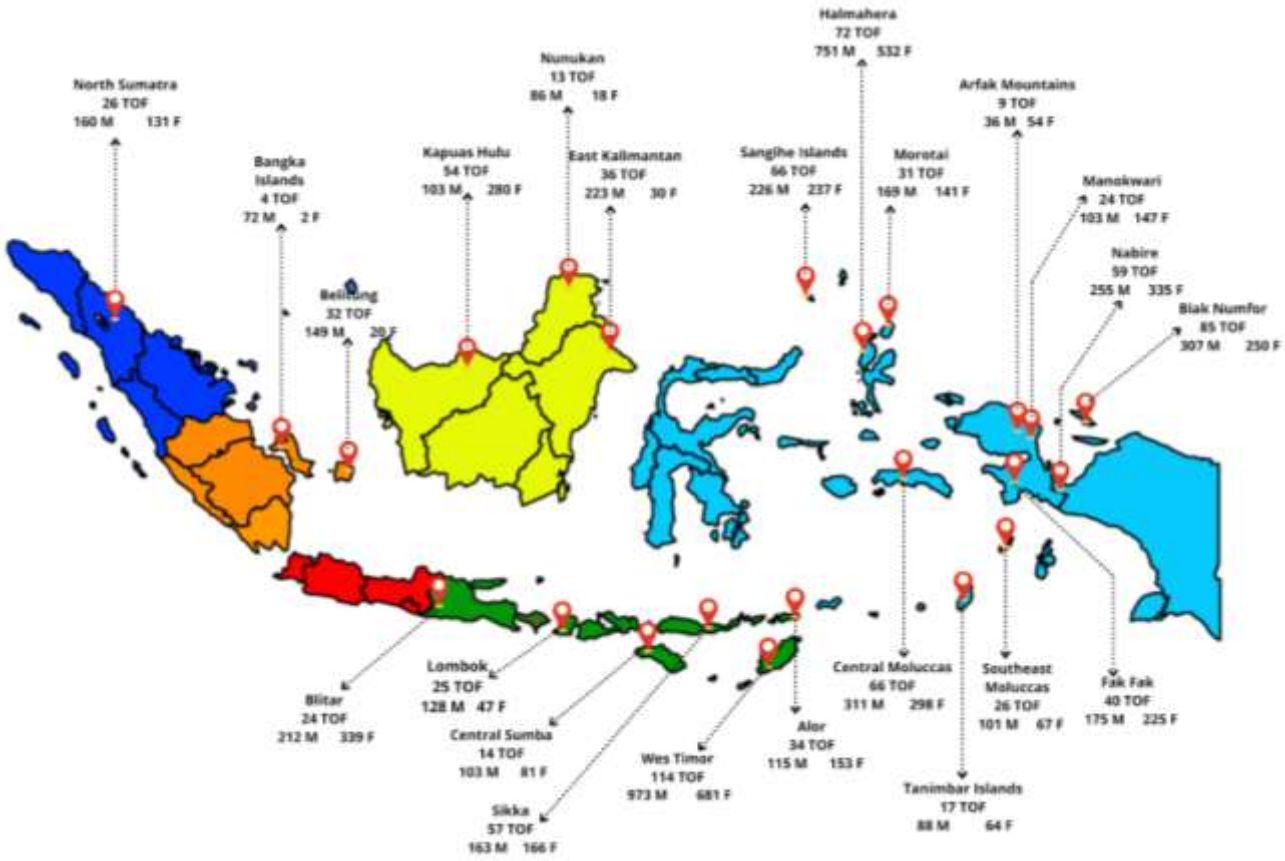
4.6. Use Personal Protective Equipment (PPE) a mask, long shirt and trousers, rubber gloves, googles, hat and boots. Do not smoke, drink or eat while spraying.

4.7. Right after spraying, clean all spraying equipment and your entire body. Wash your spraying clothes separately from your everyday clothes.

4.8. Store chemicals in a locked cabinet. Dispose empty pesticide containers away from the residential area.

Annex 2. Overview and outreach of Training of Farmers organized by YBTS and EWINDO

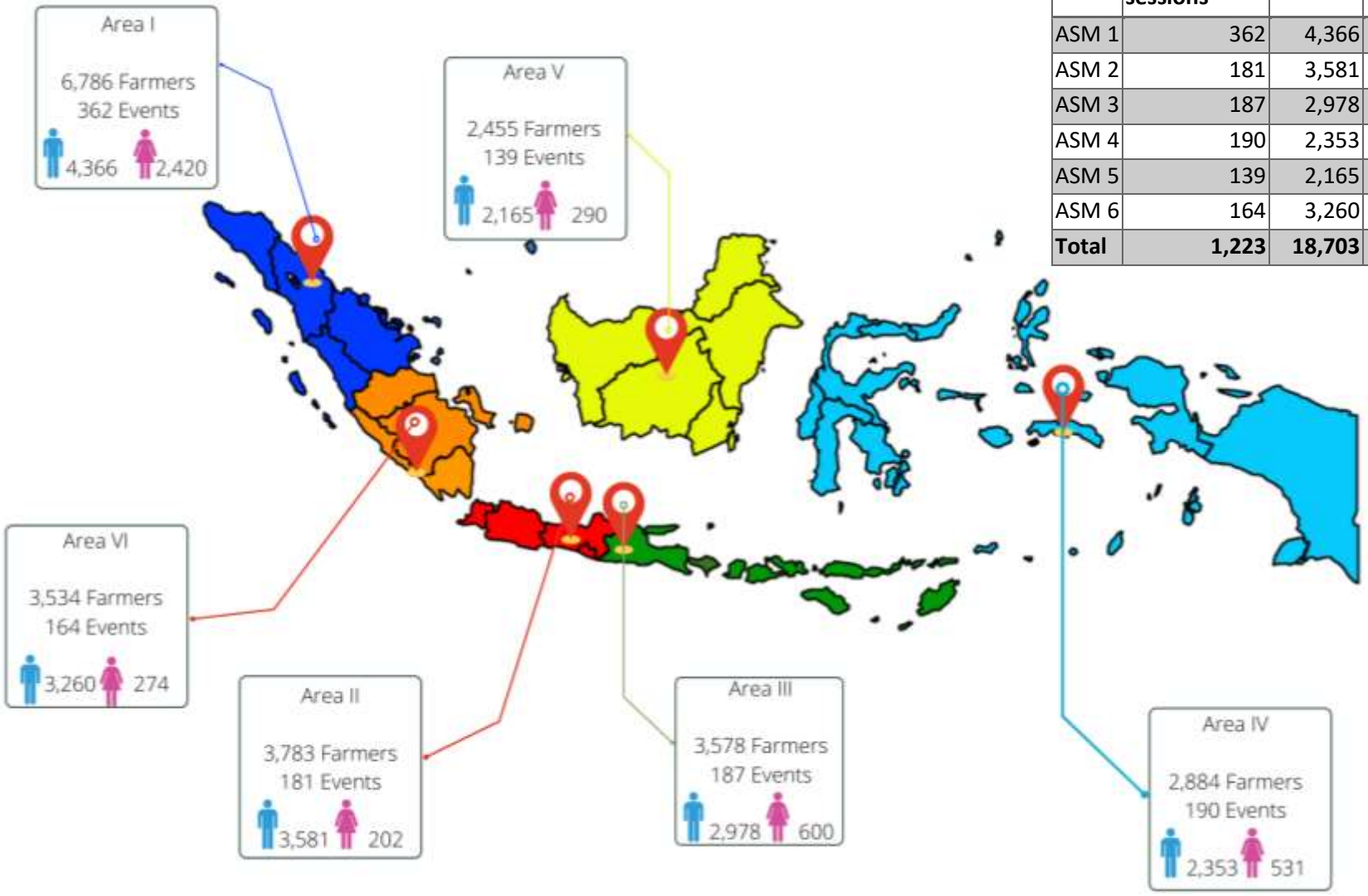
Training of Farmers organized by YBTS



Area	Event	Male	Female	Total no. of trainees
North Sumatra	26	160	131	**291**
Bangka Islands	4	72	2	**74**
Belitung	32	149	20	**169**
Kapuas Hulu	54	103	280	**383**
Nunukan	13	86	18	**104**
East Kalimantan	36	223	30	**253**
Sangihe Islands	66	226	237	**463**
Halmahera	72	751	532	**1,283**
Morotai	31	169	141	**310**
Manokwari	33	103	147	**250**
Nabire	59	255	335	**590**
Biak Numfor	85	307	250	**557**
Fak Fak	40	175	225	**400**
Arfak Mountains	9	36	54	**90**
Southeast Moluccas	26	101	67	**168**
Tanimbar Islands	17	88	64	**152**
Central Moluccas	66	311	298	**609**
Alor	34	115	153	**268**
West Timor	114	973	681	**1,654**
Sikka	57	163	166	**329**
Central Sumba	14	103	81	**184**
Lombok	25	128	47	**175**
Blitar	24	212	339	**551**
Total	**937**	**5,009**	**4,298**	**9,307**

