

Developing a registration system for farmers' varieties

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HIGHLIGHTS

- A review of the characteristics of farmers' varieties and their importance for seed sector resilience.
- The contribution of a farmers' varieties registration system to Farmers' Rights and inclusive seed sector development.
- An analysis of what a farmers' varieties registration system needs to address following the seed regulatory value chain.
- Four proposed principles to guide the division of rights and benefit-sharing between registrants and users.
- Practical solutions to key issues for successful implementation of a farmers' varieties registration system on the ground.

GRAPHICAL ABSTRACT



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ABSTRACT

CONTEXT: Many countries only allow seed of registered varieties to be legally produced and sold in the market. Due to strict requirements regarding the characteristics (e.g., distinctness, uniformity, and stability) and performance (e.g., outperforming high-yielding varieties under standardized growing conditions) for varieties to be released, this implies that many farmers' varieties are confined to the spheres of the informal sector as 'potential planting materials': their production, use, exchange, and trade remain unregulated, largely unsupported, and their importance underestimated.

OBJECTIVE: The present article provides a guided approach on how to develop and implement a registration system suitable for farmers' varieties in full recognition of their inherent properties that often distinguish them from those that are developed in the formal seed sector.

METHOD: By following the seed regulatory value chain through which new crop varieties normally reach the market, this article analyses approaches to solve key questions that need to be addressed when adapting that regulatory chain to facilitate the registration and release of farmers' varieties. These questions range from what constitutes a farmers' variety to which rights a registrant may receive over the registered variety vis-à-vis other stakeholders. Answers are provided based on country cases, a literature review, and the learnings and inputs received during several stakeholder workshops and meetings organized in the context of seed system development programmes.

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RESULTS AND CONCLUSIONS: Based on a discussion of the major principles and elements of current variety registration systems developed for the formal seed sector, our analysis leads to a plausible approach through which a farmers' variety registration system could be implemented. In that context, this study provides guidance on who qualifies to register a farmers' variety, how to agree on more flexible criteria for distinctness, uniformity, and stability, and elaborates key principles that can inform solutions for the division and distribution of rights, and access and benefit-sharing.

SIGNIFICANCE: Several national governments have indicated their interest in implementing a farmers' variety registration system. However, the practicalities on the ground and the principles that could guide implementation have not been elaborated or well-defined in the literature. This article aims to fill that gap. Through the registration and diffusion of farmers' varieties, governments will contribute to an increase of on-farm agrobiodiversity that can enhance farmers' resilience and livelihoods, while contributing to the implementation of Farmers' Rights as defined in the FAO International Treaty on Plant Genetic Resources for Food and Agriculture.

1. Introduction

Many smallholder farmers across the world grow crop varieties that have been developed and are maintained by themselves. They are often shared and marketed locally and are of major importance for the resilience of local seed systems and for food and nutrition security. Still, many of these varieties have been poorly studied and documented, and the wider use of these varieties and their beneficial properties is hampered by their absence from formal registration systems introduced and used for the marketing of new varieties in the formal seed system. Many authors have emphasized the importance and values of the informal or, as we prefer to call it, farmer-managed seed systems (McGuire and Sperling, 2016; Louwaars and De Boef, 2012; Westengen et al., 2023).

In many countries, only seed of registered varieties can be legally produced and sold in the market, with 'seed' referring to all plant propagation material, ranging from true-seed to tubers, cuttings etc. (Herpers et al., 2017; Vernooij et al., 2023a; Salazar et al., 2007). The Commission on Genetic Resources for Food and Agriculture (CGRFA, 2019) indicates that 66 out of 96 countries require that for a variety to be registered it must meet the requirements of distinctness, uniformity and stability (DUS). And that nearly three-quarters of the countries require registration of a crop variety before any commercial production or seed sales are allowed. Given that many farmers' varieties are genetically heterogeneous and, thus, do not meet the formal registration criteria, this implies that these varieties are confined to the spheres of informal sector as 'potential planting materials': their production, use, selling, exchange and trade remain unregulated, underutilized, largely unsupported, and their importance underestimated.

In agreement with Vernooij et al. (2023b), we consider the lack of a registration system for farmers' varieties "a huge development gap and a missed opportunity to recognize and reward the value of local varieties and the contributions of farmers and their organizations (e.g., community seed banks) to seed conservation, sustainable use, and improvement" (p. 102). By allowing for the registration of farmers' varieties, seeds of such varieties can be legally produced, exchanged, and commercialized. Such legislation may have multiple benefits. First, it can increase the number of crop varieties available to (smallholder) farmers. According to FAO (1999), "Some 75% of plant genetic diversity has been lost since the 1900's as farmers worldwide have left their multiple local varieties and "landraces" for genetically uniform, high yielding varieties." By stimulating the production and marketing of seed of farmers' varieties, more and better-quality seed of a much wider range of crops and varieties can enter farmers' fields. This is crucially important given the increasing dependency on a limited set of crops and dwindling biodiversity (McCouch and Rieseberg, 2023), especially when encountering effects of climate change.

