FACILITATORS' FIELD GUIDE FOR FARMER FIELD SCHOOLS ON PARTICIPATORY PLANT BREEDING

Module:
Participatory Variety Enhancement

SD = HS Sowing Diversity = Harvesting Security

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Module: Participatory Variety Enhancement

This module is written by Frederik van Oudenhoven, Anita Dohar and Hilton Mbozi.

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This illustrated field guide is developed jointly with SD=HS' consortium partners. It is based on Farmer Field School training experiences in Zambia, Zimbabwe, Uganda, Peru, Guatemala, Lao P.D.R. and Nepal.

Parts of this guide draw on the manual for 'Stratified Mass Selection in Maize' (Selección masal estratificada en el cultivo de maíz) written by Marío Roberto Fuentes López for FUNDIGASOCUCH-ICTA.

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Most illustrations in this module are inspired by indigenous farmers and their farms in the Peruvian Andes and the Cuchumatanes Highlands in Guatemala. Some illustrations were copied from other illustrated guides, which represent people from different cultures.

All illustrations by Irene Cécile (**www.irenececile.com**) 2021

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This module is part of the Facilitator's field guide for Farmer Field Schools on Participatory Plant Breeding.

03. Participatory Variety Enhancement

Participatory Variety Enhancement (PVE) works with appreciated local varieties of cross- and self-pollinating crops. The objective is to either i) **restore** characteristics, or 'traits', that have deteriorated over time, ii) **improve** preferred traits, or iii) **adapt** the varieties to changing growing conditions.

What makes PVE attractive is that it requires no materials from outside. Farmers work with their own varieties, including 'official' varieties that have been in their community for a long time and which may have deteriorated. These varieties are generally well-adapted to local growing conditions and farming practices and they have an important role in fulfilling the cultural and nutritional needs of the community.

By carrying out rigorous selection over three or more growing seasons, farmers will be able to improve the quality of seeds and the productive potential of the variety (a 20% increase in yield is common). This can result in the continued use and conservation of the variety; it may also mean the community is able to produce good quality seeds for the market.In this module we will walk through a full Farmer Field School

(FFS) season working on PVE. From the setting of breeding objectives to obtaining seeds, land preparation and sowing, to the selection that must be done at different growing stages of the crop and finally the harvest and final evaluation of the work.

For other topics related to Participatory Plant Breeding in Farmer Field Schools, please refer to the other illustrated guides and the elaborate field guide on the SD=HS website (www.sdhsprogram.org).

Incomplete cover of the maize causes ear rot and makes it easy for insects to enter. This trait can be removed through selection.

When the maize ears are high on the plants they are difficult to harvest and can make the plants fall over, or 'lodge'.

Through PVE, plant and ear height can be reduced.

Structure of the module

Checklist for facilitators: key points of attention

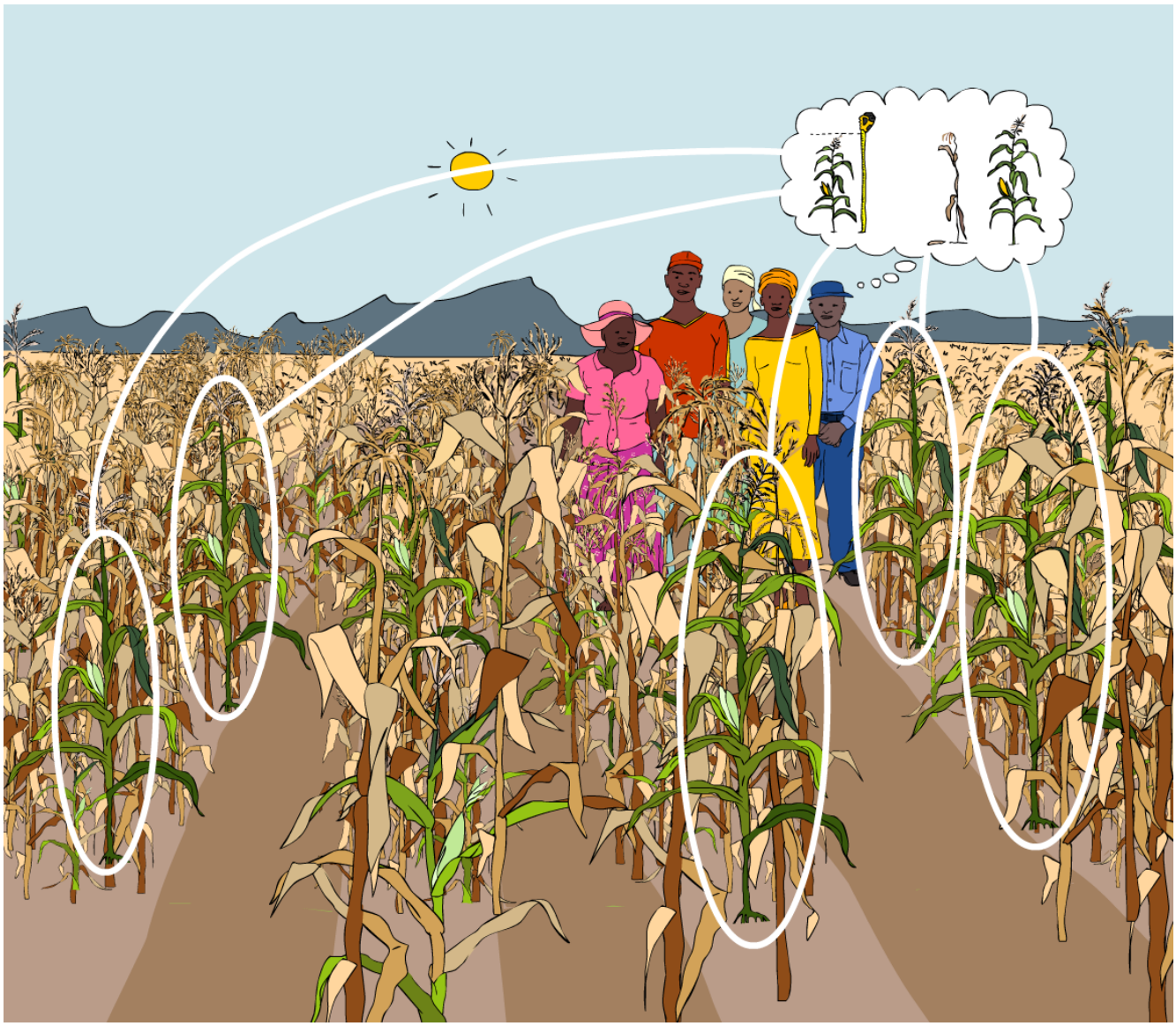
1. When to choose Participatory Variety Enhancement as a breeding approach?

You should choose PVE when these three conditions apply:

- ☐ You can find the traits you are looking for in a crop variety in your community or in a community nearby.
- ☐ The variety can be improved or restored through **selection**. Consult a plant breeder if you are not sure whether selection will help enhance desired traits and remove negative traits.
- ☐ The variety, despite weaknesses and the arrival of new varieties, remains **popular** in the community and farmers are keen to improve it and continue to grow it.

If these conditions are not met, it is better to look for different varieties (see the module on Participatory Variety Selection) or create a new variety through cross-breeding (see the module on Participatory Variety Development).

Note: Selection of traits, and hence PVE, ***does not work with crops that are propagated through clones****, such as potato, cassava, sweet potato, yam, ulluco. Selection and good agronomic practices can improve the quality of harvested seeds of these crops, which can improve the next season's yield, but cannot change a variety's traits.*



If some plants of a local variety have the desired traits and others don't, strict selection can improve the variety by increasing the number of plants that have these traits.

2. Preparation

- ☐ Has the FFS carried out the diagnostic process?
- ☐ Do all FFS members agree with the choice of crop and variety?
- ☐ Has the FFS defined clear, realistic and measurable breeding objectives?
- ☐ When is the best time for the FFS group to ask support from

breeders?

3. Source of the PVE seeds

- ☐ Where and when can the FFS get seeds of the variety? How many seeds do you need?
- ☐ Who will be responsible for obtaining the seeds?

4. Site selection and size of the PVE plot

- ☐ Is the chosen site easily accessible for community members? Is it representative of agricultural land in the community?
- ☐ Is the site large enough to grow 2000 - 5000 plants?

5. Selection method

- ☐ Is your crop self- or cross-pollinating? Will you use only positive selection or also negative selection?
- ☐ At which stages will you do selection?
- ☐ What is your selection pressure (what percentage of plants will you select for next season)?
- ☐ How should the group agree on the final selection of plants?
- ☐ How will the group use the breeding objectives to guide the selection of plants and seeds for next season?