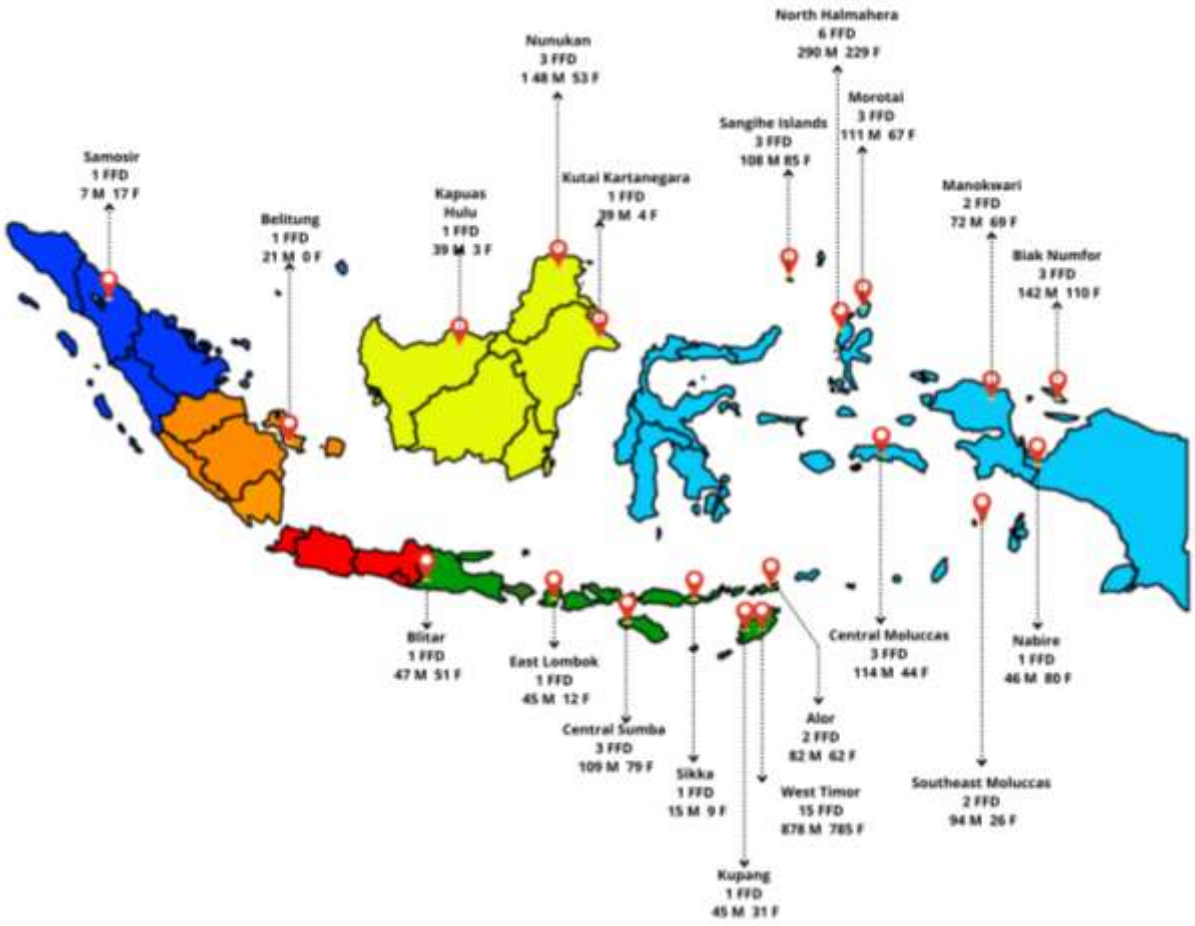
Training of Farmers organized by EWINDO

Area	Number of sessions	Male	Female	Total no. of trainees
ASM 1	362	4,366	2,420	**6,786**
ASM 2	181	3,581	202	**3,783**
ASM 3	187	2,978	600	**3,578**
ASM 4	190	2,353	531	**2,884**
ASM 5	139	2,165	290	**2,455**
ASM 6	164	3,260	274	**3,534**
Total	**1,223**	**18,703**	**4,317**	**23,020**



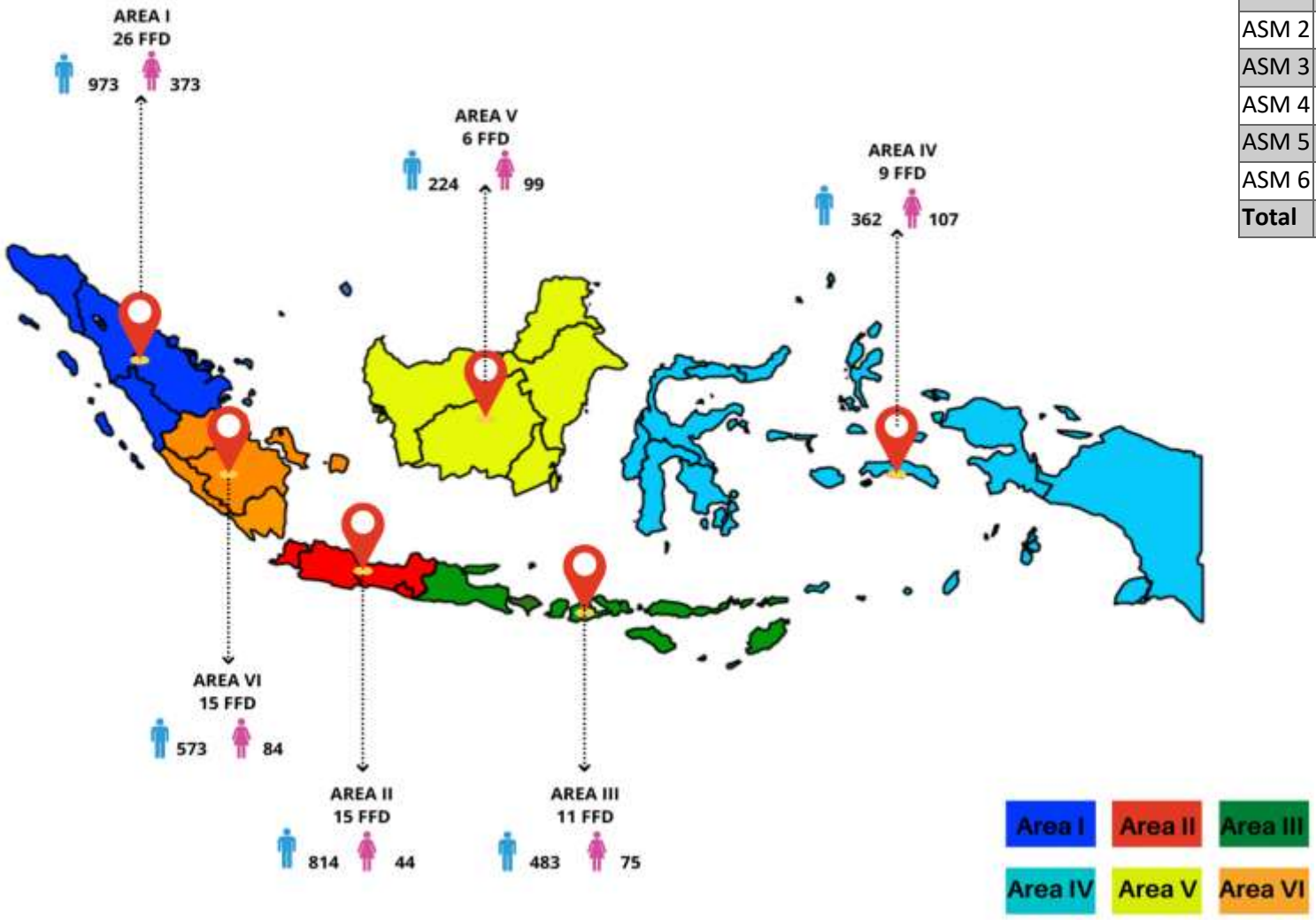
Annex 3. Overview and outreach of field days organized by YBTS and EWINDO

Field days organized by YBTS



Area	Nb. of event	Male	Female	Total
Alor	2	82	62	**144**
Belitung	1	21	0	**21**
Biak Numfor	3	142	110	**252**
Blitar	1	47	51	**98**
Halmahera Utara	6	290	229	**519**
Kapuas Hulu	1	39	3	**42**
Sangihe Islands	3	108	85	**193**
Kupang	1	45	31	**76**
Kutai Kartanegara	1	39	4	**43**
East Lombok	1	45	12	**57**
Central Moluccas	3	114	44	**158**
Southeast Moluccas	2	94	26	**120**
Manokwari	2	72	69	**141**
Nabire	1	46	80	**126**
Nunukan	3	148	53	**201**
Morotai	3	111	67	**178**
Samosir	1	7	17	**24**
Sikka	1	15	9	**24**
Central Sumba	3	109	79	**188**
West Timor	15	878	785	**1,663**
Total	**54**	**2,452**	**1,816**	**4,268**

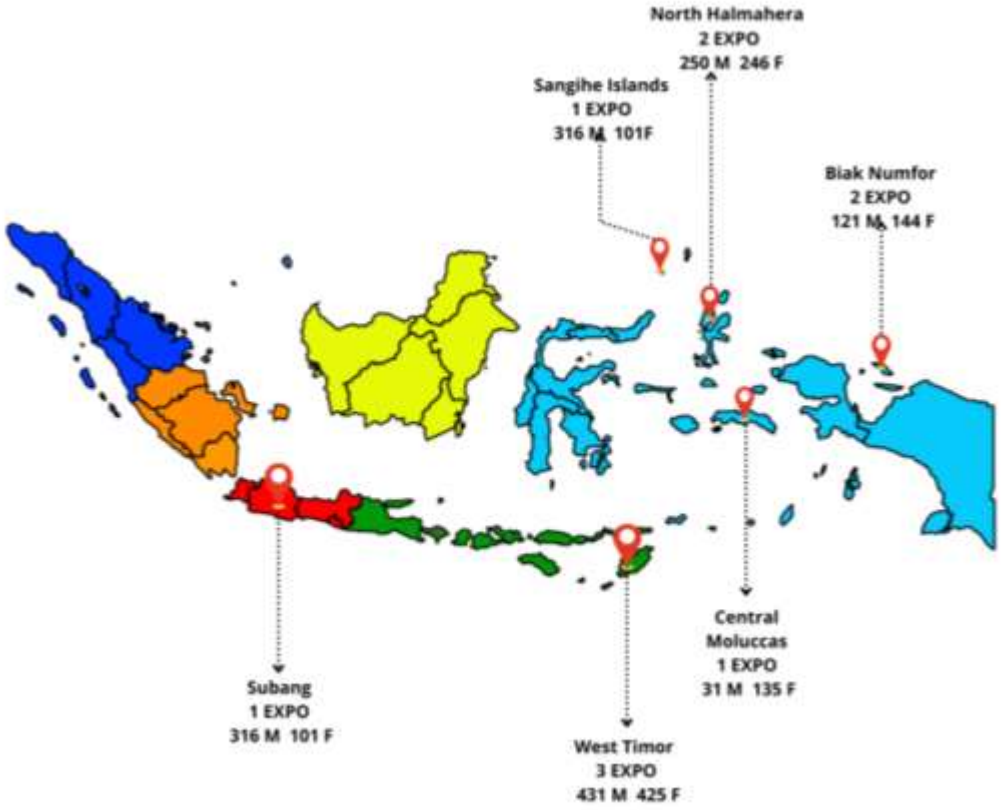
Field days organized by EWINDO



Area	Number of events	Male	Female	Total
ASM 1	26	973	373	**1,346**
ASM 2	15	814	44	**858**
ASM 3	11	483	75	**558**
ASM 4	9	362	107	**469**
ASM 5	6	224	99	**323**
ASM 6	15	573	84	**657**
Total	**82**	**3,429**	**782**	**4,211**

