The future of the Indonesian vegetable seed sector

Policy recommendations for improved seed availability

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Management summary

Indonesia's horticultural seed sector is developing fast and the authorities have the goal to promote this development by adequate laws and regulations.
At present only very few companies are actively performing selection and breeding work. Farmers in the more remote areas are even totally dependent on seed imports. Only gradually the domestic seed producing companies are penetrating that market. This development shall go hand in hand with the development of the horticultural sector as a whole, which includes the development of strong value chains which will result in a better product and at the same time in a better income for the farmer.
In all regulations there is no distinction between agricultural (food and estate) and horticultural crops. This results in very strict regulations for vegetables, which are very difficult or impossible to fulfil. It is recommended that in future 1. Laws, regulations and decrees shall be based on the special case of vegetables; 2. All legal texts should distinguish between generative true seeds and vegetative planting material. 'Seeds' should no longer be covering both; 3. Policy should be aimed at the provision of farmers with a wide choice of varieties. Decisions on suitability shall be left to the farming professionals themselves. [General recommendations 1-3].

The successful development of a domestic seed industry depends on a number of factors, of which the availability of skilled personnel is an important one. Every effort shall be made to encourage students to engage in plant breeding and seed technology. [Recommendations 1.1-1.3]

In the recent past (2000) a law on Plant Variety Protection has been passed and implementation is ongoing. However the de facto protection has not materialised due to lack of enforcement. This is one of the main impediments for the development of a healthy seed industry: breeding requires investments of billions of Rupiahs over many years of crossing and selection work. It is essential that there is a good return on investment. This is equally important for domestic as for international companies. [Recommendations 2.1-2.6]

In order to be able to import and export effectively, it is important that Indonesia adopts international agreements and joins international associations relevant to seeds and varieties. This especially includes UPOV, ISTA and OECD. To become a successful player in international seed trade, it is important for Indonesia to be able to produce International ISTA certificates for seed lots to be exported, and to recognise and be recognised by other countries' systems of inspection and control.
Especially the system of vegetable certification needs revision: it is highly recommended to improve it by adopting the Standard and Commercial seed classes (OECD system for vegetables). [Recommendations 3.1-3.5]

A general remark could also be that in order to promote the development of the domestic seed industry, it will pay to use supportive rather than restrictive measures.
The new regulations that limit imports of hybrid seed (and effective all seed categories) to two years may indeed stimulate the development of domestic seed companies. However a careful monitoring of the seed situation must be performed during the initial years, to be sure that the farmers, especially in remote areas where there are and never will be seed companies, will not become victim of this policy. [Recommendations 4.1-4.5]

In this report we will start having a closer look at some important aspects of seed quality and the special case of vegetables and Indonesia, after which we will discuss the various regulations in an international perspective. The chapters are: Breeding and seed production,

Variety release and registration, Seed quality control, and Trade and distribution. Each chapter starts with a short presentation of the existing regulations, followed by the actual state of implementation, a discussion and ending with recommendations. At the end all recommendations are enumerated.

This paper is destined to support policy makers with points of discussion, by supplying views from an outsider. Let us hope that this will prove useful and will help the authorities in their constant endeavour to improve the seed sector of Indonesia.

Introduction

This report is the result of consultations with various actors in the Indonesian vegetable seed sector, including government and private seed producers, certification and seed testing experts, government officials, seed farmers, and farmers as end users. These talks have taken place during a number of years. Starting in 1997 with a study visit on the quality of vegetable seed (Van der Burg, 1997) in the framework of the bilateral research programme BIOBREES, followed by yearly visits to Indonesia in the framework of the bilateral projects and programmes BIOBREES II, BIOTRAIN, HORTIN and now HORTSYS. This included visits to West, Central and East Java, West Sumatra and Ambon.
The report tries to summarise and comment on the most disputed issues that are being discussed during the preparation of a proposed separate law for horticulture, which will include chapters on seeds and other planting material. This is done with an international perspective and a future role of Indonesia as seed exporter and importer in a globalised world.
In this report a distinction is being made between 'seeds', which refers to true generatively propagated seeds, and vegetatively produced planting material. In the following we will only consider the case of true seeds, since vegetative planting material represents a number of totally different materials: bulbs, tubers, minitubers, in-vitro material, cuttings, grafts, etc. These are completely different things and all require a separate approach. From a botanical and technical view however, the situation with most true seeds is quite comparable and thus they can be treated as one category.

In the following we will have a closer look at some important aspects of seed quality and the special case of vegetables and Indonesia, after which we will discuss the various regulations in an international perspective: Breeding and seed production, Variety release and registration, Seed quality control, and Trade and distribution. Each chapter starts with a short presentation of the existing regulations, followed by the actual state of implementation, a discussion and ending with recommendations.

What is quality seed?

Farmers require seed that meets four main criteria:
1. it should be of the right quality
    - it should have the right genetic composition, *i.e.* be of the right variety and be sufficiently pure (varietal identity and purity);
    - it should have sufficient physical quality, *i.e*. be free from weeds and inert material (analytical purity);
    - it should have sufficient physiological quality, *i.e.* germinate readily and producing a percentage of normal seedlings (germination capacity and vigour);
2. it should be available in the right quantities
    - the type and size of the packages must answer the farmer's needs;
    - the quantities should be sufficient for his needs;
3. at the right time
    - if the seed is supplied too late, the crop may miss essential weeks of the growing season;
4. and at the right place
    - if the seed is not easily accessible, then it is difficult for the farmer to judge the need to buy it. It should be available in shops nearby
    - and the costs of travel may be too high.
5. and it is important that the farmer has a choice

- that there are different varieties of the same crop, because even in one area the soil and climatic conditions, as well as the farmers' and end-users preferences vary;
- and he has several suppliers to choose from. Some suppliers give better after-sales service (crop advice), have better-suited varieties or produce physically better seeds.