Second, farmers' varieties can contribute to increased seed security, and hence food and nutrition security, and food system resilience by trade in nearby markets. Multiple studies have shown that more crop diversity (Renard and Tilman, 2019; Bellon et al., 2020) and greater

diversification of seed delivery pathways (Mausch et al., 2021) are needed to meet the UN's Sustainable Development Goals (SDGs) to achieve an inclusive agricultural transformation (McCouch and Rieseberg, 2023; Waha et al., 2022). Establishment of a farmers' variety registration system can make an important contribution to these overarching policy goals. Third, such legislation can further strengthen farmer-managed seed systems by facilitating the closer involvement of public sector actors in the development, production, and dissemination of farmers' varieties. Something that can be difficult to achieve if such activities are deemed not to be legalised (ACB, 2018). Fourth, it would recognize the efforts and contributions of farmers who maintain and develop farmers' varieties. As such, a farmers' variety registration system can be considered one possible instrument in the national implementation of the FAO International Treaty on Plant Genetic Resources for Food and Agriculture and its provisions on Farmers' Rights (FAO, 2001).

There are probably several reasons why, until today, only a few countries have established a registration system for farmers' varieties. These may relate to the heterogeneous characteristics of the varieties in question, to the absence of (strong) commercial markets for the seed of such varieties, or the lack of political will to support farmer-managed seed systems. Also, there are many challenging questions that need solutions when developing a farmers' variety registration system. For example: Who qualifies to register a farmers' variety? Which (intellectual property) rights should a registrant receive over the registered variety vis-à-vis other stakeholders? How can the regulatory burden (for farmers and governments) be kept to a minimum?

The first question that needs answering, however, is what a country's main objective would be by establishing a farmers' variety registration system. A system that first and foremost aims to promote the conservation of farmers' varieties will need different components and procedures than one that mainly aims to promote farmers' rights. The key objective that directs the system's framework explored in this article is providing farmers and farming communities the same position as 'formal' seed actors: the ability to legally develop, produce and commercialize quality seed of farmers' varieties in full recognition of their properties that often distinguish them from varieties developed in the formal seed sector. A registration system for farmers' varieties should consider that these varieties have been developed in farmers' fields, respond to specific field conditions, and fulfil the specific needs of smallholder farmers.

The goal of this article is to provide the different tenets needed to develop a farmers' variety registration system using the notion of a seed regulatory value chain as applicable in the formal sector, so that national governments, local institutions, farmers, implementing partners and other stakeholders could tailor feasible approaches to move forward taking into consideration the local context and existing regulatory environment.

2. Methods

Various elements of the seed regulatory value chain are recognized: from varietal development, to identification, testing, releasing, cataloguing of new varieties, followed by seed multiplication, distribution, and marketing. Using the regulatory value chain notion in [Kuhlmann and Dey \(2021\)](#), we have adapted the same for a proposal for the registration of farmers' varieties in this framework. At each node of the chain, we have identified questions that warrant attention and reflection to inform the development of a farmers' variety registration system (see [Fig. 1](#)). Although each node of the chain is important, for the purposes of the present article, we have selected key questions along the first three nodes. This was based on discussions with multiple stakeholders during several meetings (see [Table 1](#)), which resulted in the conclusion that questions related to these first three nodes are most often more complex and less interpretable (and thus implementable) for policy makers.

In the sections below, the selected key questions have been elaborated and possible options and examples to answer these are discussed. The examples and perspectives provided are based on country experiences, a literature review, and discussions with key informants at several international workshops and events (see [Table 1](#)). Given seed sector is pluralistic in nature, the workshops held reflected this pluralism by making the participation as inclusive as possible, including representatives from government (ranging from local officials to national policy makers, and representatives of ministries, genebanks, seed certification, biodiversity agencies etc.), (inter)national research organizations, farmers and civil society organizations, private sector, and international governmental agencies.

In [Section 3.1](#), the first node in [Fig. 1](#) that refers to the overall policy and regulatory context that governs the seed sector in a given country is discussed. As the role and development stage of the seed sector and its context of applicable national, regional, and international laws differ from country to country, each country needs to assess the legal space and options for integrating a farmers' variety registration system into its

existing legislative context. A key question that surfaced in all country pilots and workshop discussions in which we were involved, is the definition of a farmers' variety. This definition has a strong bearing on any of the following nodes in the regulatory value chain.