Annex 4. Overview and outreach of expos organized by YBTS and EWINDO

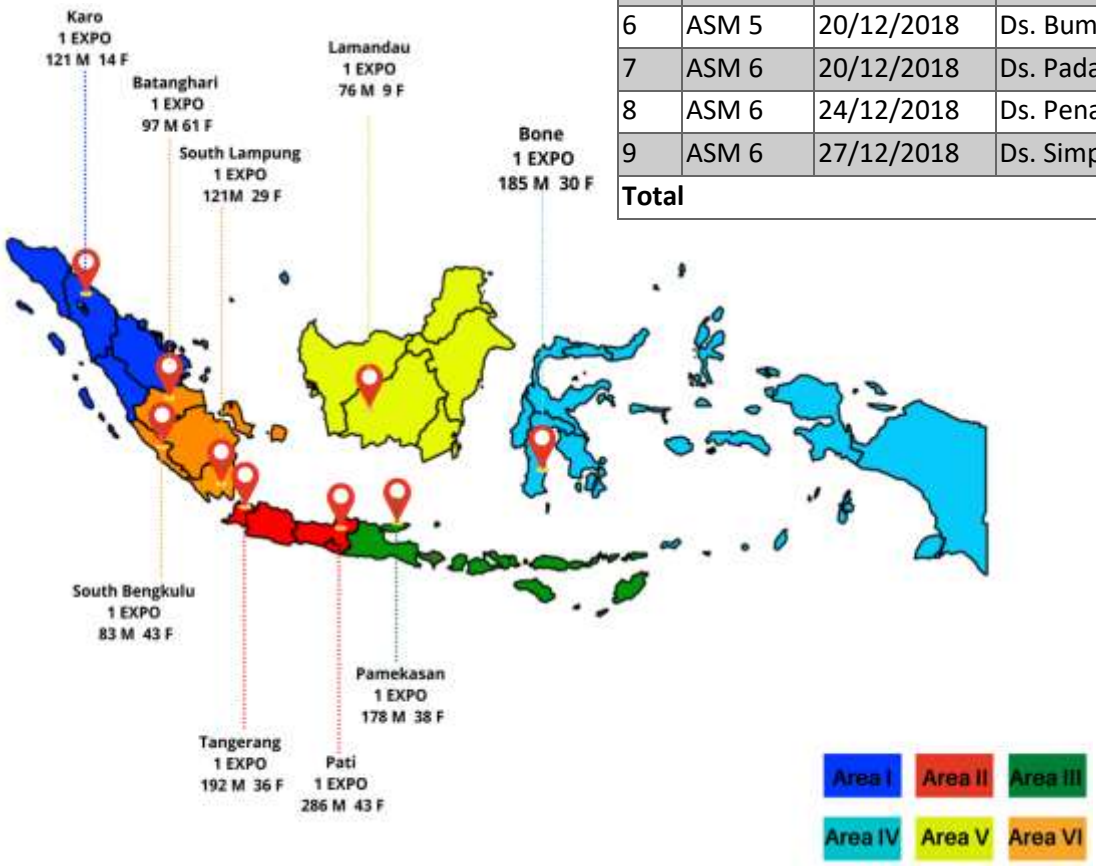
Expos organized by YBTS



No	Date	Place	Male	Female	Total
1	06/09/2018	Ds. Soakonora, Kec. Galela Selatan, Kab. Halmahera Utara	151	183	**334**
2	18/09/2019	Ds. Peleri, Kec. Malifut, Kab. Halmahera Utara	99	63	**162**
3	21/05/2019	Ds. Warsansan, Kec. Biak Utara, Kab. Biak Numfor	54	57	**111**
4	13/11/2019	Ds. Kajasbo, Kec. Biak TimurKab. Biak Numfor	67	87	**154**
5	16/05/2019	Ds. Jerili, Kec. TNS, Kab. Maluku Tengah	31	135	**166**
6	23/10/2019	Ds. Pananekeng, Kec. Tahuna Barat, Kab. Kepulauan Sangihe	144	76	**220**
7	26/11/2019	SMKN 2 Subang	316	101	**417**
8	26/06/2019	Soe, NTT	141	151	**292**
9	18/09/2019	Soe, NTT	128	127	**255**
10	05/12/2019	Soe, NTT	162	147	**309**
Total			**1,293**	**1,127**	**2,420**

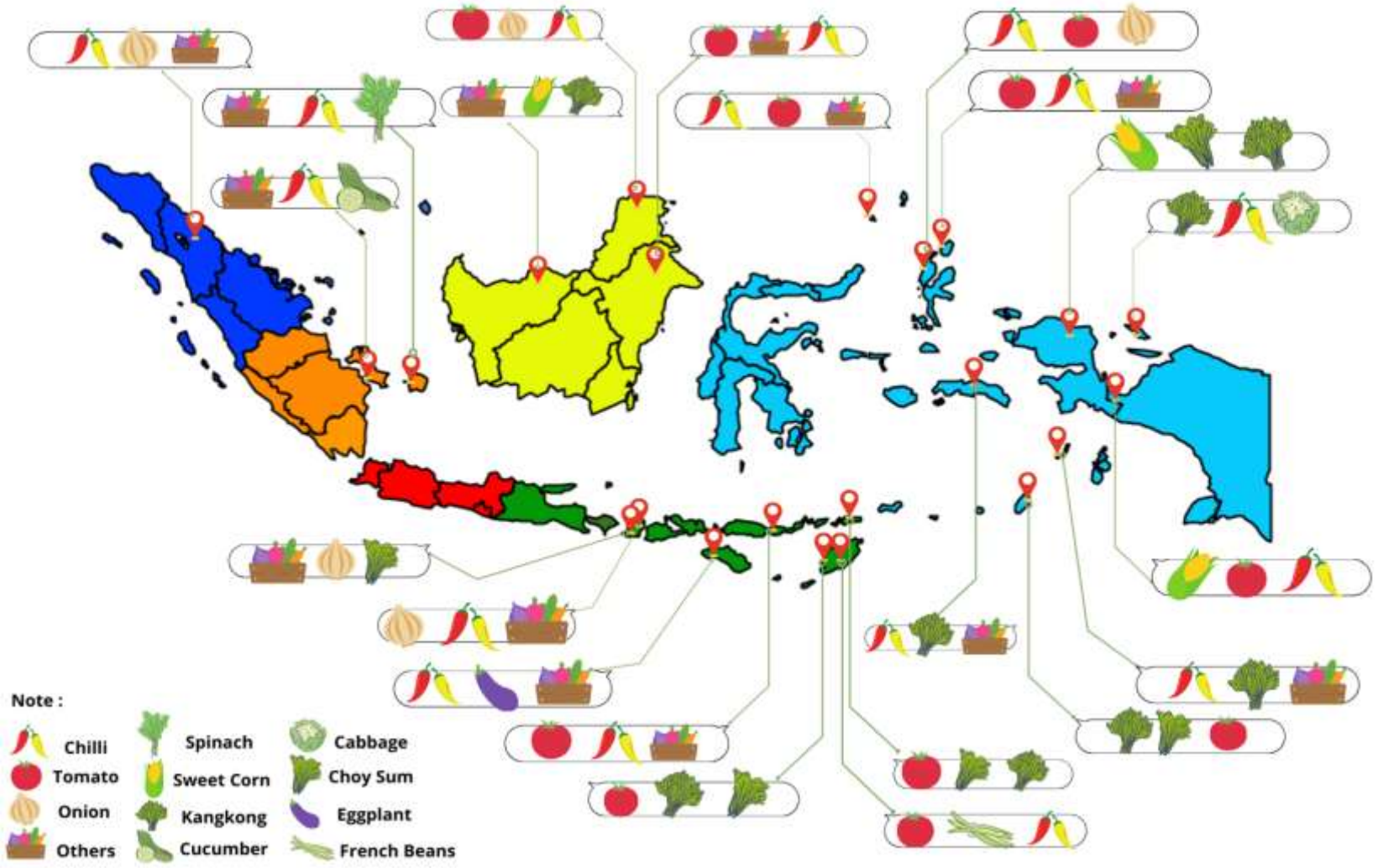
Expos organized by EWINDO

No	Area	Date	Place	Male	Female	Total
1	ASM 1	05/09/2018	Desa Juma Raja, Kec. Merdeka, Kab. Karo	121	14	**135**
2	ASM 2	20/12/2018	CV. Indo Kimia Pati (Ds. Mulyoharjo, Kec. Pati, Kab. Pati, Jawa Tengah)	286	43	**329**
3	ASM 2	23/01/2019	Ds. Teluknaga, Kec. Teluknaga, Kab. Tangerang	192	36	**228**
4	ASM 3	11/12/2018	Ds. Sumedangan, Kec. Pademawu, Kab. Pamekasan	178	38	**216**
5	ASM 4	12/12/2018	Kel. Bukaka, Kec. Tenete Riattang, Kab. Bone	185	30	**215**
6	ASM 5	20/12/2018	Ds. Bumi Agung, Kec. Bulik, Kab. Lamandau	76	9	**85**
7	ASM 6	20/12/2018	Ds. Padang Siring, Kec. Seginim, Kab. Bengkulu Selatan	83	43	**126**
8	ASM 6	24/12/2018	Ds. Penangan, Kec. Jati Agung, Kab. Lampung Selatan	121	29	**150**
9	ASM 6	27/12/2018	Ds. Simpang Karmeo, Kec. Batin XXIV, Kab. Batanghari	97	61	**158**
Total				**1,339**	**303**	**1,642**