We may observe that the Indonesian farmer is being served by a growing number of varieties and suppliers. It is one of the key elements to develop the vegetable sector further.

The special case of vegetables

The present law (UU12, 1992) describes the processes needed for certification. All varieties shall be officially released and all seed moving in trade shall be certified. This applies to all seed sectors: food crops, estate crops, and horticultural crops.
There are a number of reasons why the system of seed production and certification of vegetables and flowers is entirely different from what we are used to in agriculture.
In agriculture (food and estate crops) the number of varieties per crop is limited, while the areas grown are large, so the amounts of seed needed are huge. This means that many multiplication stages are needed to produce enough certified seed. This includes a risk of multiplication of problems too, especially increased amounts of weed seeds and increased disease incidence. This calls for more strict rules and regulations. Because of the large surfaces planted with a few varieties during many years, and because in agriculture we often deal with essential food crops, governments usually don't want to take any risks and also want to establish the suitability of such varieties in large multilocational trials: VCU tests.

Table 1. Characteristics of Agriculture *versus* Horticulture

Agriculture (food & estate crops)	Horticulture (vegetables & flowers)
Large fields	Small fields
Large seed lots	Small seed lots
Few varieties	Many varieties
Release: description & VCU	Release: description only
PVP: DUS only	PVP: DUS only
Many generations	Many generations
Simple technologies	Simple technologies
Cheap seed	Cheap seed
Mostly domestic production	Often imported

Source: Amended after Course Manual of HORTSYS, course I, 2008.

Because the lots in horticulture are smaller and the number of generations is small, often only one multiplication step from Basic Seed, farmers plant many different varieties. And because we are usually not dealing with essential food crops, governments usually allow seed companies to do their own certification and only control them afterwards. This then is done by checking samples taken during production, by random visits to production fields, by taking samples in shops and warehouses, etc. and testing them in the field and/or in the laboratory. This is what we call post-control. This can result in two types of denominations: Standard Seed, of which the Basic seed production has been controlled and certified, and the certified seed generation is only subjected to random post-control; and Commercial Seed, in which both generations are under full responsibility of the company and in which only the commercial generation is randomly checked through post-control. See paragraph 'Standard Seed and Commercial Seed' below).

In the countries that participate in the OECD schemes for varietal certification of seeds moving in international trade, vegetable seeds are therefore not certified in the sense as is done in food crops. Almost all, if not all, vegetable seed coming from Europe and the other associated countries is Standard Seed or even Commercial Seed. [1]

The special case of Indonesia

Unlike many other countries, Indonesia is composed of a multitude of small and large islands, which makes distribution of seeds problematic. The territory also comprises quite a number of very differing agro-climates, with different rainfall patterns and different elevations.
In many cases the (sea) borders are virtually open, and strict control of for instance, seed import and export is nearly impossible. Total control would involve a multitude of officials, many more than currently available, and it may be questioned whether this would be justified.

A logical consequence would be, rather than to try to distinguish the good from the bad seed lots and suppliers through intensive control of everything, instead to emphasise on their responsibility and develop special tools to encourage honest trade.
These would include a special monitoring and sanctioning system. With this we mean a system of intelligent market control, focusing on the suppliers who are known to fail to bring good quality onto the market. Because of the limited possibilities to control everything, this system would include taking samples from warehouses and shops focusing emphasis on certain crops and suppliers. These samples will then be tested in the lab for purity and germination and in the field using the principles of post-control for varietal purity and varietal identity (trueness to variety). This control should apply equally to imported as well as domestically-produced seeds.

The companies will receive a report about the findings with only the results of their own seed lots. They are also invited individually to the trial fields to discuss quality issues that arise from the inspection. During this discussion problems are discussed and solutions proposed. Then a final report will be made including the conclusions and measures needed for improvement. If companies wilfully cheat, this will be reported to the central authorities and a fine will be given. This may be a financial fine, but can also include disciplinary measures such as suspending or withdrawal of a licence to deal in seeds.
A very important condition for this system to be able to work is a very competent and sincere staff that can avail of good facilities. These post-control tests and discussions are a major tool to reach higher general standards (both of production and trade).

[1] More information can be found at the OECD site: http://www.oecd.org/dataoecd/30/44/40203688.pdf

Breeding and seed production

Current regulations

Seed producers must register at the district level and are subject to certification of their final seed class, i.e. certified seed, by the respective provincial BPSB. Companies can become accredited for self-certification under the KAN-LSSM system. This is mentioned in Agriculture Ministerial Decree no. 39 of 2006.