6. Harvesting and evaluation

- ☐ How will you evaluate progress?
- ☐ How many seeds need to be saved/harvested for next season?
- ☐ When will the FFS organize the Farmer Field Day?

Gender: women and men in the Farmer Field School

For any work done in a farmer field school to be successful, it needs to respond to the needs of all participants – women, men, youth. PVE will require at least 3 seasons and if not everybody feels their interests are included, people will stop coming to the weekly sessions very quickly. This is why the breeding objectives must reflect equally the preferences of men, women and youth.

It is also important to organize the FFS in such a way that women and men can take part equally in the activities, that the workload is shared and that decisions are taken by all. Even if this is not the case in regular community life, it can be rewarding to address unfair or unproductive relationships between men and women *within* the FFS, for example by supporting women to take on leadership roles.

Here are some tips to keep in mind during critical stages of the FFS season:

FFS formation	*Try to balance the number of men and women FFS participants. Identify and see if it is possible to address issues why men or women would not want to take part in the FFS.* *The FFS members and the FFS site should represent the reality and needs of the majority of the community. The FFS should consist of a mixed of people, coming from different socio-economic background, including the poorer majority, women and youth.* *Support the election of women and youth for FFS leader and other functions.* *When drafting the FFS constitution, agreements can be made about men and women having an equal say in decision making.*
Diagnostic stage and the setting of breeding objectives	*Consider conducting the 'Gender journey*' to agree on specific gender action points for the season.* *Create men and women-only subgroups when discussing the choice of crop and its preferred characteristics.* *When the FFS votes on the crop and the breeding objectives, men and women vote using differently colored seeds. This will highlight any differences in preferences, which will be discussed in plenary.* *If there is strong divergence in preferences, women and men may focus on their own crops or breeding objectives in separate sub-plots.*

** The 'Gender Journey' is a module in the FFS Field Guide. It is a dedicated exercise to work towards gender equality and women leadership in the farmer field school.*

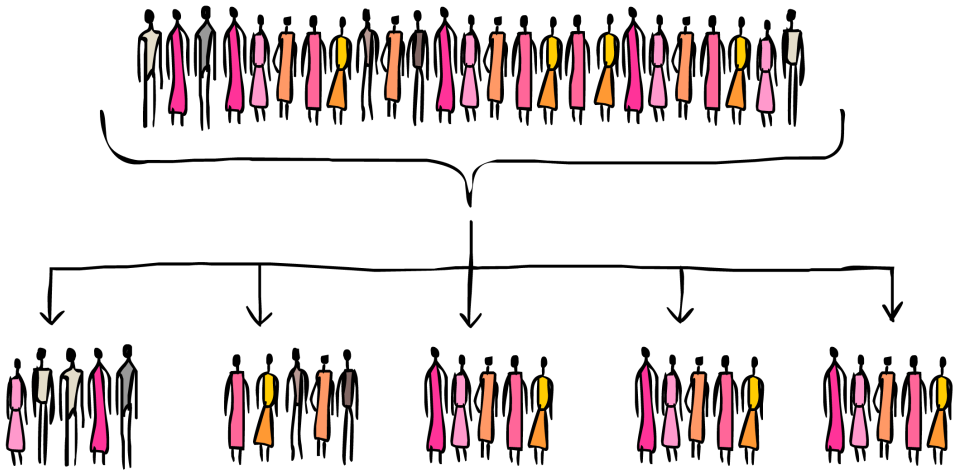
Developing the workplan	*Choose meeting times that suit all participants and that interfere as little as possible with other family or household duties (childcare, cooking, market times).* *Divide tasks and labour fairly among men and women.*
Final evaluation by FFS participants	*The evaluation of the progress that has been made towards achieving the breeding objectives starts with men and women subgroups.* *If relevant, evaluation should be done both in the field and in the kitchen.*

Frost resistance, marketability or nutritious values: men and women often prioritize different traits. Their preferences should be reflected equally in the breeding objectives of the FFS.

Step 1: Organising the group

The establishment and organisation of the farmer field school are described in detail in the FFS Field Guide and the two illustrated field guides on 'Plot design for Participatory Variety Selection' and the 'Diagnostic Stage'. Here is a summary:

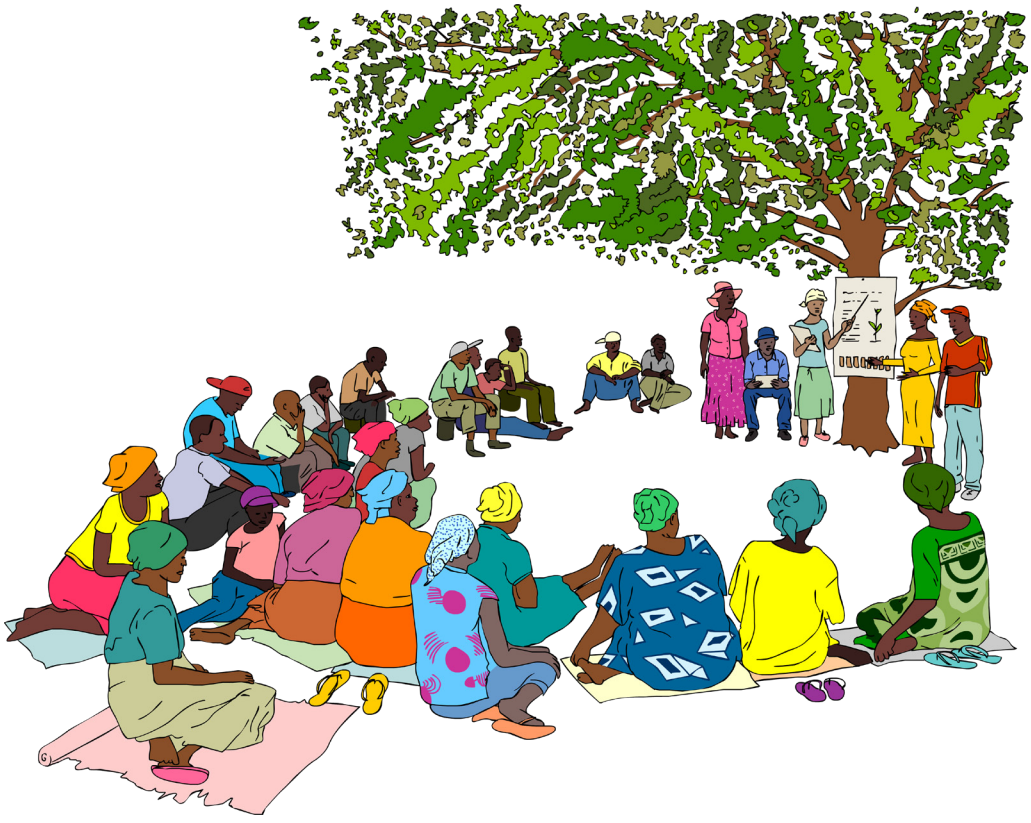
- A FFS consists of 20 to 30 members. The group is divided into sub-groups of five people. This allows everyone to participate. Subgroups are generally mixed, except at times when it is important to consider the perspectives and interests of women and men separately (e.g., during the diagnostic stage and the final evaluation).



- Subgroups have a leader, reporter and recorder (someone who is able to write). The functions of reporter and recorder may rotate from week to week to allow all members to assume responsibility and gain experience.

- Each sub-group is assigned a part of the FFS plot to maintain and to conduct weekly tasks and observations.

- FFS sessions go back and forth between working, observing and discussing in **sub-groups**, and presenting and discussing their findings in the entire group (**plenary**). Decisions are made in plenary, based on the inputs from the subgroups.