Annex 5. Overview of crops cultivated by YBTS and EWINDO

Crops cultivated by YBTS

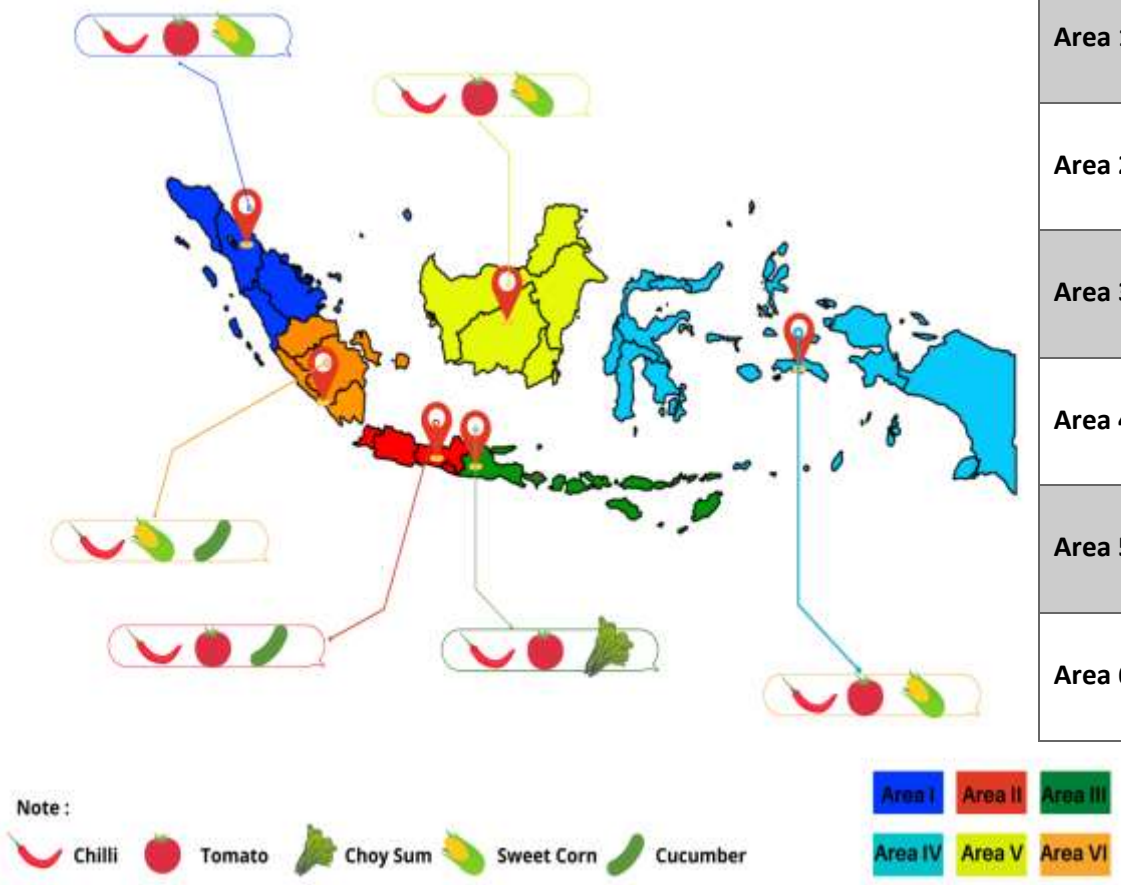


Area	Crop	Total	Share among the top 3 crops (in %)	Share among the total number of crops (in %)
North Sumatra	Chilli	131	52	34
	Onion	74	29	19
	Others	49	19	13
Bangka Islands	Others	46	77	69
	Chilli	8	13	12
	Cucumber	6	10	9
Belitung	Others	79	60	43
	Chilli	41	31	22
	Spinach	12	9	7
Kapuas Hulu	Others	61	60	35
	Sweet corn	21	21	12
	Kangkong	20	20	11
Nunukan	Tomato	26	49	31
	Onion	15	28	18
	Chilli	12	23	14
East Kalimantan	Tomato	100	40	22
	Others	86	35	19
	Chilli	62	25	14
Sangihe Islands	Chilli	114	52	32
	Tomato	63	29	18
	Others	44	20	13
Halmahera	Chilli	75	43	24
	Tomato	54	31	17
	Onion	46	26	15
Morotai	Tomato	30	35	30

	Chilli	28	33	28
	Others	28	33	28
Manokwari	Sweet corn	119	60	50
	Choy sum	62	31	26
	Kangkong	19	10	8
Nabire	Sweet corn	64	36	18
	Tomato	60	34	17
	Chilli	52	30	15
Biak Numfor	Kangkong	139	58	31
	Chilli	51	21	11
	Cabbage	51	21	11
Southeast Moluccas	Chilli	47	41	20
	Kangkong	34	30	14
	Others	33	29	14
Tanimbar Islands	Chilli	47	41	20
	Kangkong	34	30	14
	Others	33	29	14
Central Moluccas	Chilli	93	50	29
	Kangkong	58	31	18
	Others	36	19	11
Alor	Tomato	61	40	24
	Choy sum	51	34	20
	Kangkong	39	26	15
Southeast Central Timor	Tomato	206	61	33
	French beans	66	20	11
	Chilli	63	19	10
Kupang	Tomato	104	80	74

	Kangkong	14	11	10
	Choy sum	12	9	9
Sikka	Tomato	251	69	65
	Chilli	96	26	25
	Others	17	5	4
Central Sumba	Chilli	24	51	47
	Eggplant	16	34	31
	Others	7	15	14
East Lombok	Onion	123	73	66
	Chilli	25	15	14
	Others	20	12	11
Central Lombok	Others	20	47	39
	Onion	17	40	33
	Choy sum	6	14	12

Crops cultivated by EWINDO

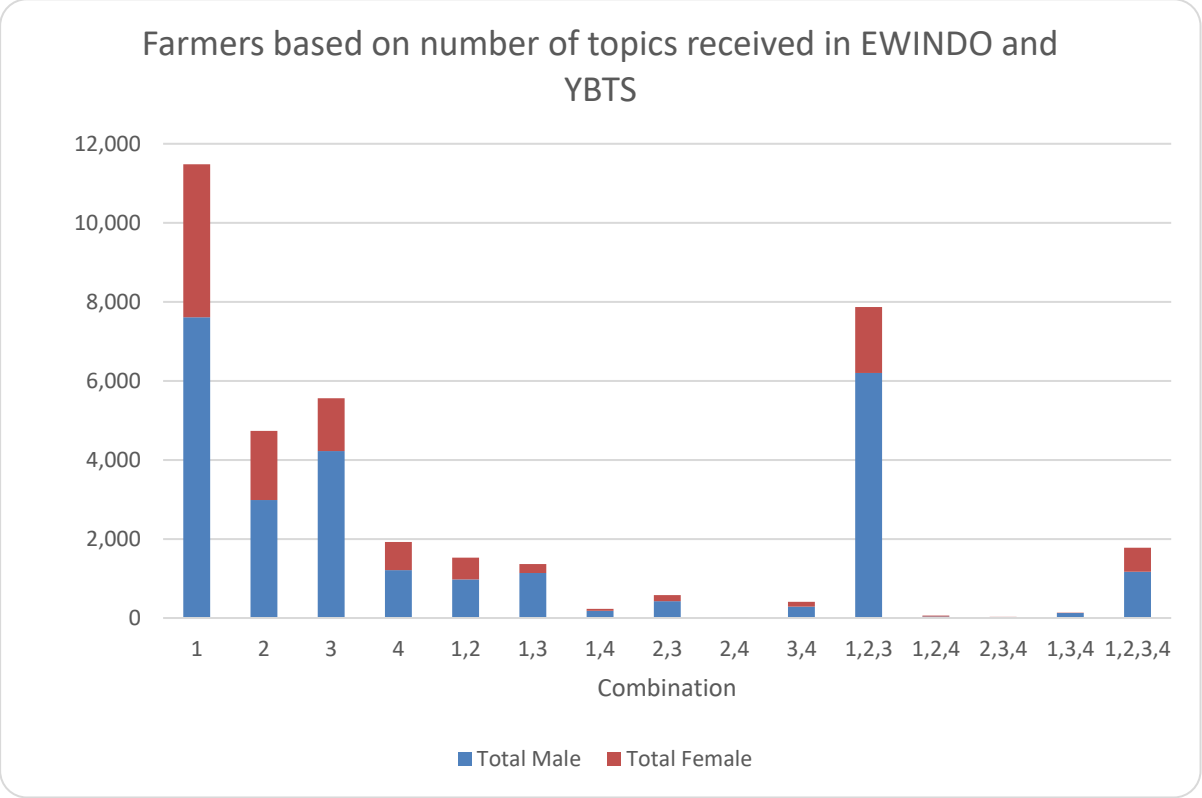


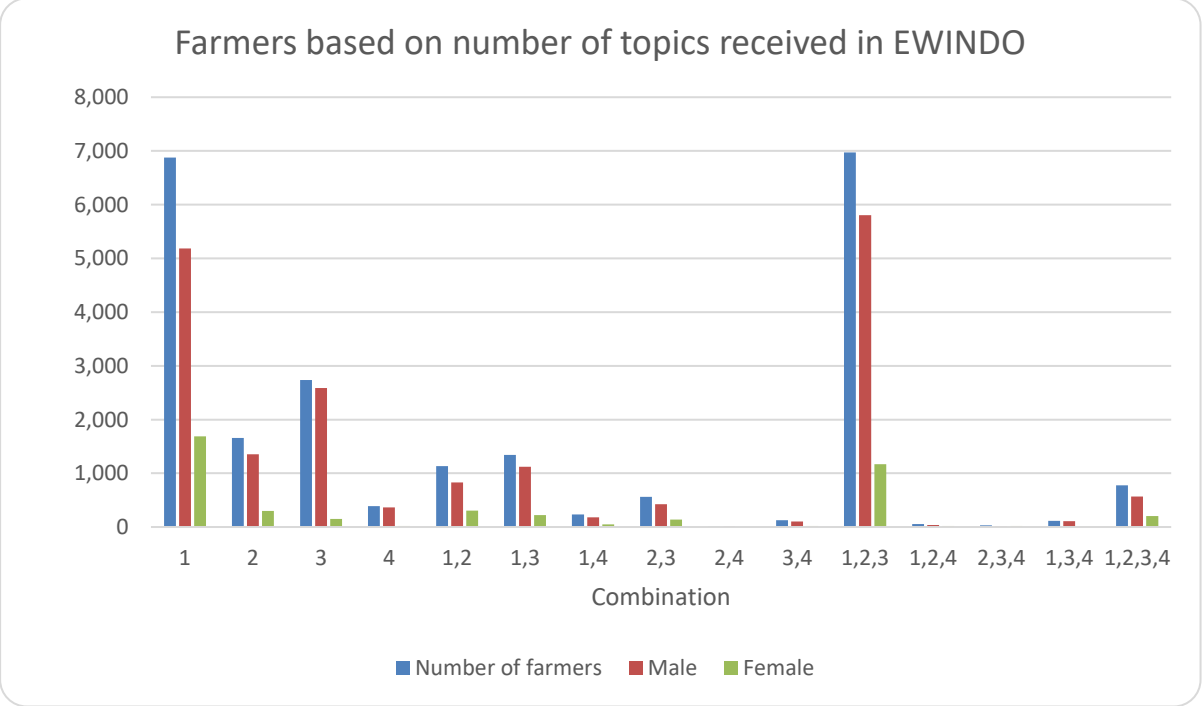
Area	Crops	Total	Share among the top 3 crops (in %)	Share among the total number of crops (in %)
Area 1	Chilli	958	56	30
	Tomato	437	25	14
	Sweet corn	331	19	10
Area 2	Chilli	867	69	43
	Tomato	254	20	13
	Cucumber	128	10	6
Area 3	Chilli	485	47	26
	Tomato	376	36	20
	Choy sum	181	17	10
Area 4	Chilli	330	45	22
	Tomato	238	33	16
	Sweet corn	164	22	11
Area 5	Chilli	781	53	29
	Sweet corn	461	31	17
	Cucumber	242	16	9
Area 6	Chilli	558	57	36
	Sweet corn	300	30	19
	Cucumber	127	13	8