Present state of implementation

Two larger private companies and one governmental company have been accredited for self-certification under the LSSM system. LSSM has been placed under both the Directorate General of Food Crops and the Directorate General of Horticulture and has no staff of itself. The persons carrying out the LSSM audits are officers of the respective Directorate General and other officers of MoA.
At IPB Bogor one can study subjects that are relevant to horticulture: there are majors (s2&s3) in Agronomy and Horticulture, Biotechnology & Plant Breeding, Seed Science and Seed Technology, and one can become Professional Master of horticulture or of seed science.

Discussion

Despite the fact that endless numbers of varieties are available on the international market, and small countries have to rely on them, Indonesia's domestic market is so big that this justifies its own (seed) breeding industry.
This has a number of advantages:

- varieties can be developed that are specially suited to Indonesia's climate;
- varieties can be developed that have resistance to the forms and pathotypes of indigenous pests and diseases;
- breeders can have a direct feedback from the farmers;
- farmers can have a direct contact with the company in case of problems;
- it provides quality jobs ranging from the technician level up to academic researcher;
- it renders the country more self-sufficient on an essential input;
- seed supply will become more sustainable;
- the seed price will become independent from currency shortages or fluctuations;
- the seed price can become much lower due to the lower production costs and the proximity of producer and consumer.

Why then, do we not have many seed companies operating in Indonesia?
Starting up a seed business is not easy. For a start one needs to have sufficient genetic material to start breeding; then this breeding process takes many years, typically between 10 and 15 years; so if one has to start from scratch it will take a few decades to become well-established. The natural evolution from farmer to (contract) seed farmer to seed producer is a long way and starts with modest revenues. It may be difficult to compete with companies that are already established. Nevertheless there are farmers in certain areas that are known for their good seed. These could be stimulated with soft loans to develop further. This would be especially useful in areas where the bigger companies have not yet penetrated and farmers are still in the transition from subsistence to market-oriented farming. Under these conditions small seed producers could develop. *[Recommendation 1.1]*

Constraints for the larger companies includes first and foremost the lack of legal protection, and secondly the lack of trained personnel. Other factors include lack of investment in breeding, partly due to high interest rates for agriculture, but for a large part due to the lack of expertise to start such a business.

At present the number of companies involved in breeding is limited to two larger ones, with a few smaller ones concentrating on one or two commodities. The smaller companies do not have trained breeders and only select in open pollinated varieties.

One limiting factor for seed breeding companies to develop is the lack of trained breeders in Indonesia. Breeding is a science-intensive activity, which involves many disciplines. The breeder must know everything about genetics of course, including the technologies and possibilities of molecular breeding, but also be well-trained in plant pathology, crop management and biology. Universities like IPB should be encouraged to develop the breeding specialisation further and attract students by showing them the job opportunities. This shall be done in conjunction with companies. *[Recommendation 1.2]*
There is also a shortage of skilled technicians who can carry out the breeding tasks. This is covered by IPB polytechnic (D3 program for seed) but should also be taken up by secondary type of universities and polytechnic schools in the provinces like PPPG Pertanian. *[Recommendation 1.3].*
The development of more than the present handful of companies, of which only 2-3 are doing serious breeding work, will therefore take time. It is not just a lack of initiative by companies and educated individuals, but also because of lack of opportunity due to the absence of sufficiently educated breeders, and there may be other restrictions such as high interest rates on investment. This means that for the near future great care must be taken to avoid shortage of seed and lack of sufficient varieties to choose from.

Recommendations

1.1. Soft loans and other incentives should be granted to small emerging companies, especially in remote areas.
1.2. IPB and companies should line up to create a strong plant breeding specialisation, with the possibility of apprenticeship at companies.
1.3. Other universities and polytechnic schools, especially in the provinces, could consider starting curricula to train mid-level technicians that can carry out field and laboratory work related to breeding and seed technology independently.

Variety release and registration

Current regulations

The release of horticultural varieties is regulated by Act no 12 (UU12) of 1992; Government Regulation no. 44 of 1995; and Agriculture Ministerial Decree no. 37 of 2006.
This law makes no distinction between agricultural and horticultural species, treating the latter as the former. So also for vegetables (and flowers) there is the formal requirement of multilocational adaptation trials (VCU trials). This implies tests at 3 locations for two seasons. Adaptation tests can be done by the owner of the variety or by BPSP or a Horticulture Research Centre (for vegetables this will be Balitsa, Lembang).
Law UU29 of 2000 regulates the protection of registered varieties. Plant breeder's rights can be obtained from the Center for Plant Variety Protection under MoA. The law does not fully comply with the requirements op UPOV, so we cannot speak of Plant Breeder's Rights (PBR) in Indonesia. We shall further refer to it as PVP. The release of a variety is decided upon by the Variety Release Committee (TP2V) composed of staff of MoA including AARD, Universities, horticulture experts, and farmers.

Present state of implementation

The PVP law is carried out by the Center for Plant Variety Protection (the 'PVT office') under MoA. It is an administrative body coordinating the DUS trials. The trials themselves are carried out at the company's premises under supervision of the PVT office.
The major companies use the system to protect their varieties, but recent court cases indicate that the protection does not go further than the court room. Persons convicted of infringement can go freely out of the court room; and even when they don't pay, they are not put in jail. This failure to enforce the law creates a vacuum in which plant breeders will not bring in valuable breeding material from outside and are reluctant to invest in facilities in Indonesia. They wait until better times, and in the meantime they import F1 hybrid material and open pollinated 'free' varieties (old varieties of which the PBR has expired).
[Recommendation 2.1].