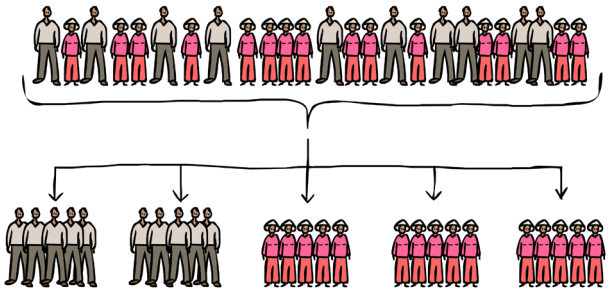


Step 2: Choosing a crop and defining breeding objectives

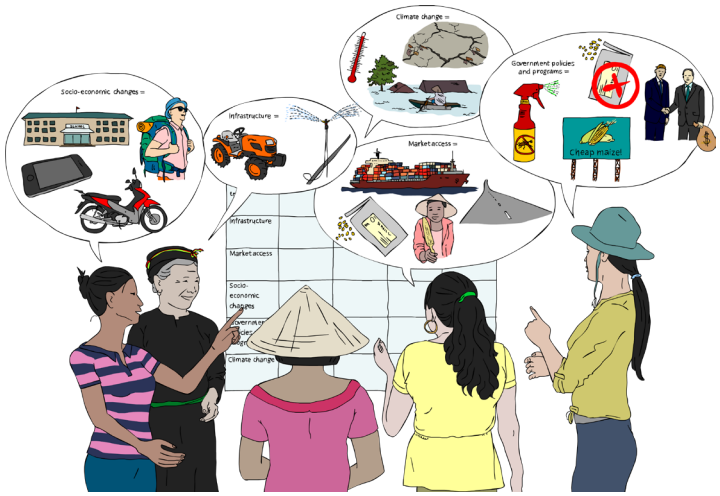
The decision of the FFS to do Participatory Variety Enhancement, to work on a specific crop or variety, and the breeding objectives they choose, must be the result of a **careful decision-making process**. All members of the FFS must have their say. We call this process the **Diagnostic Stage***. The diagnostic stage is crucial to ensuring the FFS will address the primary needs and concerns of the farmers in the community. This is the only way to ensure the farmers' commitment.

Again, a short summary:

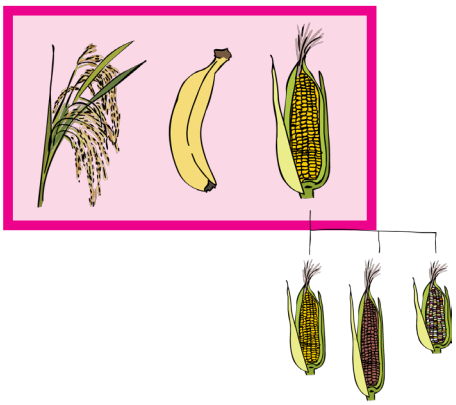
- For the diagnostic exercises, the FFS group is divided into sub-groups of women and men only (or, alternatively, by socio-economic status). This helps makez sure that both women and men feel completely free to express their ideas and preferences.



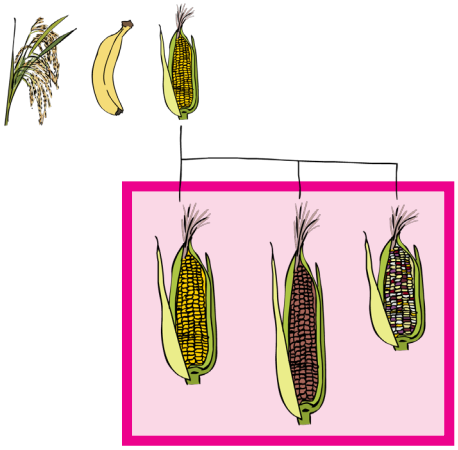
- Doing the **Timeline Analysis**, the FFS participants try to understand the challenges in their farming systems – socio-economic, climatic, cultural and infrastructural – that their breeding efforts need to address.



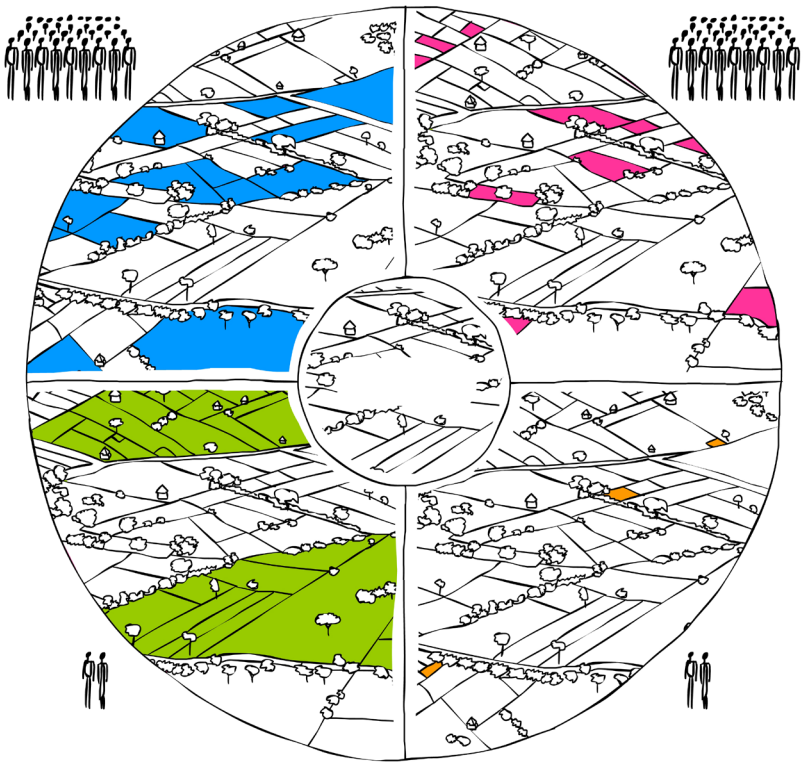
** The Diagnostic Stage is explained in detail in a separate illustrated module.*



- The **Diversity Wheel for Crops** helps farmers identify the crop they want to work on in the FFS. This is the crop the FFS members agree is most important to improve or solve problems with.



- The **Diversity Wheel for Varieties** helps identify the traits, farmers find most important in the chosen crop. Traits can be positive (to further improve) or negative (when you want to eliminate them). Farmers prioritise the important traits on the list through voting. Men and women vote with differently coloured seeds to visualize their preferences. The prioritised list of traits forms the basis for the **breeding objectives** that will guide the PVE work.



Setting breeding objectives

Every farmer or farming community has different preferences when it comes to their crops or crop varieties. And every growing environment poses different challenges. This is the reason there exists such an enormous diversity of crops and crop varieties.

When beginning PVE, it is important to define as precisely as possible the 'profile' of the variety the FFS is looking for.

This begins with the list of most important traits defined when doing the Diversity Wheel for Varieties.

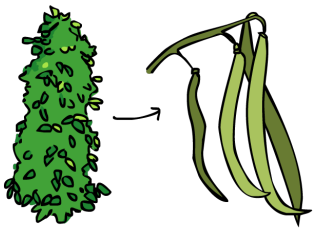
If there is a variety in the community that matches a few of these important traits, the FFS systematically analyses that variety, listing its positive and negative traits.

When the FFS thinks they can further improve that variety through selection*, this is the variety they choose for their PVE work.

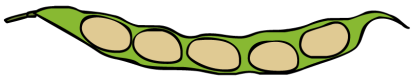
* ***What traits can be selected?*** *Some traits are easier to improve or remove through selection than others. For example, plant height, disease tolerance, early maturity and traits related to yield (cob or grain size) are relatively easy to select. Taste and drought-resistance, however, are much more difficult. You do not want your work to be in vain, so ask a plant breeder for help if you are not sure!*

cooking time

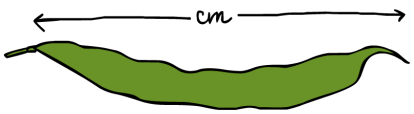
number of pods per plant



number of seeds per pod

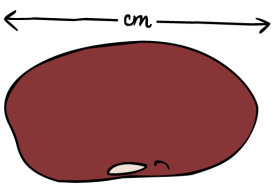


pod size

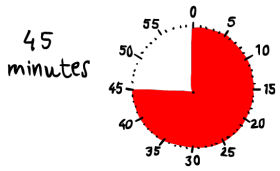
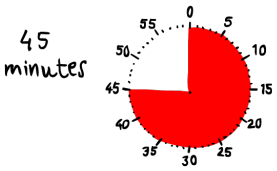
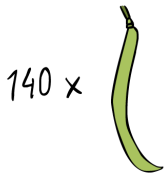
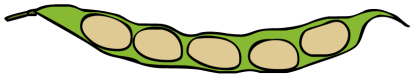
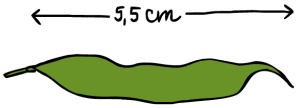
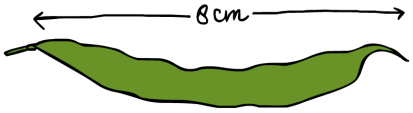


seed color

seed size



pod rot / disease resistance

Deteriorated local variety	Ideal variety	votes (by **men** and **women**)	ranking
		𝍸 ||	3.
		𝍸 𝍸	1.
		𝍸 |	4.
		|||	7.
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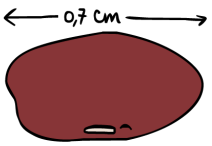
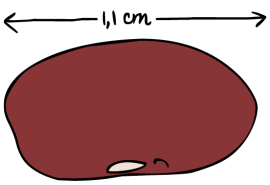
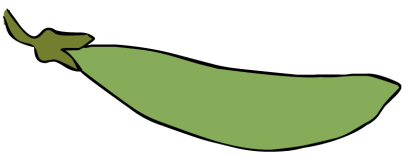
		𝍸	5.
		𝍸 |||	2.