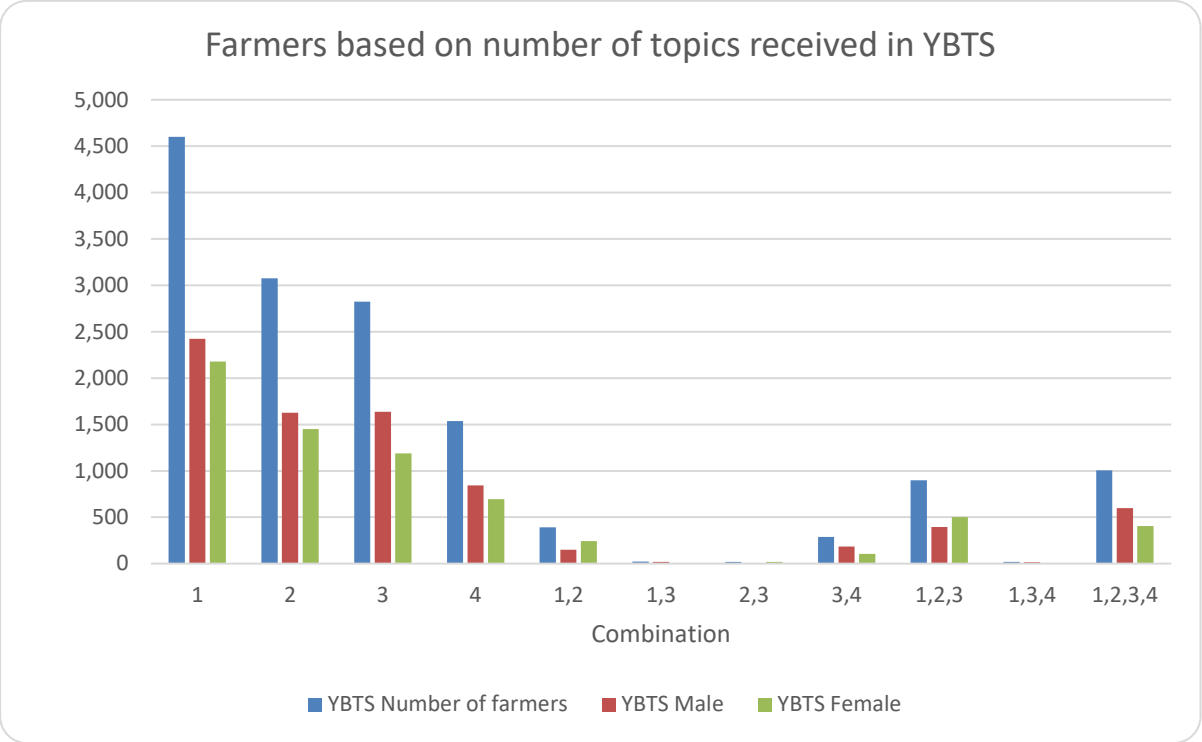
Annex 6. Materials distributed in the Knowledge transfer track

Tools	Number
Flipchart	58 sets
Booklet 30 Slogans	7,000 copies
Booklet spraying technique	500 copies
Spraying Mask	200 units
Crop guide	11,000 copies
Technical guide	9,000 copies
Smartphone	7 units
Projector Portable	4 units
WSP	10 packs
Booklet Identification of Pest and Disease	3,000 copies
T-Shirt for farmers	4,600 pcs
Polo shirt for field staff	600 pcs
Pen	1,000 pcs
Key-ring	2,350 pcs
Goodie bag	2,500 pcs
Face Mask	2,300 pcs
USB	140 pcs
Mug	200 pcs

Annex 7. Training of Farmers outreach per training session, area and sex







Topic 1: Seed selection and nursery

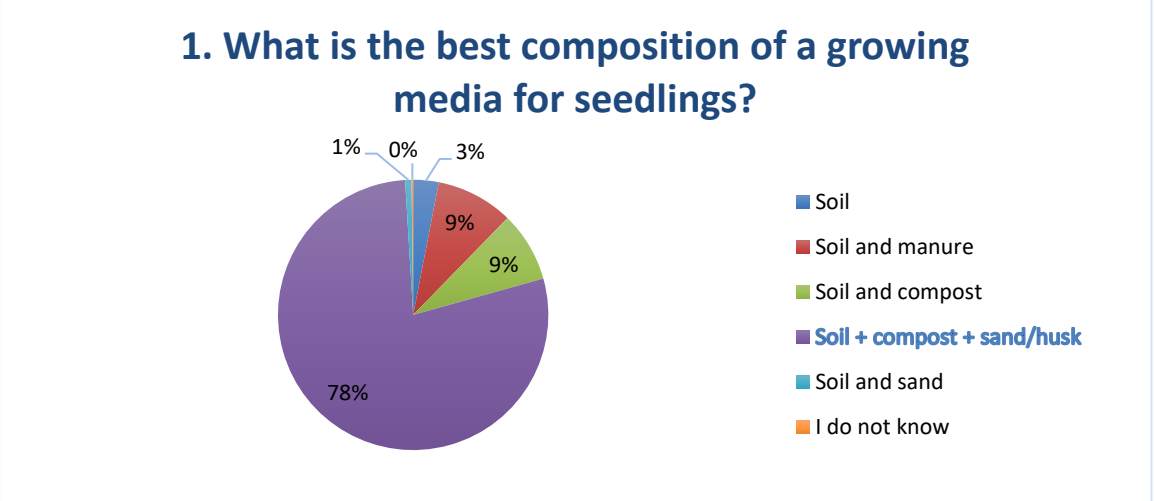
Topic 2: Fertilization

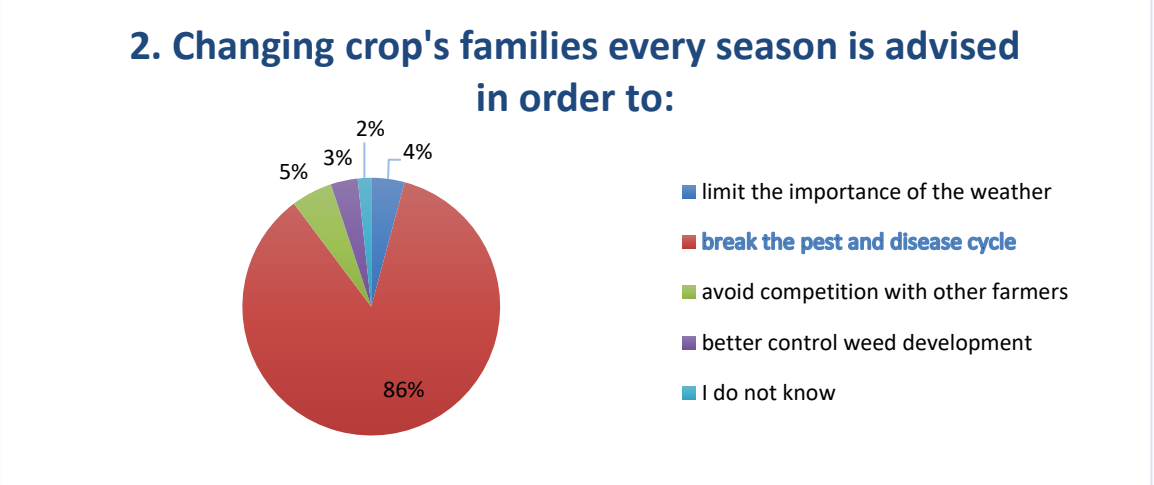
Topic 3: Integrated Pest Management

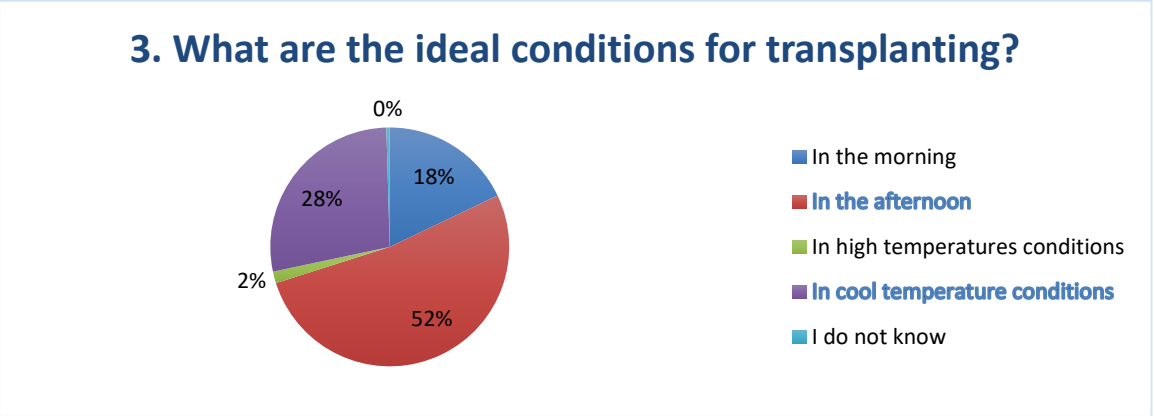
Topic 4: Spraying techniques and farmer safety

Annex 8. Knowledge Transfer test – cumulative answers

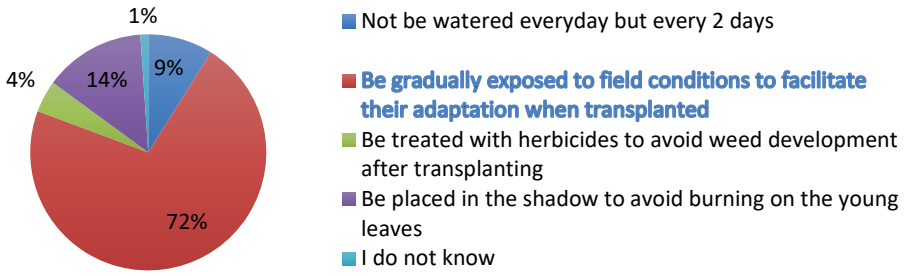
The following section gathers the cumulative answers of the farmers, meaning that respondents could answer as many times as there are propositions per question. Therefore, for each question, are compiled the **cumulative** share of answers in percentage among the entire sample of respondents. This allows to identify where mistakes were made. Correct answers are highlighted in the legend in blue.