The second node, elaborated in [Section 3.2](#), considers the registration system for farmers' varieties per se, and entails criteria for registrants, criteria for variety registration, the application process, the establishment and roles of a variety registration and release committee, the design of the variety catalogue, and the roles and responsibilities that national and local institutions may play in the registration process. Based on the definition of what constitutes a farmers' variety, this section analyzes the criteria that can be applied to register such variety and answers the question who may do so, i.e. which body would qualify to register a farmers' variety.

Variety registration and attribution lead into issues of rights, and access and benefit-sharing, which is discussed in [Section 3.3](#) as a third node along the regulatory value chain. Here we probe whether farmers' varieties could be protected by Intellectual Property Rights (IPRs), and if not, which alternative rights or benefits a registrant should receive over the registered variety vis-à-vis other stakeholders. The rights or benefits assigned to registrants may come with certain responsibilities. Questions of access to registered varieties by third parties will need to be included in the decision-making process leading to a farmers' variety registration system.

The remaining fourth and fifth nodes along the value chain relate to the quality assurance mechanisms associated with seed marketing and distribution systems that may best facilitate the production and use of farmers' varieties. Quality assurance mechanisms such as Quality Declared Seed (QDS) or Truthfully Labelled (TL) seed have been considered, in addition to more established seed certification systems. Choices will have to be made regarding the feasible extent of governmental oversight on the marketing process, including the registration of producers, sellers, and venues where seed of farmers' varieties can be sold, and the development of packaging and labeling requirements or

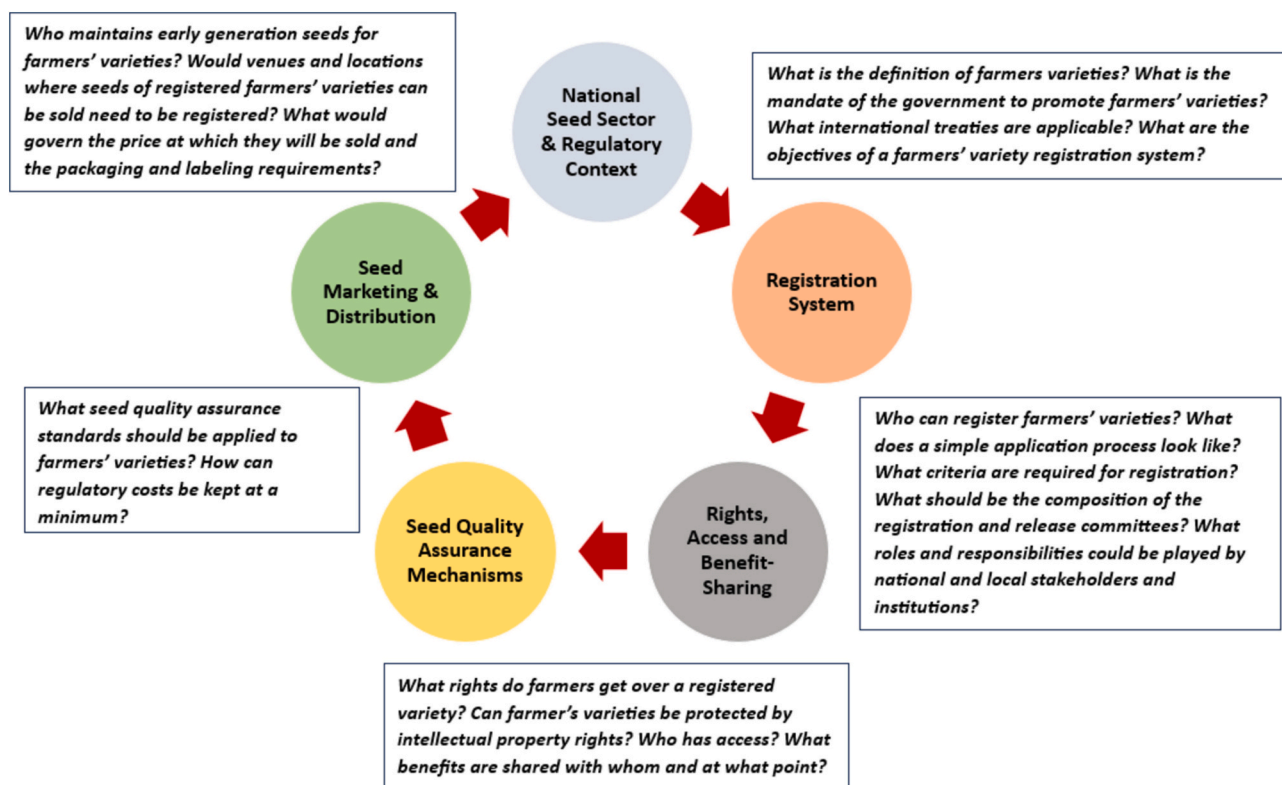


Fig. 1. Seed regulatory value chain for farmers' varieties.