A variety can be used for PVE work if it includes important traits the community is looking for and if the variety can be further improved through selection.

Step 3: Finding seeds

Finding good seeds is an important start. Discuss what may be the best places to find this seed: from one of the farmers from the FFS, a good farmer in the wider community or from a neighbouring community, a community seed bank, or even the national gene bank.

There should be at least 2000 seeds, as this gives enough diversity to select the right plants. The maximum number is guided by the space available, but need not be higher than 5000.

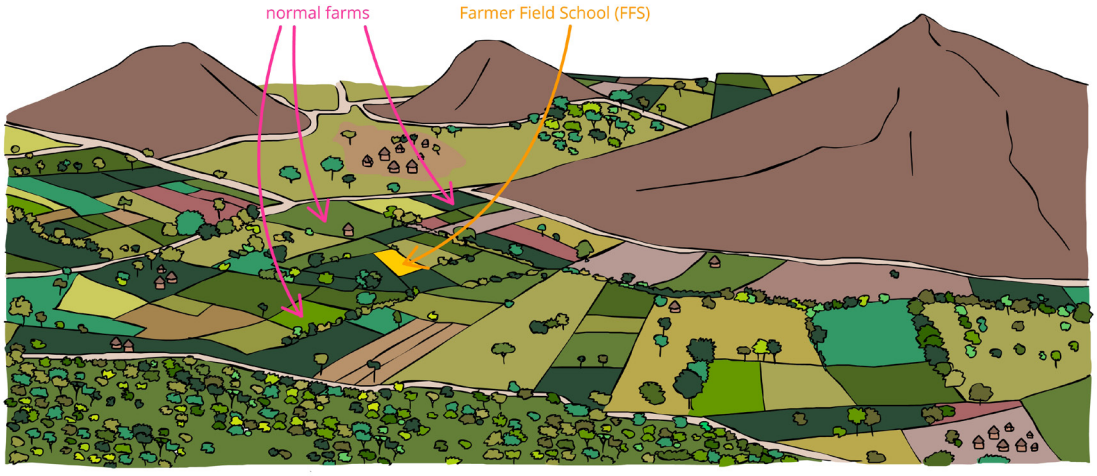
Some criteria:

- Follow farmer's criteria for selecting best seeds (e.g., colour, not wrinkled, size)
- Use seed with the best possible germination and vigour, preferably from a recent harvest
- Seed should not be mixed with seed from other varieties or crops
- Choose seed that is adapted to the local altitude and environment (if seeds are coming from outside the community)

Step 4: Plot design* and planting

In selecting the site of the FFS plot it is important to consider a few general criteria that apply to all participatory plant breeding methods. These include:

- The plot should be **representative** of agricultural fields in the community, in terms of soil, slope, moisture and (sun) exposure. There is no need for the land to be entirely uniform, as with PVE the best performing plants will be selected from all corners of the field, including the parts where conditions are poorer.



- It should also be **easily and safely accessible**, near a road or a pathway, and within walking distance for all participants, especially **women**. The plots should also be familiar to women and be representative of their own plots; otherwise, results may only cater to men's interests and demotivate women's participation.

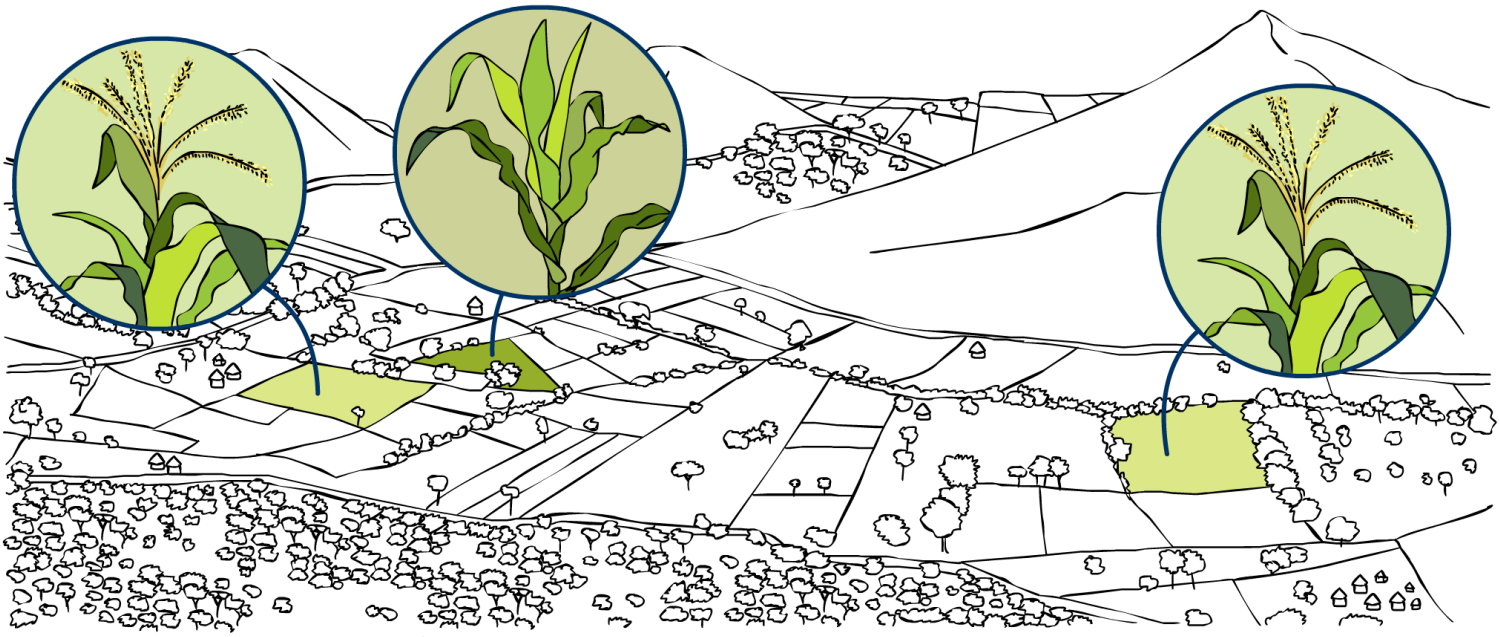
- And protected from **animals** (fenced).

** The Plot design is explained in detail in a separate illustrated module.*

When doing PVE, plot design should also consider **isolation**:

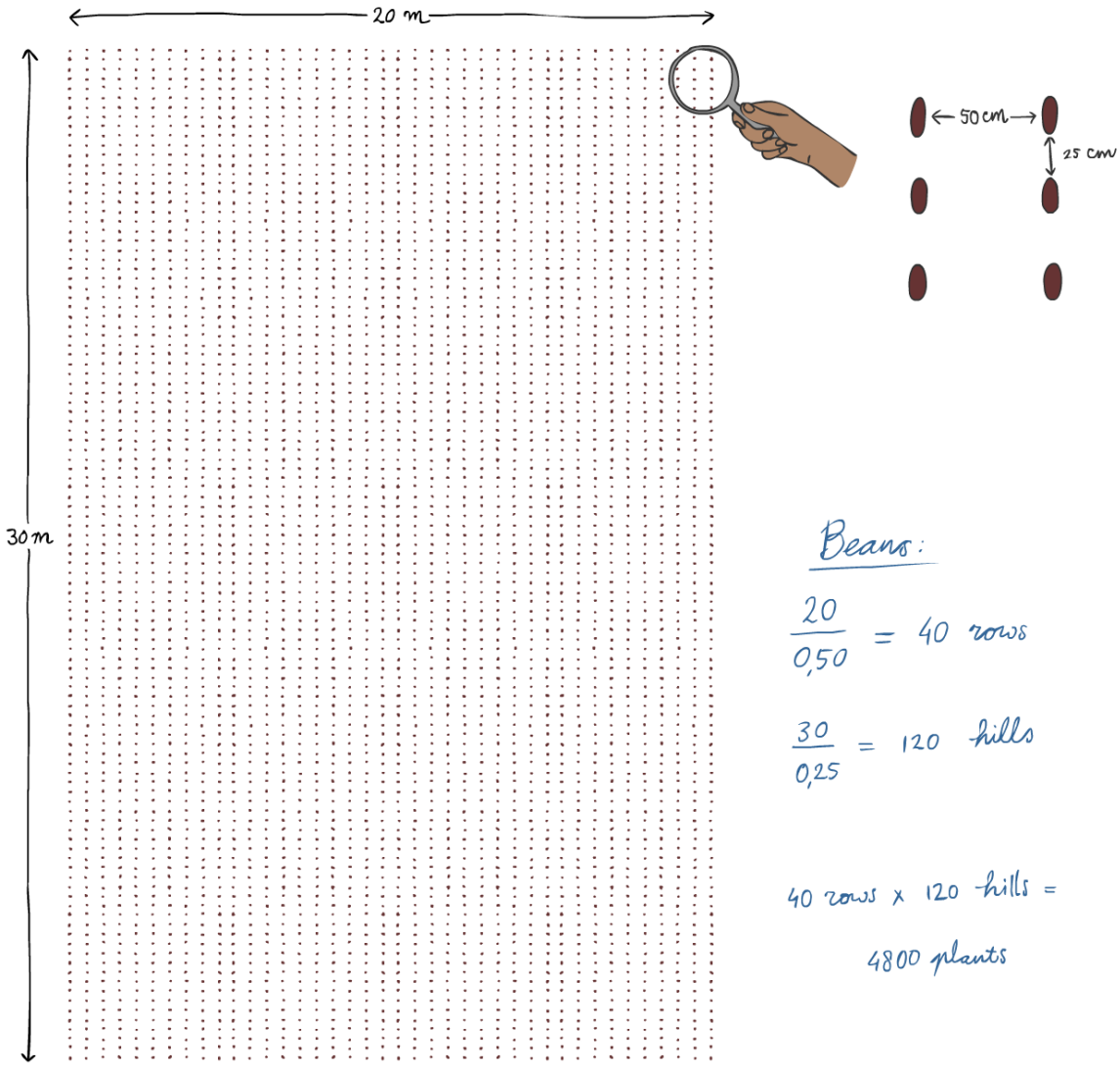
If the crop is **cross-pollinating**, pollen from other varieties of the same crop can reach and 'pollute' the plants in the plot where PVE is being done (see step 6: *Selection*, below, for an explanation). This can be prevented in two ways:

- By keeping a distance of 200-300 meters from those other plots.
- By making sure the flowering time of the PVE variety does not overlap with that of other varieties. Early or delayed planting of 15 days is usually enough, although it may not be feasible everywhere because of shortening growing seasons and unreliable rains. Isolation is not necessary if the crop is self-pollinating.



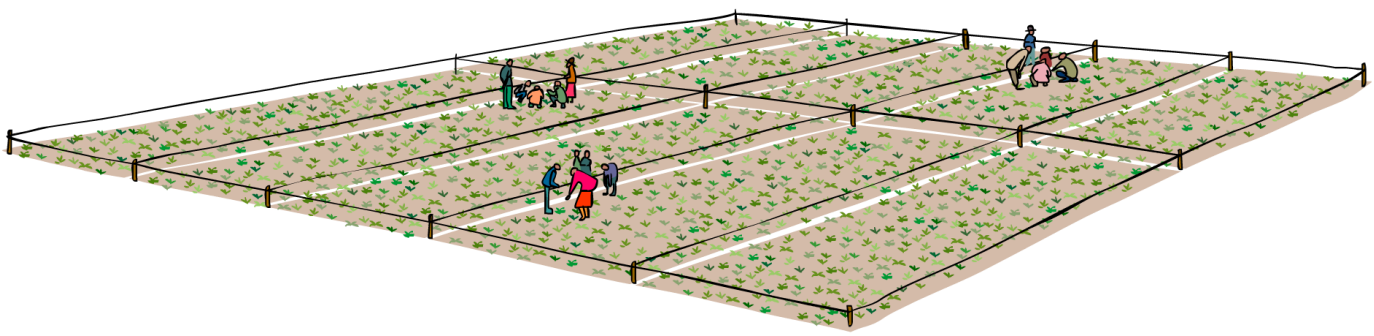
Size of the plot

- The **recommended size of a PVE plot** is about 600 square meters (e.g., 20 x 30 meters). As an example: if the planting distance is 20cm between plants and 80cm between rows, this gives a total of 3750 seeds.
- Often a community will have less space available, and sometimes more. In that case, keep in mind that the **minimum number of**



seeds required is 2000.

- The plot is divided into 10 smaller subplots and **each sub-group of five people is allocated two subplots**. In these subplots, they will observe plants, take recordings, and perform selection. At the time of harvest, equal numbers of plants will be selected for seed from each subplot. It is a good idea to mark the subplots well.



Planting

The facilitator and the members of the FFS ensure that the land is well prepared for planting, according to the requirements of the crop. **All FFS participants take part in land preparation and planting.**

Unless the FFS decided to isolate the plot through early or delayed planting, **sowing should be done at the same time as the other fields in the community**.

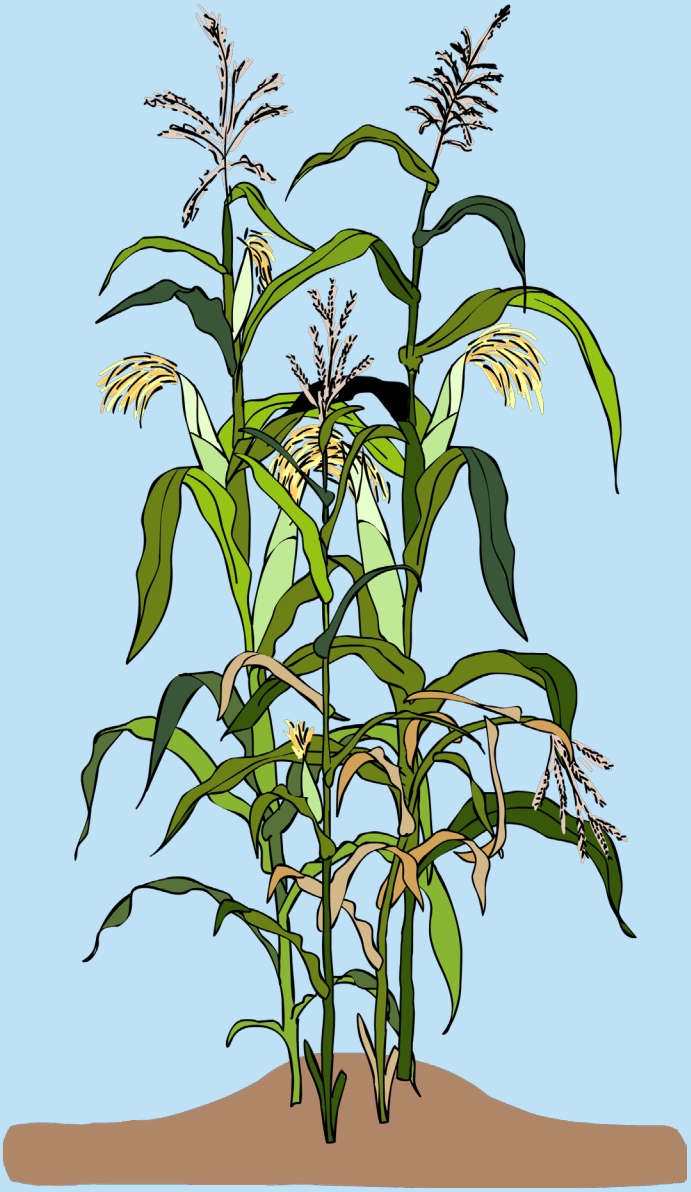
The planting density should follow common farmers' practice or be determined together with the agricultural extension worker or breeder assisting the FFS. In most PPB studies, seed is planted in rows at a set interval*. Depending on the crop, it is good practice to sow several seeds per hill, especially if the germination rate of the seed is not optimal. The crop can be thinned one week after emergence to achieve the desired spacing. The FFS can also decide not to thin the plants to stimulate competition among the plants (see box 'Maize in Guatemala').

** The illustrated guide on Plot design for Participatory Variety Selection includes examples of planting densities for maize, sorghum, millet and groundnut.*

Maize PVE in Guatemala: best practices

Maize was domesticated in Guatemala and Mexico 6,000 to 10,000 years ago. Cultivation practices are very old and there is an incredible diversity of local varieties. A common way to grow maize in Guatemala is together with pumpkin and beans: the maize stem supports the growing bean vines (the strength of the stem can be an important breeding objective!), the bean plants help fertilize the soil, while the pumpkin leaves protect the soil from erosion.