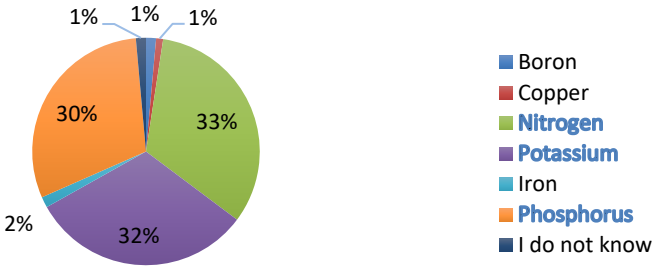




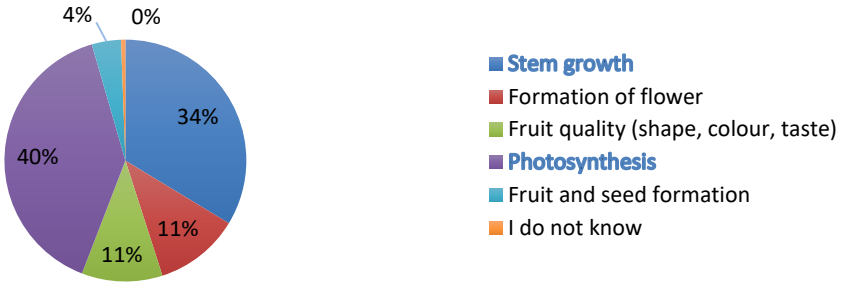
4. One week before transplanting, seedlings should



5. What are the 3 main nutrients (primary nutrients) required by plants to grow?

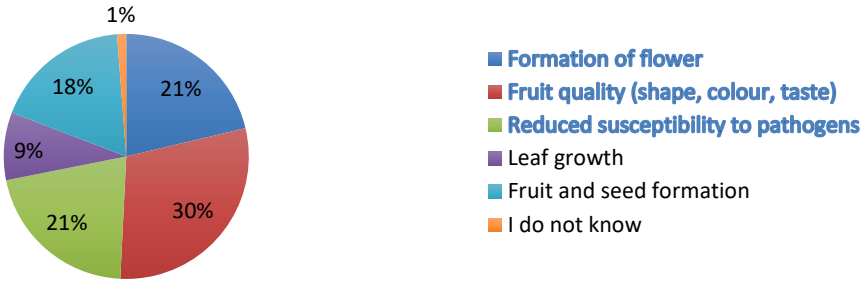


6. Nitrogen is required for:

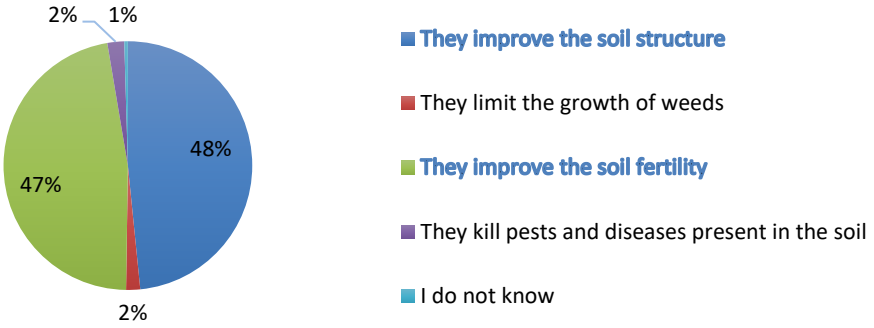


7. Phosphorus is essential for:

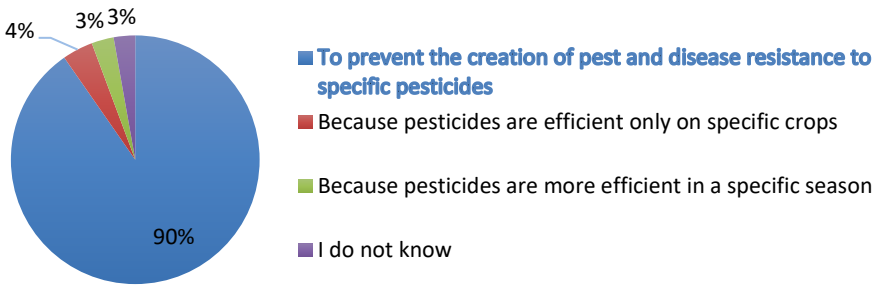
8. Potassium is essential for:



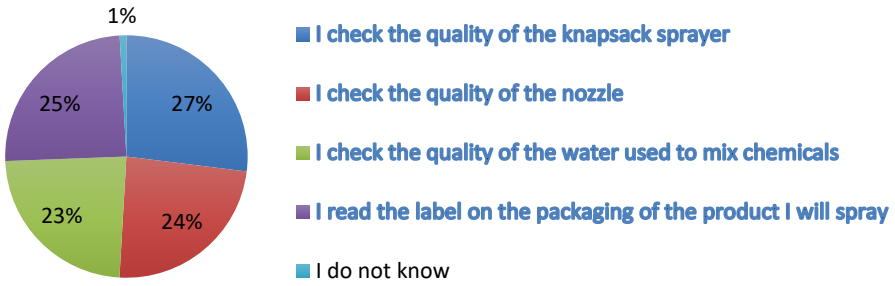
9. What are the benefits coming from the use of organic fertilizers?



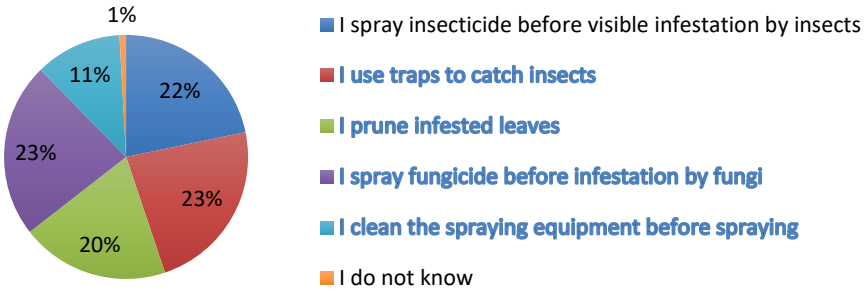
10. Why the alternation of pesticides is important?



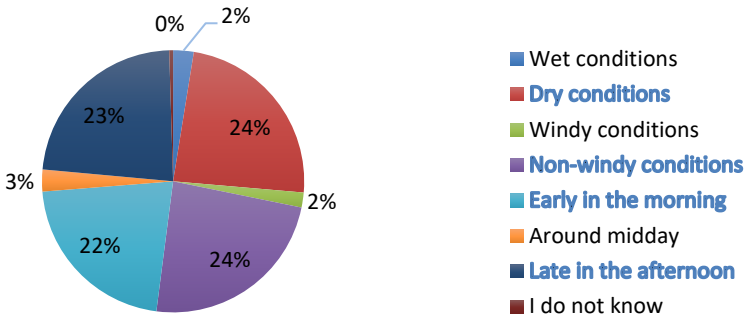
11. What should I do before spraying?



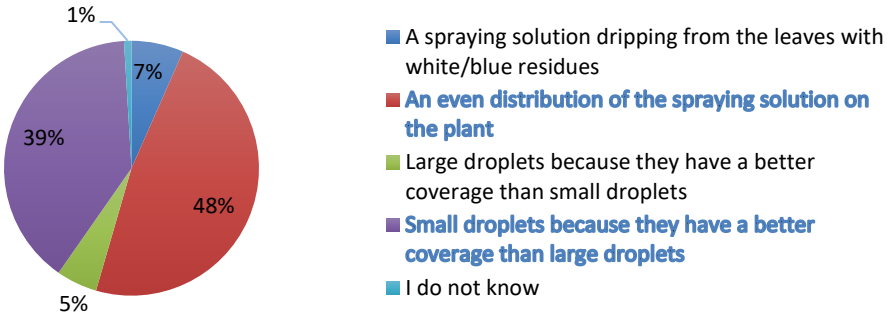
12. What can I do to prevent pests and diseases infestation based on IPM approach?



13. What are good conditions for spraying?



14. What are the characteristics of a good spraying practice?

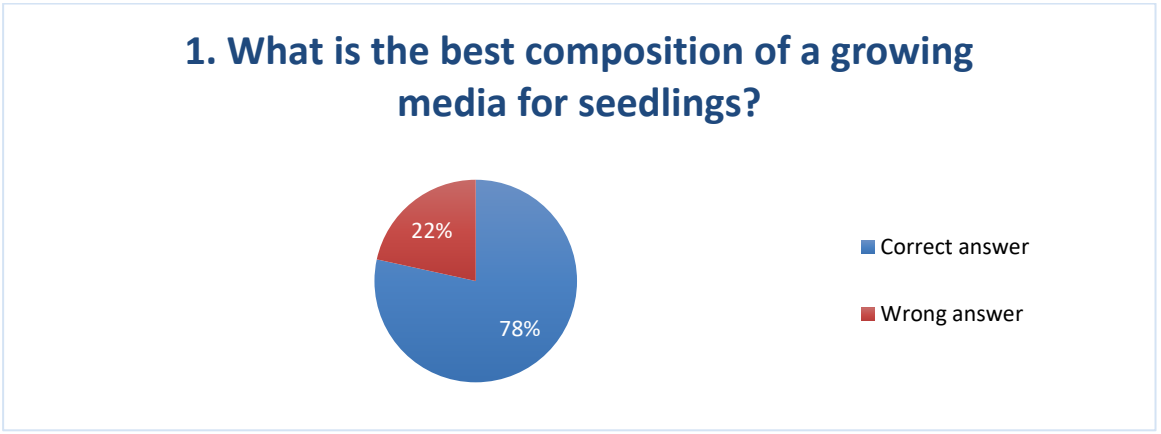


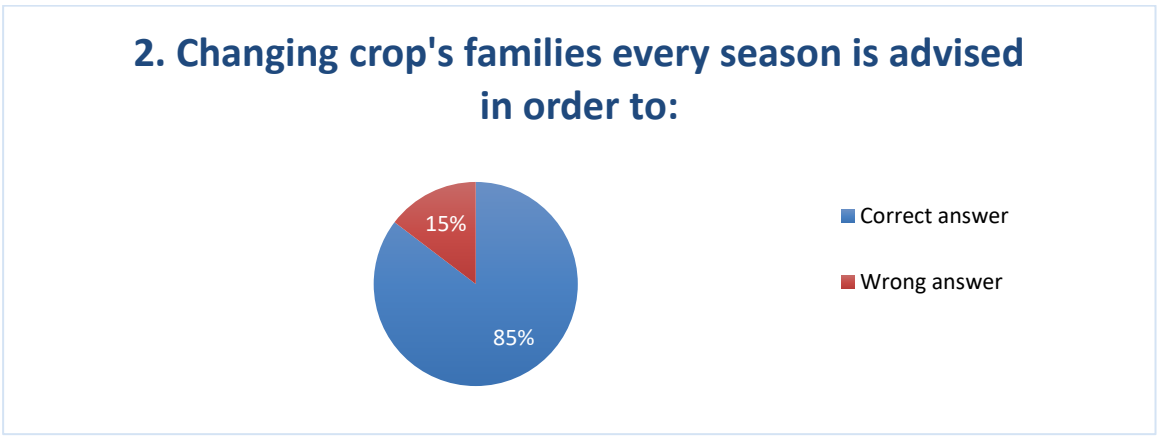
15. Can I mix pesticides while preparing a spraying solution?