Discussion

Although this report focuses on 'seeds' this inevitably involves 'varieties', and variety release and PVP will be subject of future laws and regulations. Here we have to refer to the difference between horticulture and food crops (see paragraph 'The special case of vegetables'). Due to the rapid turnover of horticultural seeds, in part due to the rapid development of resistances, it is imperative that the release and registration (PVP) process runs as efficiently as possible. For a vegetable variety bred in Indonesia to be released, not protected, the current process takes up to three years, from the start of the adaptation test, and shall be carried out on three locations (multilocational trials). Multilocational trials are often used in food crops, although their necessity can be debated, since the requirements on the different islands are so different, that no variety can be outperforming existing ones on all locations. As a consequence it is a process that limits the availability of genetic variation to farmers, by limiting the number of released varieties to an unacceptably low number of varieties with wide adaptation and to the detriment of small farmers in remote areas who have conditions that deviate from the mean (Louwaars, 2002). This is a fact that has to be accepted.

In vegetable growing, the most important characteristic of a new variety is not if it outperforms the existing ones in yield. More important are specific resistances, and combinations of resistances, growth habit, nutrient efficiency, consumer preferences, which

involve for instance taste, colour and texture of the products. These are aspects that can not be established in multilocational trials, but are more important than yield. So in practice, the farmer should be able to choose between a large range of varieties, and he will select the one with the right combination of price, production characteristics, and market opportunity. Farmers are smart and risk-avoiding persons; they will only select the best for their conditions and possibilities. Therefore, testing for release must be carried out on one location per season (with replications on this location) and will normally take two seasons. This location may be the facilities of the applicant or a central facility. It may also be a combination of the two: first at the company, then on the central facility.
The characters that will be studied are the same as required for PVT, namely the DUS criteria. The applicant will supply a full description of the variety which is then verified and completed during the two tests. Upon completion the administrative process shall be as short as possible.
This is important because the applicant needs to recover the costs of his investments through seed sales as soon as possible. This is especially a burden on the smaller breeders. So the more effective the system, the better the national policy of promoting new breeding initiatives will be realised. *[Recommendation 2.2]*

The release of varieties coming from abroad is a purely administrative procedure. Any variety which is released elsewhere is allowed to enter the country (see however paragraph 'Trade and distribution' for import restrictions). The importer has to provide a series of data, including the official description of the variety to obtain the import permit from MoA and he also needs to fill in a form of Quarantine Office.
This administrative procedure is satisfactory because it allows many varieties to come into the country, and the farmer is able to choose from a number of suppliers and varieties. *[Recommendation 2.3]*

In order to get variety protection (PVP), the procedure also includes testing on three locations. The companies applying must therefore find three locations where they can safely sow their varieties in comparison with standard reference varieties. Apart from the fact that it is unscientific to base a morphological description on a number of locations, and technically complicating things (creating statistical variation), it is also a burden on the companies, favouring the bigger ones. *[Recommendation 2.4]* The Indonesian regulations allow the use of the data of variety release to be used for PVP. This creates efficiency. For the right to obtain PVP it is important that the applicant proves his right to apply for protection. Or in other words, that the variety was obtained by his own breeding and selection activities.

For smaller companies not being able to provide the necessary controlled facilities for DUS evaluation at international standard, one could consider to appoint a central institution for the task. This institution should be independent, meaning that it has no vested interest in the outcome of the evaluation. This excludes research institutes like Balitsa, who are breeding varieties themselves. Such an institution could for instance be BBPPMB-TPH in Cimanggis. Presently they lack the necessary trail fields and screen houses and would need some extra qualified personnel, but they seem the ideal independent national authority.
[Recommendation 2.5]

Because the whole procedure of release takes about three years, the farmers badly need the variety with the new resistance, and the company needs the income, in other countries one will allow commercialisation of a limited amount of seed. This is called 'provisional release' of a 'variety under investigation'. This has the great advantage that the variety is tried out on a larger scale than can ever be done in trials, and the acceptance and suitability of the variety under Indonesian conditions can be established with certainty. This allows a

good evaluation in year three. If in the end the variety fails to become released for technical reasons, then the commercialisation should stop. *[Recommendation 2.6]*
There is no risk for the applicant, because release will always be granted to the first applicant. In case it concerns an application for PVP, it is important to note that the variety shall be fully protected as soon as PVP is requested, so that thieves can be tried under the PVP law.

Recommendations

2.1. Verdicts on infringements on PVP must be enforced.
2.2. The process of release of varieties coming from Indonesian domestic breeding programmes shall be as short a possible. The testing should be carried out in 2 growing seasons on one single location.
2.3. The administrative procedure for imported varieties is satisfactory and shall remain unchanged.
2.4. DUS testing shall be carried out on one location only and VCU elements shall not be part of the process.
2.5. An independent test site shall be created for DUS testing for companies who do not have adequate facilities themselves. These facilities and tests shall be managed by an organisation not involved in breeding or seed production, like for instance BB PPMB-TPH. Such an institution shall be provided with adequate equipment and skilled personnel.
2.6. A system of provisional release (‘variety under investigation‘) shall be implemented.

Seed quality control

Current regulations

Seed production, certification and distribution are regulated in Act no. 12 of 1992, Government Regulation no. 44 of 1995 and the Agriculture Ministerial Decree no. 39 of 2006.
By these regulations seed certification and testing is carried out by BPSB's, the provincial services for seed inspection or for companies with LSSM accreditation, by themselves. PPMB-TPH has a role as national reference seed laboratory.