When doing PVE, farmers in Guatemala sow 4 or 5 seeds per hill and, contrary to practice in many other places, they do not thin the plants after they emerge from the ground. This way the roots of the plants compete for space, water and nutrients. The plants that do this best are visibly taller and stronger than the other plants growing from the same hill. These strong plants are the ones from which the ears are selected at harvest time.



Step 5: Weekly activities

Agro-ecosystem analysis (AESA)

Field observations are the heart of the weekly FFS meetings. They are guided by the breeding objectives and practical questions raised by the participants and are the starting point of the weekly discussions. Divided into their small groups, participants randomly select five plants from their sub-plots each week. They study the performance of these crops, the growing conditions, pests, diseases, and beneficial insects. In essence, **they study how the plants (genes) interact with the local growing conditions (the environment) that characterize their farms**. They note down their observations on agro-ecosystem analysis (AESA) forms and discuss these in the plenary, and jointly take decisions about crop management or selection (see step 6).

In each crop, different traits are important, and these traits become visible at different growing stages. Therefore, each crop has its own AESA forms, which differ slightly for each stage of crop development.

Summarized results of the AESA observations at **critical growth stages**

are used in the final evaluation of the PVE work. These stages are the early vegetative ("emergence") stage, the late vegetative stage, the flowering stage, and the maturity stage. The results can also be very valuable for breeders and breeding institutes working together with the FFS. An app called KoboToolbox is available to share the results via smartphone or tablet.

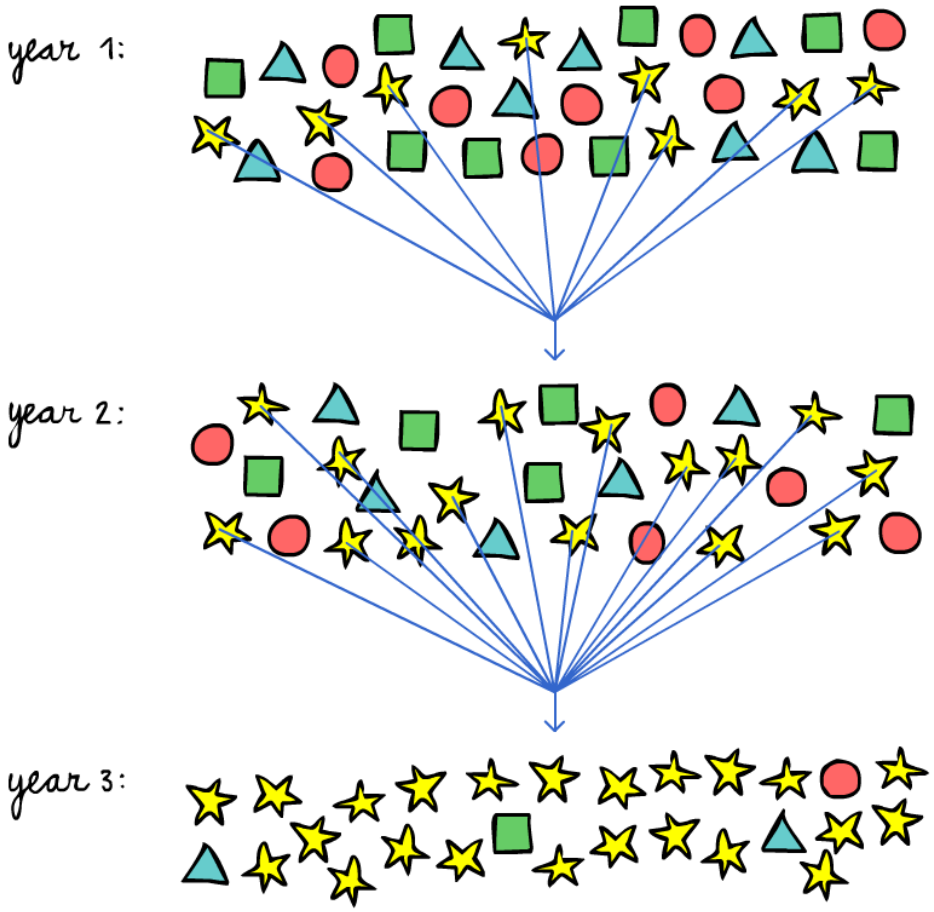
Step 6: Selection in PVE plots

In Participatory Variety Enhancement, the FFS works with a local variety that shows variability, or diversity: the variety is not anymore (or probably never has been) uniform and plants differ in the positive and negative traits they have, or in the degree to which they display these traits. The objective of PVE is to restore or improve the variety by **increasing, year by year, the percentage of plants in the field that have the desired traits**. Or, put differently, by decreasing the percentage of plants that have undesirable traits. This is done through **selection**. (Note that farmers are very familiar with selection, as they do it every year when deciding which seed to keep for the next season. In essence, PVE is an 'improved', more rigorous version of farmer selection.)

Over 3 years, selection in PVE looks like this:

1. In **year 1**, the FFS defines clear breeding objectives for their variety: they identify the positive traits they wish to keep, and the negative ones they want to eliminate.
2. Over the season, in line with the breeding objectives, plants with positive traits are marked and plants with negative traits are removed.
3. At harvest time, seed is selected for the next season: choose maximum 10 percent of the best plants in every sub-plot.
4. Securely store enough of the selected seed for 3 replantings (in case of crop failure).
5. Evaluate the breeding objectives. Revise them if necessary.
6. Repeat the process in **year 2**. At harvest time, evaluate whether progress has been made towards the breeding objectives. Even if already many more plants have the desired traits, it is important to still only **select the best 10% of the plants** for seed.
7. Towards the end of **year 3**, a significant improvement in the variety

and its yield should be visible. Compare with the original variety (before it was improved through selection) and decide whether to complete the study or continue to improve the variety further.



Self-pollinating plants: positive selection

Perhaps the most important thing to remember when doing PVE is that selection can be done in two ways - positive and negative - depending on whether the crop is **self-pollinating** or **cross-pollinating**.

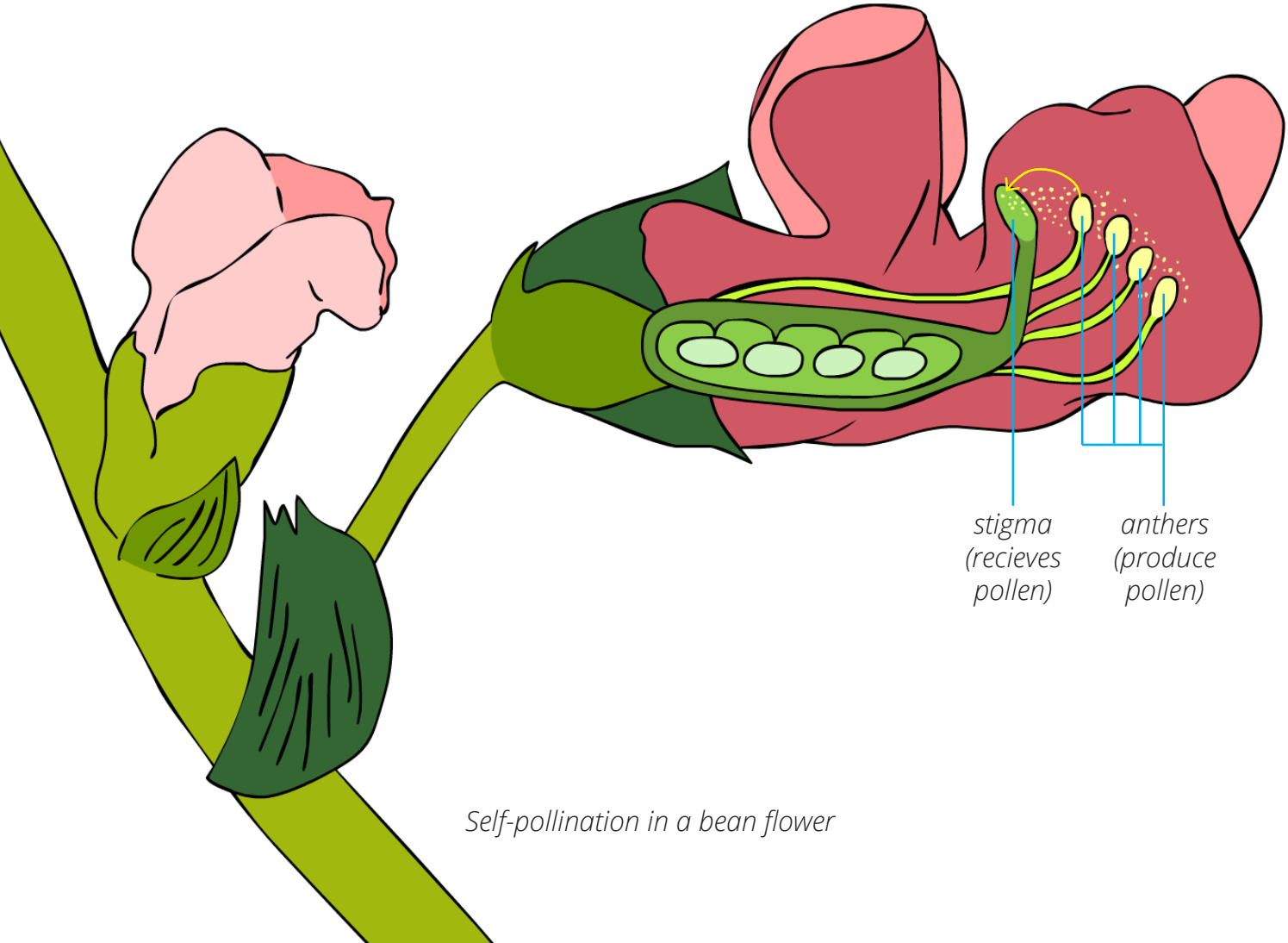
Peas, beans, rice, wheat, and many more important food crops are self-pollinating. Their flowers contain both male and female parts and generally pollination happens inside the flowers before they open, and before pollen from other plants arrives. This means the traits (genes) from poorly performing (inferior) plants cannot easily transfer to superior plants. **Inferior plants can therefore be allowed to mature.**