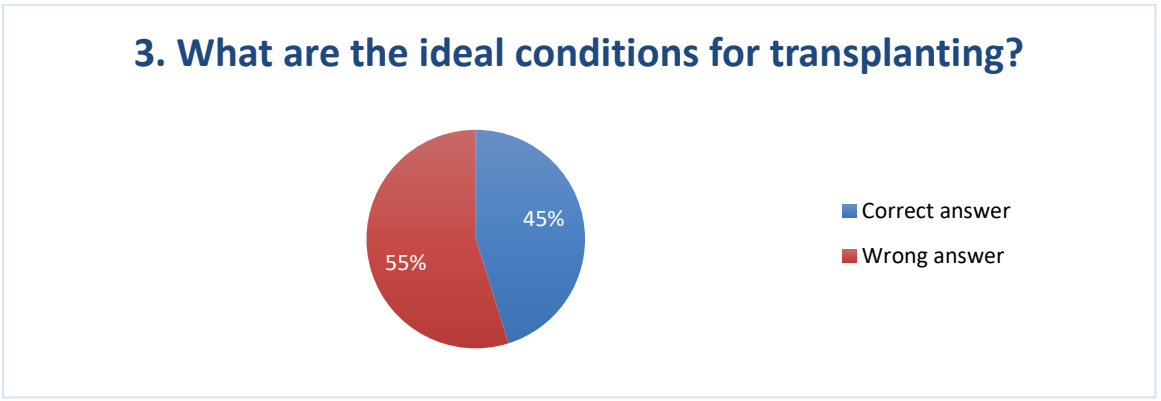

16. What are the recommended practices after spraying?
4%
0%
32%
30%
32%
2%
Clean the spraying tank right after spraying
Directly store the spraying equipment after spraying
Take a shower right after spraying
Wash your clothes separately from everyday clothes
Wash the clothes used for spraying with everyday clothes
I do not know

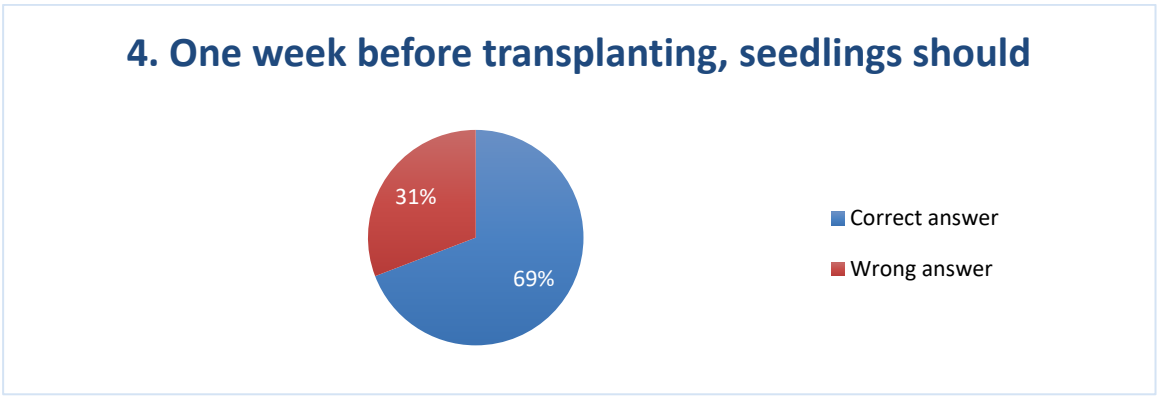
Annex 9. Knowledge Transfer test – share of correct answers

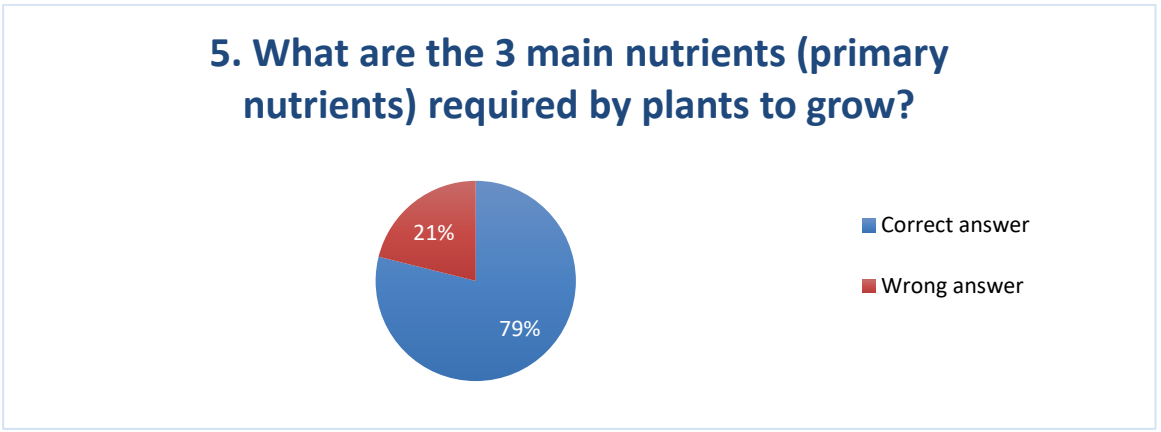
The following paragraph presents the share of right answers per question for the entire sample of respondents. As a reminder, depending on the questions, the correct answer can be one single proposition or a combination of several. Correct answers for each question are presented in the previous section.