Present state of implementation

In Indonesia methods and procedures for agricultural seeds are also applied to horticultural seeds. This includes full certification. As indicated in paragraph 'The special case of vegetables', this is unrealistic and undesirable.
While the national guideline for horticulture seed certification indicates a minimum of three visits, the intensity of inspections in some provinces is disproportionately high with 7 and even up to 11 inspections! This increases the costs of inspection to unacceptable levels, resulting in high expenditures on government personnel. In the long run this will not prove sustainable. In other provinces however, one has hardly begun to think about seed inspection of vegetable seeds. This of course is also not desirable. It is difficult to determine what is worse.

Indonesia has developed a system of company accreditation, based on KAN (national accreditation body) called LSSM, which seems to serve the purpose well. It includes the self-certification of their seed. Until now LSSM has been granted to two large seed companies in Indonesia

Discussion

Seed quality control systems are designed to ensure that seed sold to farmers is of the indicated variety, has sufficient physical and varietal purity, high germination capacity and is free from seed-borne diseases.
Usually a special organisation, the certification agency, is entrusted with this type of quality control. This organisation is usually governmental, but it can also be parastatal or private. In more advanced systems some or most tasks can also be carried out by the producers themselves, by using fixed protocols and through accreditation of in-house quality control systems.
Seed produced under a quality control system must relate, via one or more generations, to seed obtained from the plant breeder (Breeder's Seed).
In vegetables the number of generations is usually limited to one and Certified Seed (called 'Extension Seed' in Indonesia) is produced directly from Basic Seed (called 'Foundation Seed' in Indonesia). This is the category of seeds that goes to the farmers for growing the crop.

Like we noted earlier (see paragraph 'The special case of vegetables'), the case of horticultural seed is quite different from agricultural crops. Currently the BPSB's are applying full certification to vegetable seeds as is normally used for food crops seed. This includes a number of documents to be filled by the seed grower, as well as a number of field visits by the certification agency (BPSB).

There are a number of developments and arguments that will necessitate reviewing this situation.

1. The horticultural sector is booming and the number of companies. Seed growers, varieties and seed lots will grow to maybe tenfold in the next decade.
2. The government is de-investing in certification services. The number of seed inspectors is decreasing and the investments in infrastructure and equipment is far from what is needed for the tasks to be performed. It is expected that this tendency will continue.
3. All over the world, there is a tendency for deregulation and giving more responsibility and accountability to the producer.
4. At present almost all costs of certification are borne by the government. The fees for certification and testing being merely symbolical: 10 000 Rs/ha and for seed testing 6(!) Rs per kg. Because vegetable seeds are produced on relative small surfaces of land and result in relative small seed lots, this does not result in an income that would at least cover the costs. Income that could help maintain the infrastructure and equipment. Now the whole budget goes to salaries and fuel. In other words, this system is not sustainable in its present form.
5. There is a general lack of training and knowledge about production of the many types of vegetable seeds. Due to the lack of experienced inspectors, each inspector is required to handle all horticultural and food crops. This is a serious challenge to the seed inspectors; meaning that they often do not know how to evaluate the crop.
6. Seed companies have proven to devote much effort in producing quality seed. Farmers are smart and risk avoiding, and they know where and from whom to buy seeds. Companies can not afford to deliver inferior material. The competition is becoming more and more stiff, and badly performing producers are loosing their clientele. The deplorable situation of vegetable seed production by government agencies (BBI) is proof of this development. It shall be regarded as a positive development and a sign of reaching a more mature vegetable seed sector in Indonesia.
7. Horticultural crops are generally not considered as essential food crops, so would need less strict regulation.

In this light, how can we expect the BPSB's and other related agencies to perform well, now and in the future? What can be their role? Therefore it is appropriate to reconsider the procedures and select the most crucial activities to be performed as good as possible.

At present the certification of seeds involves a lot of paper work and inspections. Depending on whether it is an OP or F1, the number of field visits is up to 11 in total!
In most countries, the number of field visits is limited to a maximum of 2 in agriculture and 0 in horticulture. How can this result in good quality seed (and a fulfilling task for the government agencies involved)?

Simplifying and improving the certification system

For a start, a number of field visits carried out now by the seed inspector can be combined in one visit: all visits prior to the visit at the vegetative stage can be combined with this visit. These visits have an administrative character, and the producer can supply the data with the field inspector verifying at vegetative stage. For instance, crop history is something that can be known from previous production years and should be available at the BPSB, if not the farmer can supply the evidence on paper. Another issue, like isolation distance, can also be verified at vegetative stage, because no cross-pollination can have occurred in the meantime. At the time of the first visit this is verified by the inspector, and if something is not quite o.k., this can still be corrected at that stage, for instance by removing an adjacent potential pollinator. If this cannot be done, the field shall be rejected. It is the responsibility of the grower to follow the certification rules; the certification agency only has to check if he complies. In this way, the present system could be improved while requiring less personnel. (But as noted, many provinces will not be able to carry this out due to lack of skilled personnel).