They will simply not be selected for seed at the time of harvest.

Since desired traits become visible at different moments in the life of a crop, positive selection must be done at different growing stages, from the vegetative stage, to flowering, to the time the plants reach maturity. This is **one way in which PVE differs from the selection traditionally practiced by farmers** to maintain crop varieties, which is generally performed only at harvest time.

Plants with desirable characteristics are marked or tagged using ribbons from cloth or plastic, or any other material that is locally available. Use different colors for different traits or breeding objectives, e.g., red ribbons for head or panicle size, blue for early flowering, green for pest resistance.

At the time of harvest, **select no more than 10 percent of the plants in each subplot for seed**: if the entire plot counts 3000 plants, and



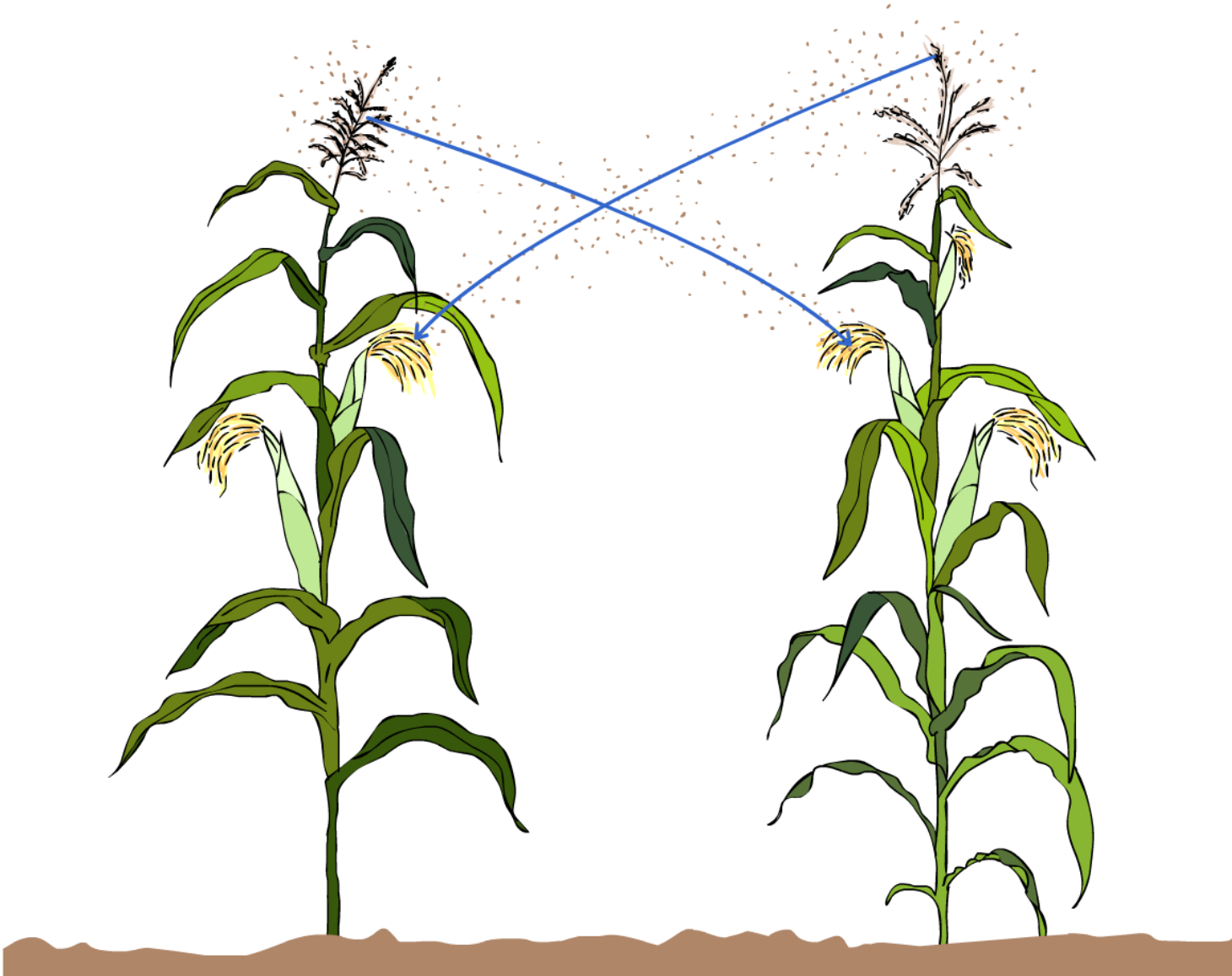
Self-pollination in a bean flower

each subplot 300, 30 plants should be selected per subplot.

Positive selection continues after harvest: seeds are selected only from heads, panicles, pods or ears with desirable characteristics. Look at head or panicle size, number of mature seeds per pod, grain size, grain pests or diseases, etc.

Cross-pollinating plants: positive and negative selection

Millets, maize, squash, and many vegetable crops are cross-pollinating. Some crops, such as sesame, quinoa and sorghum can be partially cross-pollinating: the harsher the growing conditions, the higher the chances of cross-pollination. In these crops, pollen from plants with inferior traits can pollinate the flowers of plants with desired traits.



The seeds harvested from these cross-pollinated plants will carry the inferior traits, which will show in the plants they produce. Unless cross-pollination is prevented well before the time of flowering, breeding progress will be very limited. Eliminating inferior plants to avoid cross-pollination is a second major difference with traditional selection by farmers.

With Participatory Variety Enhancement of cross-pollinating crops, **negative selection starts as soon as the crop emerges from the ground**. All weak, diseased plants and plants showing other undesirable characteristics compared to the majority of plants within a plot are removed. This process is also called 'roguing', as the 'rogue' plants are taken out.

Roguing is done during the entire vegetative growth stage and up to the point where flowers first appear. It must be done before any pollination can occur.

All the while, **positive selection** is also carried out. This happens in the same way as for self-pollinating plants, by marking the plants with desirable traits with colored ribbons (see illustration on page 34-35).

*For maize, as an alternative to roguing, a common method of negative selection is **detasseling**: the removal of the tassels, the pollen-producing male flowers from the top of inferior plants (before they begin to produce pollen!). This will still allow the plants and ears to reach maturity and contribute to harvest, but no pollen carrying negative traits will spread to superior plants.*

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Discuss the following question: If 300 plants should be selected by the end of the season, how many plants should be negatively selected (removed) before flowering?

Answer: There is no fixed percentage of plants that should be negatively selected. Two things are important: only the better plants should be allowed to flower, and enough plants should remain after the removal of poor performing plants so that the FFS can select the 300 plants for seed for next season. Remember: good plant breeders are merciless when it comes to eliminating plants that do not fit their breeding objectives.