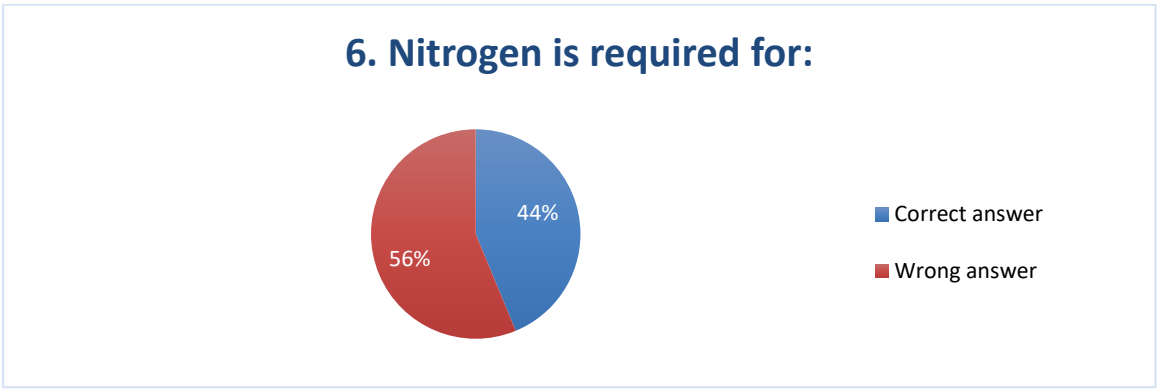


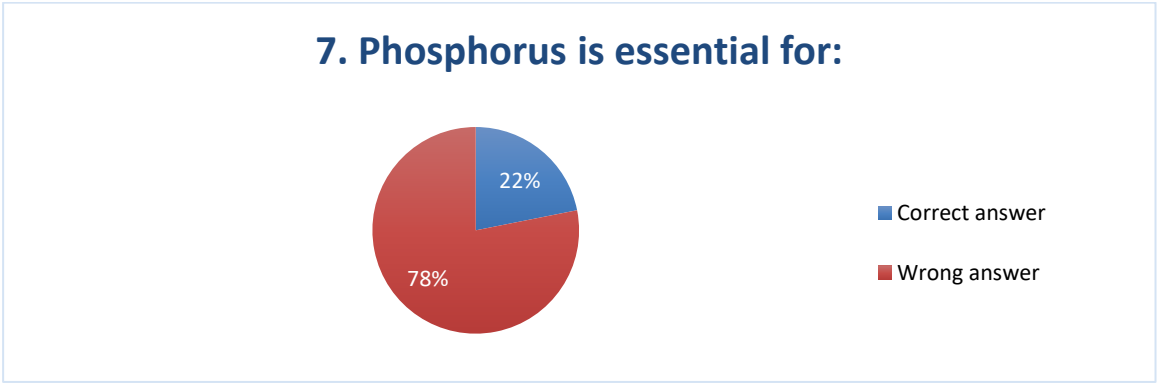


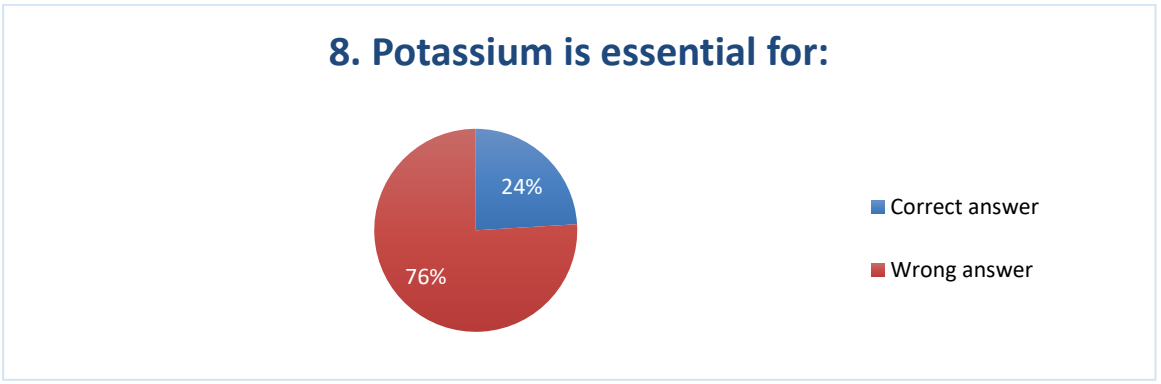


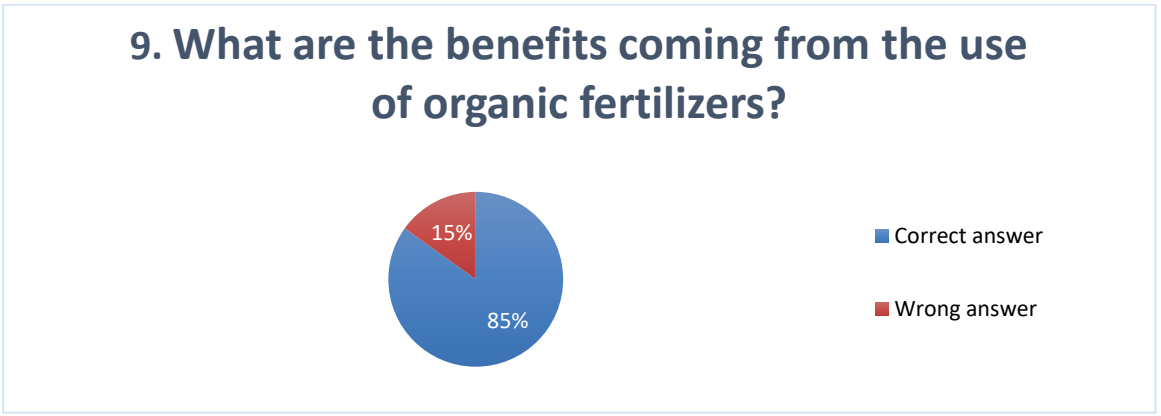

4. One week before transplanting, seedlings should
31%
69%
Correct answer
Wrong answer

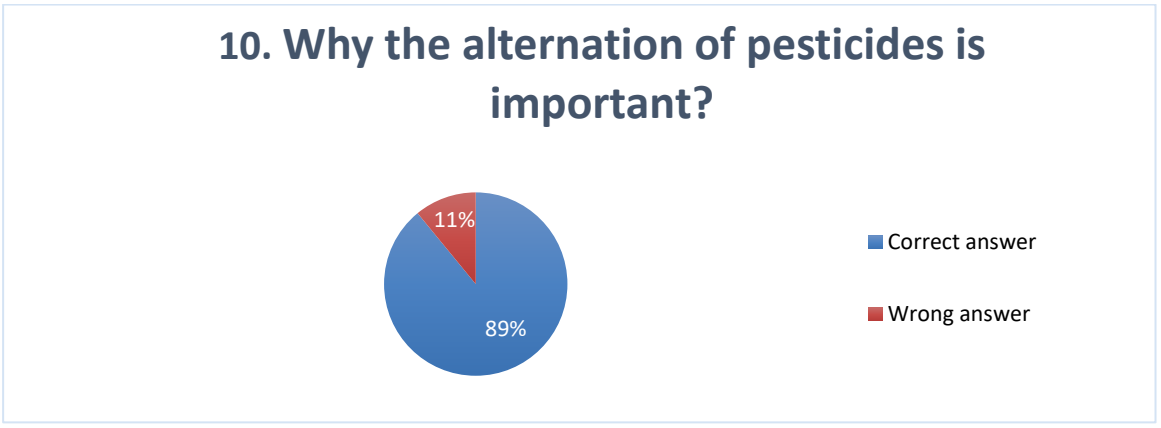

5. What are the 3 main nutrients (primary nutrients) required by plants to grow?
21%
79%
Correct answer
Wrong answer

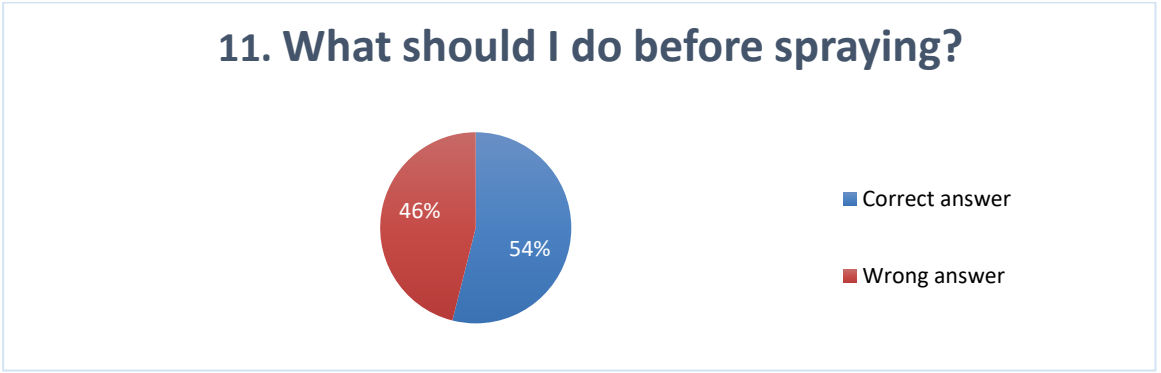

6. Nitrogen is required for:
44%
56%
Correct answer
Wrong answer

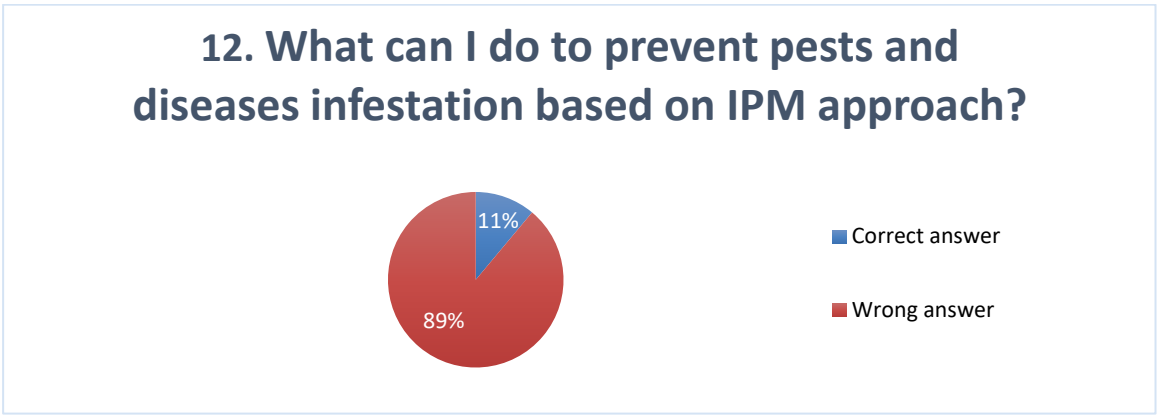

7. Phosphorus is essential for:
22%
78%
Correct answer
Wrong answer

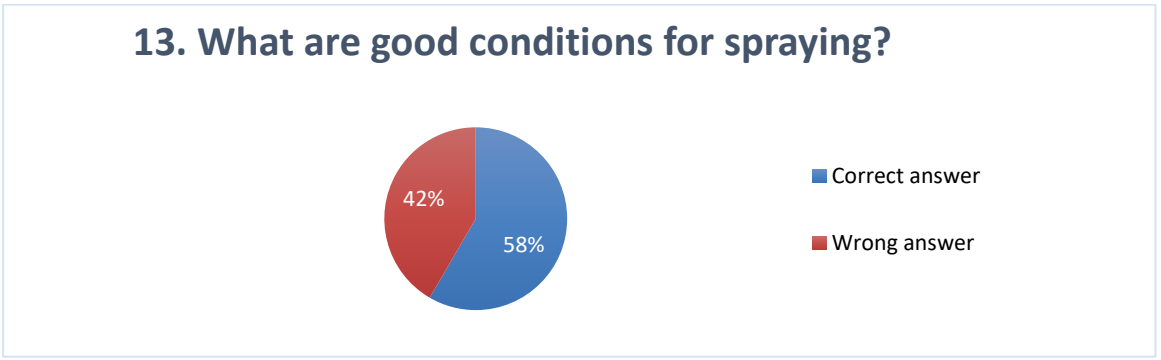

8. Potassium is essential for:
24%
76%
Correct answer
Wrong answer

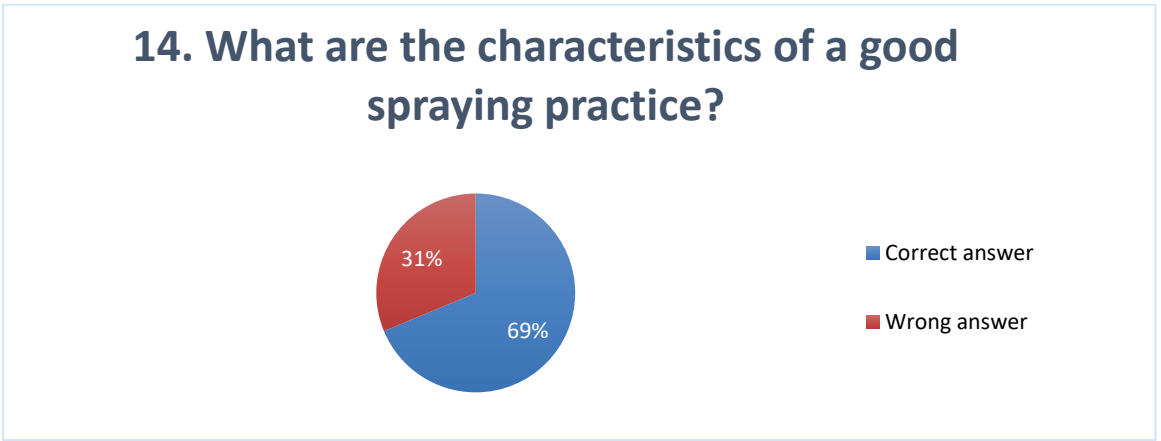

9. What are the benefits coming from the use of organic fertilizers?
15%
85%
Correct answer
Wrong answer

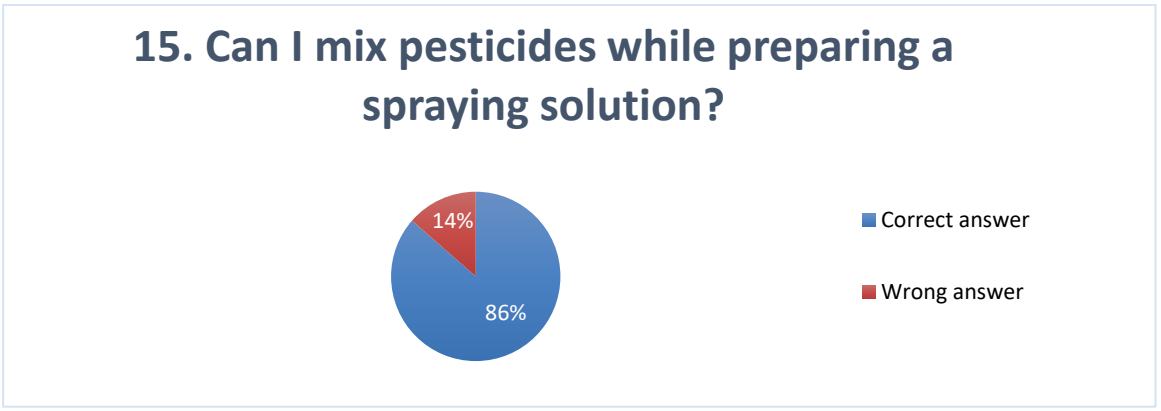

10. Why the alternation of pesticides is important?
11%
89%
Correct answer
Wrong answer


11. What should I do before spraying?
46%
54%
Correct answer
Wrong answer


12. What can I do to prevent pests and diseases infestation based on IPM approach?
11%
89%
Correct answer
Wrong answer


13. What are good conditions for spraying?
42%
58%
Correct answer
Wrong answer


14. What are the characteristics of a good spraying practice?
31%
69%
Correct answer
Wrong answer


15. Can I mix pesticides while preparing a spraying solution?
14%
86%
Correct answer
Wrong answer


16. What are the recommended practices after spraying?
25%
75%
Correct answer
Wrong answer