Alternatively, we propose to follow a different route and follow the international understanding that full certification by an external agent like a government agency, is not sustainable and a logistical nightmare. As a consequence the responsibility of producing quality seed shall be put entirely on the shoulders of the companies, where it belongs. Each self-respecting company tries to produce as good as possible seeds to satisfy the needs of the consumer. 'Fly-by-night' companies are soon out of business, outcompeted by the constant high quality of competitors and their resulting good brand image.
Producers will guarantee a certain quality, e.g. by stating that it conforms the current regulations (EC system) or by putting the quality characteristics on the package (truthful labelling system). This latter system is used in Indonesia.

The role of the government can then be limited to perform a number of controls:
1. Administrative control, in part to be sure everything goes following the rules, e.g. by following lots administratively, and partly to be informed about quantities and acreages;
2. Reducing the field inspection workload by replacing them with (random) post control.
3. Market control, by taking (random) samples from shops and warehouses, to see if there is nothing going wrong, and to remain informed about the general quality and its evolution in time.

This seed coming from such a system would not be called Certified Seed or Extension Seed, but Standard Seed (OECD 2009).
In practice this system has proven itself over the many years that it is operating in Europe. In fact, the vast majority of all vegetable seed moving around the world and imported in Indonesia is not even Standard Seed but Commercial Seed*. [Recommendation 3.1]*
In essence this principle is also advocated by the FAO even for agricultural crops, calling it Quality Declared Seed (FAO 2006).

Standard Seed and Commercial Seed

The proposed system to replace the present full certification is less labour intensive and still very reliable. It requires fewer but more skilled personnel (so a job opportunity for graduates of polytechnic schools).

This is done by checking samples taken during production, by random visits to production fields, by taking samples in shops and warehouses, etc. and testing them in the field (on post control plots) and/or in the laboratory.
This can result in two types of denominations: Standard Seed, of which the Basic seed production has been controlled and certified, and the Standard seed generation is only subjected to random post-control; and Commercial Seed, in which both generations are under full responsibility of the company and in which only the Commercial Seed is randomly checked through post-control (Table 2). *[Recommendation 3.2]*
In all cases there can be checking of seed in trade, such as retail shops, especially to see if the germination capacity is still ok. This we call market control

Table 2. Official inspections for the various certification categories

Activity	Certified Seed (Extension Seed)	Standard Seed	Commercial Seed
Field inspection of Basic (Foundation) Seed	all lots	all or random	no[2)]
Lot inspection for germination of Basic (Foundation) Seed	all lots	all lots are sampled	no[2)]
Lot inspection for varietal identity and purity through Post Control of Basic (Foundation) Seed	random[1)]	random	no[2)]
Field Inspection of Certified (Extension) Sd.	all lots	no	no[2)]
Lot inspection for germination of Certified (Extension) Seed	all lots	random	random
Lot inspection for varietal identity and purity through post control of Certified (Extension) Seed	random[1)]	random	random
Market control	random	random	random

1) Not done in Indonesia: there is no post control inspection, only checking for germination
2) Carried out by company

Field inspection

For Standard Seed production, the production of Basic Seed shall be controlled by the certification agency. This includes field inspection and laboratory tests. Companies should announce the production of Basic Seed to the certification agency before sowing. Inspectors will visit the fields usually twice during production. This can be all fields or a random selection. The philosophy behind this is that if one is sure of high quality of the starting material, that the next generation will then produce less problems. Besides, it is impossible to check all Standard (Extension) Seed fields, certainly in future, but a check of all Basic Seed can be done effectively. Of course this only applies to OP varieties, because certification of inbred lines for F1 production shall be left to the advanced companies having LSSM licence.

When producing Standard Seed the company should keep a sample of the material that will be sown. This sample is handed over to the certification agency upon request. The company does the field and laboratory inspections itself and keeps clear records of this. The certification agency will visit a selection of the fields and will also inspect the records that are kept by the company. A selection of the samples will be sown on post-control fields and tested for germination in the lab by the inspection service.

The companies having LSSM will then produce Standard Seed or Commercial Seed under their own responsibility. *[Recommendation 3.3]*

Lot inspection

Seed lots that have been multiplied abroad and will be used to produce Standard (Extension) Seed will all be sampled upon entry into the country. These will be randomly tested in the same way as if they had been grown in the country, so a check for germination and a post control to check for varietal purity and identity.

As mentioned before, inspectors will take samples from marketed lots. These samples will be tested for germination, and a selection will be sown in post-control plots.

Seed testing

Standards for germination should not be too high, to be sure that enough seed will be available for the farmers; at the same time they should not be too low, so that the farmer loses confidence in officially controlled seed (be it Certified or Standard Seed).

Indonesia

In Indonesia seed testing is the responsibility of the provinces. A general orchestrating role has been bestowed upon BBPPTMB-TPH (BPMB) to make sure that the various labs will apply the regulations equally. The HORTSYS project has endeavoured to improve the skills of this central lab as well as 23 regional labs. Much still has to be done, especially in terms of equipment and other facilities. The labs are used to test rice and palawija seeds, but testing the numerous species of vegetable seeds requires special equipment and knowledge. *[Recommendation 3.4]*

International recognition of the major seed labs seems opportune. BPMB is preparing for ISTA accreditation in order to be able to act as reference and referee lab in national seed issues and international disputes over seeds. Companies needing an Orange International Certificate for their seed exports can then ask BPMB to provide it. *[Recommendation 3.5]*

Post control

As has been mentioned, post control serves to check seeds for varietal purity and identity (trueness to variety). In some cases seed-borne diseases may also be detected.