1. *With PVE of cross-pollinating crops, negative selection starts as soon as the crop emerges from the ground. All weak, diseased plants and plants showing other undesirable characteristics compared to the majority of plants within a plot are removed. This process is also called 'roguing', as the 'rogue' plants are taken out.*

4. *At the time of harvest, only plants and ears (or panicles, heads, etc.) that fulfill one or more breeding objectives should be selected for seed.*

2. *Roguing is done during the entire vegetative growth stage and up to the point where flowers first appear. It must be done before any pollination can occur.*

3. *All the while, positive selection is also carried out. This happens in the same way as for self-pollinating plants, by marking the plants with desirable traits with colored ribbons.*

Step 7: Harvesting and evaluation

When the standing crop shows at its best, just before harvest, and when field evaluations have been completed, the Farmers' Field Day is an occasion where the FFS farmers invite their fellow community members to share what they have learned and achieved. The day may include a field tour, an exhibition, dances and tastings. It is an occasion to showcase what a group of farmers can do when working together as a team to solve their problems and can be important to secure support for follow-up activities from their community and local dignitaries.

The **final selection of plants** is guided by the breeding objectives agreed by the FFS at the beginning of the season. Only plants and ears/heads/panicles/etc that fall within the specified range of one or more breeding objectives should be selected for seed. In year 1, a plant can be selected for one or two positive traits. In years 2 and 3, the

number of traits selected in each plant progressively increases until the envisaged 'ideal' profile of the PVE variety is achieved.

Avoid selecting plants from the very edges of the plot. The possibility of cross-fertilization from neighbouring plots is higher here and plant growth is often distorted by differences in sunlight, nutrients or moisture.

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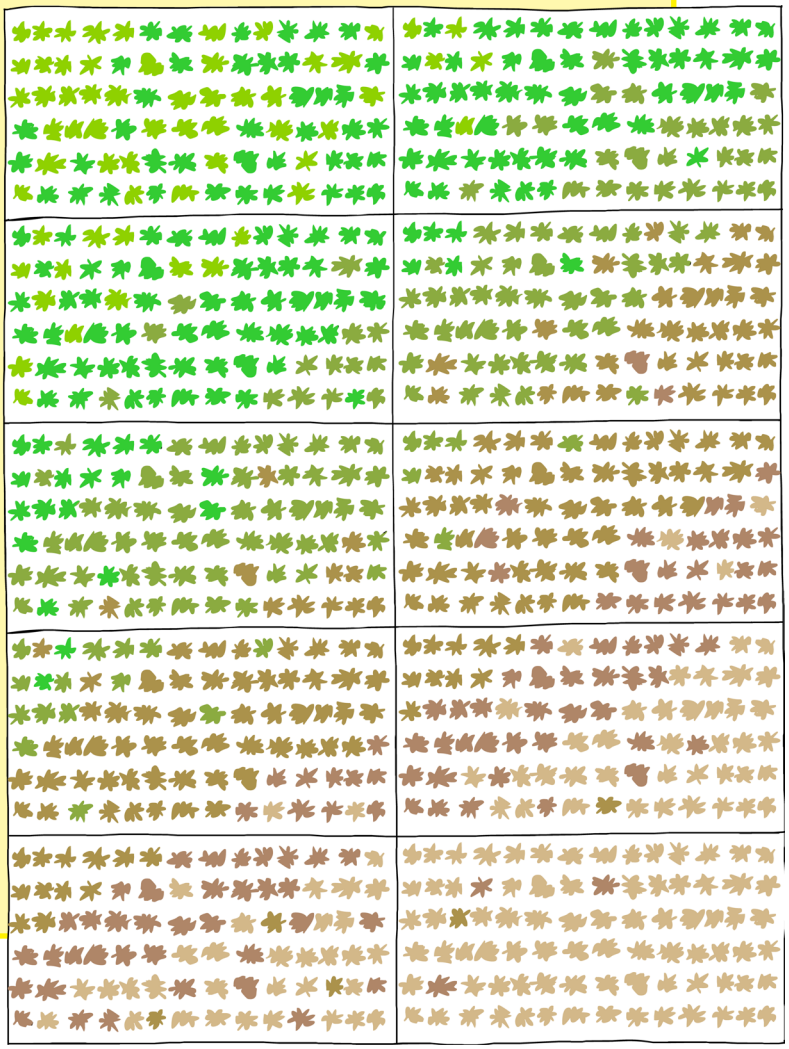
Discuss the following question: Why should we select an equal number of plants from each subplot? Why don't we simply select the best plants from the entire plot?

Answer: Soil, nutrients, water availability, or exposure to sun can vary in different parts of a field. When one corner of the field is poor, the crops there will perform worse than those in other parts of the field. This does not mean the plants themselves are inferior – they may be quite strong, but we cannot see this because the poor conditions in that part of the field prevent them from performing well. Selecting equal numbers of plants from all subplots is a way to minimize the effect of these external environmental influences on our selection efforts.



After harvesting of the selected plants, seed is put together into a single pile, or seed lot. Seed for the next season is taken from this lot. Enough seed for at least 3 plantings should be saved for the next season to safeguard against crop failure.

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Discuss the results of the year's work with these *guiding questions*:

After season 1:

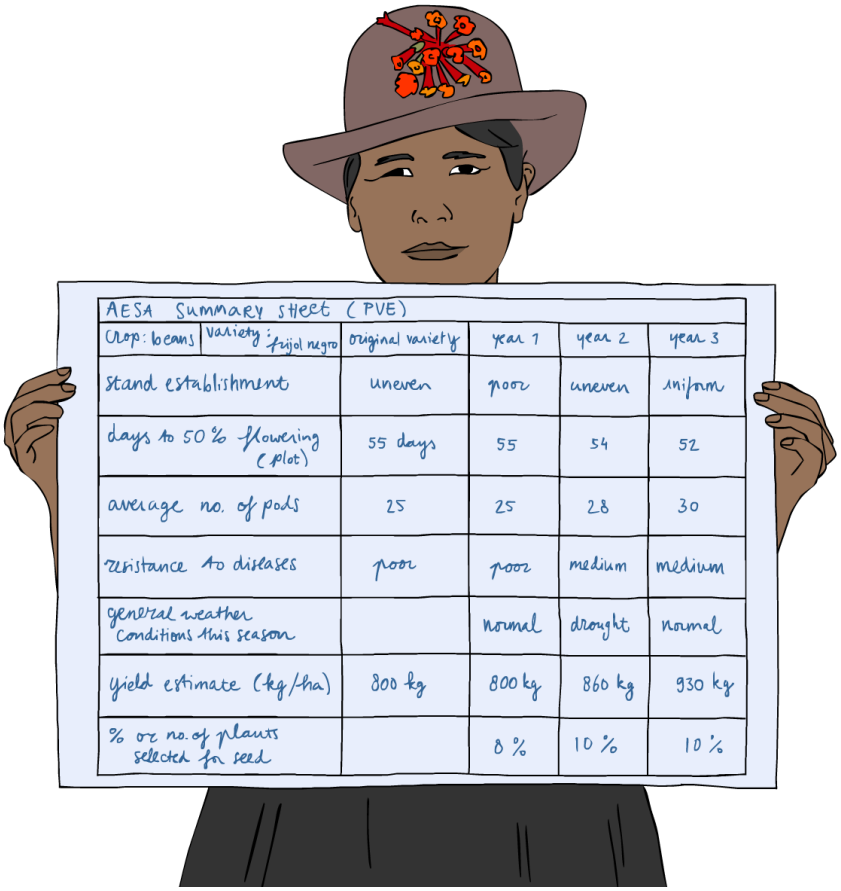
- How much seed has been saved for next season (grams)?
- Will we have sufficient seed to do replanting, if required?
- Are we still happy with our breeding objectives? Should they be revised?

After season 2 and 3:

- What was the estimated yield of the variety **before** PVE improvement (ton/hectare)
- What is the estimated yield of the variety this season, **after** PVE improvement (ton/hectare)
- Has the variety improved compared to the original variety?
- What undesirable traits still need to be improved?
- What positive traits do we want to keep?
- What is our plan for the next season? (Do we want to continue the work, or stop, or move to seed multiplication?)
- If the FFS continues with PVE: What percentage of plants have been selected for further improvement (for next year)?

When is PVE ready?

The FFS participants jointly decide when their work is finished. When the variety has been subjected to this kind of rigorous selection for three seasons, the percentage of plants with the desired traits should have increased significantly. An increase in yield by 20 or more percent is also common.



The results can be observed by comparing a PVE plot with another plot that is sown with the same variety, but with seeds that have not been improved through PVE. Another useful tool to evaluate the results is the AESA summary form, where the results from the three seasons are listed next to each other for comparison.

If after three seasons, the FFS wants to continue with PVE, it is probably

better to do so as a side activity, as the work may not be sufficiently interesting anymore to engage all FFS members. It may also be taken up by individual farmers.

Note that **the aim is not to make the variety uniform**, as the variability is a valued characteristic of local varieties in enabling them to adapt to changes in growing conditions.

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