The companies will receive a report about the findings with only the results of their own seed lots. They are also invited individually to the trial fields to discuss quality issues that arise from the inspection. During this discussion problems are discussed and solutions proposed. Then a final report will be made including the conclusions and measures needed for improvement. If companies wilfully cheat, this will be reported to the central authorities and a fine will be given. This may be a financial fine, but can also include disciplinary measures such as suspending or withdrawal of a licence to produce and sell seeds.

Indonesia

Pre- and post control (post control of Basic Seed serves as pre-control for Standard Seed) have not been officially established in Indonesia. It may be that some certification agencies use the principle, but not in vegetables. Still it is a most powerful tool and is widely used in Europe and elsewhere to verify varietal identity and purity. It has proven to be an excellent tool in providing the government with data for policy development, certification bodies for improving their functioning, companies to get feedback from the field, ultimately resulting in a constant upward line in quality improvement. *[Recommendation 3.2]*

Recommendations

3.1. Replace the full certification system by the OECD system for vegetable seed, and introduce Standard Seed and Commercial Seed.
3.2. Make provisions for post control, including regulations and trial field facilities.
3.3. The companies having LSSM shall be able to decide to follow either the Standard Seed or the Commercial Seed system for their lots. This may differ per lot, depending customer requirements.
3.4. BPMB shall get a more central authority in seed testing, to ensure even application of seed testing rules (as reference lab, through training and proficiency testing, ring tests), and by serving as expert laboratory (referee) in case of dispute.

3.5. International recognition of BPMB enabling participation in international decision making in seed testing is of great importance.

Trade and distribution

Current regulations

There are two regulations that limit the import of seeds and varieties into Indonesia. In Government Regulation no 44 of 1995 it is stated that import of seed is possible if the seed can not be produced in Indonesia or if domestic production is not enough to fulfil the farmers' needs. The Agriculture Ministerial Decree no. 37 of 2006 states that for hybrid seed which is imported from other countries, production shall be done in Indonesia from two years after release of the variety by the Minister. However, the ruling is now extended to all types of seed (including OP varieties). An amendment of the Decree is currently under discussion.

Exceptions are made for seeds that can not or not efficiently be produced in Indonesia. This includes all cabbages that need vernalisation, including Chinese cabbage, sweet pepper (paprika), spinach, onion, lettuce, edible mushroom, strawberry, garlic, asparagus. The exception is noted by the letter of Directorate General of Horticulture to the importers, producers, and all stakeholders, of January 2009. The list of exceptions is made after discussion with the horticulture research institutes and seed producers.
In case of carrot, seed can be produced in Indonesia but so far there is no interest from breeders and seed companies to breed an Indonesian variety due to the low price of the seed and the relatively small market. Most farmers save their own seed. The same applies to celery.
Export of seed is only allowed if the domestic demand has been fulfilled. In practice, this means that it can be refused when there is a complaint from farmers. This never happened until now, so an export permit will normally be granted and no tax will be imposed. For export there are no requirements regarding quarantine, unless this is required by the importing country. Since January 2010 the government launched an online system for requesting import and export permits.

Present state of implementation

The permission to import vegetable seed for commercialized and adaptation test purpose is given by the PPI (Centre for investment and permit) in consultation with the Directorate General of Horticulture. The Ministerial Decree no. 38 year 2006, states that The Government determines the national seed requirements for each commodity. This is determined two years before planting. For vegetable seed, the Directorate of Vegetable Production annually calculates the seed needs from the actually planted areas.
This Directorate has annual meetings to plan the necessary planting areas needed nationally for the major vegetables, such as potato, shallot, tomato, chilli, and cabbage. A representative from the Directorate of Seed is invited to calculate the amounts of seed required. On basis of this, the Government will decide whether seed import or export is needed. In the case of seed potatoes and shallot sets, the Government cooperates with the National Seed Growers Association to calculate the need for and availability of seed.

Discussion

Import / export

Limiting the imported amounts of seed, or in other words, a quotation regulation, is in conflict with free market mechanisms. It may potentially create shortage of seed for certain commodities and result in unnecessary high seed prices for the farmers. On the other hand it will promote the usage of domestic seed or farmer's own seed. It is the question whether

this will result in the required higher yields and quality of the end product. It is recommended to review this ruling. *[Recommendation 4.1]*

Decree No 37 has raised quite some eyebrows from exporting countries. It is a unique regulation that cannot be found elsewhere in SE Asia. Notwithstanding, one can notice some virtues. Clearly, it is intended to encourage domestic production of advanced varieties. At present some Indonesian-based companies are already very successful in breeding and seed production work. The Indonesian government encourages others to establish themselves as well. These may come from outside or they may come from initiatives of Indonesian origin. It may indeed promote the establishment of foreign companies in Indonesia, but for that to become true one will need more incentives, like land availability, ownership, transparent regulations and financial incentives. *[Recommendation 4.2]*
The question may be asked whether this regulation will not decrease the number of varieties available to the Indonesian farmer. In the short run, certain popular hybrid varieties will disappear, because of the two-year term.
It must be observed however, that for hybrid varieties this measure will not automatically result in foreign companies starting to produce these varieties in Indonesia. They are too keen on their inbred lines, which value millions of dollars each, and due to the absence of serious punishment of infringements on PVP in Indonesia, companies will stop importing these varieties when the two years are over.
Another positive effect could be that the small local seed companies, who for their business heavily rely on imported varieties, will start producing their own. This will then have a positive effect on job opportunities in rural areas.

It is to be expected that importing companies will do their best to supply the Indonesian market with new varieties every two years. It remains to be seen however, whether these varieties will then be as good as the popular ones. Alternatively, one may argue that in this way the farmer will be getting more choice and more modern varieties, because monopolism by certain (imported) varieties will be broken. *[Recommendation 4.3]*

Seed exports are becoming more frequent, with species like kang kong, string bean, chilli, cucumber, tomato and sweet corn being exported to countries in the region.

Quarantine

Quarantine organisation and port officials shall make a distinction between seed for commercialisation and seed for ring tests, like ISTA Proficiency Tests.
In the first case it is material for experimental purposes only to be carried out by fellow-governmental agencies and shall pass without restriction. The present seed import form is therefore not applicable and should be replaced by one for seed for non-commercial purposes. Such a form shall not contain questions regarding the variety, its origin, or is agronomic requirements, because they will be tested in a lab and destroyed afterwards. Quarantine may require certain tests to be sure of absence of certain restricted or prohibited pests and diseases, but if these requirements are fulfilled, the seed should be allowed to move over the border without re-testing. *[Recommendation 4.4]*

When BBPPMB will have its international accreditation, it will be able to provide such ISTA certificates for seed exports and seed accompanied by these certificates shall normally pass the border untested and without much administration. In international trade one recognises each other's certificates.
The decision to destroying someone else's properties shall be made very carefully in consultation with the owner and based on legal grounds.

Port authorities and quarantine authorities shall allow peer second opinion investigation (retest by a recognised lab) and arbitration in case of dispute over seed lots that they want to refuse or destroy. *[Recommendation 4.5]*

Recommendations

4.1. The effects of quotation of seed imports shall be investigated. Does it have an overall positive effect for farmers or does it result seed shortages of particular varieties, and as a result also a higher seed price for such varieties.
4.2. More incentives and positive support should be the basis to promote the development of the domestic seed industry, rather than restrictive measures.
4.3. The new regulations that limit imports of hybrid seed to two years may indeed stimulate the development of domestic seed companies. However a careful monitoring of the seed situation must be performed during the initial years, to be sure that the farmers, especially in remote areas where there are and never will be seed companies, will not become victim of this policy.
4.4. Imported seed accompanied by an International Orange ISTA Certificate shall pass the border untested. Quarantine may require certain tests to be sure of absence of certain restricted or prohibited pests and diseases, but if these requirements are fulfilled, the seed should be allowed to move over the border without re-testing.
4.5. Port authorities and quarantine authorities shall allow peer second opinion investigation (retest by a recognised lab) and science-based arbitration in case of dispute over seed lots that they want to refuse or destroy.

Summary of recommendations

General

1. Future laws, regulations and decrees should be based on the special case of vegetables compared with food crops and estate crops.
2. All legal texts should distinguish between generative true seeds and vegetative planting material. ‘Seeds’ should no longer be covering both.
3. Policy should be aimed at the provision of farmers with a wide choice of varieties. Decisions on suitability shall be left to the farming professionals themselves.

Breeding and seed production

1.1. Soft loans and other incentives should be granted to small emerging companies, especially in remote areas.
1.2. IPB and companies should line up to create a strong plant breeding specialisation, with the possibility of apprenticeship at companies.
1.3. Other universities and polytechnic schools, especially in the provinces, could consider starting curricula to train mid-level technicians that can carry out field and laboratory work related to breeding and seed technology independently.

Variety release and registration

2.1. Verdicts on infringements on PVP must be enforced.
2.2. The process of release of varieties coming from Indonesian domestic breeding programmes shall be as short as possible. The testing should be carried out in 2 growing seasons on one single location.
2.3. The administrative procedure for imported varieties is satisfactory and shall remain unchanged.
2.4. DUS testing shall be carried out on one location only and VCU elements shall not be part of the process.
2.5. An independent test site shall be created for DUS testing for companies who do not have adequate facilities themselves. These facilities and tests shall be managed by an organisation not involved in breeding or seed production, like for instance BB PPMB-TPH. Such an institution shall be provided with adequate equipment and skilled personnel.
2.6. A system of provisional release (‘variety under investigation‘) shall be implemented.

Seed quality control

3.1. Replace the full certification system by the OECD system for vegetable seed, and introduce Standard Seed and Commercial Seed.
3.2. Make provisions for post control, including regulations and trial field facilities.
3.3. The companies having LSSM shall be able to decide to follow either the Standard Seed or the Commercial Seed system for their lots. This may differ per lot, depending customer requirements.
3.4. BPMB shall get a more central authority in seed testing, to ensure even application of seed testing rules (as reference lab, through training and proficiency testing, ring tests), and by serving as expert laboratory (referee) in case of dispute.
3.5. International recognition of BPMB enabling participation in international decision making in seed testing is of great importance.

Trade and distribution

4.1. The effects of quotation of seed imports shall be investigated. Does it have an overall positive effect for farmers or does it result seed shortages of particular varieties, and as a result also a higher seed price for such varieties.

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