Table 1
International workshops and events to discuss farmers' variety registration systems.

Date	Place	Title (including link to more information)	No. of Participants	Type of Participants
4–7 December 2018	Kampala, Uganda	International workshop on registration of farmers' varieties	52	A; B; C; D; E; F
10 November 2020	Webinar	To register or not to register, that is the question. Sharing views and experiences around the registration of farmers' varieties.	138	A; B; C; E; F
20 September 2022	New Delhi, India	Side event: Towards a more inclusive seed system based on participatory plant breeding to implement Farmers' Rights: A Zambian perspective.	25	A; B; C; F
21 September 2022	New Delhi, India	Side event: Achievement in farmers' variety registration in support of Treaty implementation in Nepal.	30	A; B; C; F
28–30 March 2023	Addis Ababa, Ethiopia	Farmers' variety registration system workshop	39	A; B; C; F
23 November 2023	Rome, Italy	Side event: How to develop a farmers' variety registration system? Lessons from several country pilots.	20	A; B; C; F
30 November 2023	Lusaka, Zambia	Development of a framework for registration of farmers' varieties in Zambia	41	A; B; C; E; F

Type of participants:

A = Civil society organization.

B = Farmers organization.

C = Government (national and international).

D = Politicians.

E = Private sector.

F = Research organization (national and international).

guidelines. In our approach, we portrayed the seed regulatory value chain as circular to emphasize the dynamic and ongoing process of policymaking and the continual need to evaluate and adapt policies and regulations based on evidence and challenges encountered in the process of implementation on the ground.

Even though literature on farmers' variety registration is steadily growing, this article is – to the best of our knowledge – the first that analyses core aspects of a farmers' variety registration system in an integrated way, while providing a level of detail that will facilitate reflections by policy makers and stakeholders on the desired key features and possible nuances of any farmers' variety registration system.

3. Results

3.1. What constitutes a farmers' variety?

There is no standard or universally agreed definition of a farmers' variety. In essence, the term farmers' variety refers to a crop variety developed by farmers, an activity that started with the domestication of

wild species about 10,000 years ago (Brush, 2004). In literature, the term farmers' variety is often used interchangeably with terms such as landrace, local or traditional variety, and usually contrasted with varieties that are developed by formal, public or private sector, breeders (Halewood and Lapeña, 2016; Rechta et al., 2019; Villa et al., 2005). For the latter, a universally agreed definition is embodied in the cultivar, which is defined by the International Code of Nomenclature for Cultivated Plants as “an assemblage of plants that (a) has been selected for a particular character or combination of characters, (b) is distinct, uniform, and stable in these characters, and (c) when propagated by appropriate means, retains those characters” (ISHS, 2009, Article 2.3). This definition is compatible with the definition of plant variety in the UPOV Convention (UPOV, 1991) and well-suited for providing breeders with an intellectual property right of a new, distinct, uniform and stable (DUS) variety. Arguably, the definition of a cultivar has been chosen in such a way that it allows for a feasible distinction between different varieties; in practice, the interpretation of uniformity varies from self-pollinators to obligatory cross-pollinators, the latter being less uniform than the former.

Cherfas (2016) explained that some farmers' varieties can be considered cultivars under this definition, but others may not “because they fail to meet one or more of the essential qualities of distinctiveness, uniformity and stability” (p. 29). This is due to the interacting influences of 1) the behavior of the crop and the culture of those that cultivate the crop, and 2) the environment in which they are cultivated, added on the genetic effects of different reproductive systems of crops (i.e. clonal propagation, self-pollination and cross-pollination). Cherfas concludes that “Landraces are generally components of large, interconnected and dynamic networks of exchange (among communities and among gene pools) that defy strict definition. And without continuous intervention by farmers, their varieties would cease to exist.” (2016, p. 37). In other words, a key characteristic of many farmers' varieties is their variability over time and space, combined with high levels of material exchange among farmers and communities, and an openness among farmers for integration of new traits from manifold sources. As a result of farmers' continuous selection efforts, however, the varieties do maintain a certain identity or identifiability, i.e., a set of characteristics that are purposely maintained by those who grow them in a genetic background that may show variation over place and time (Louette, 2000).

India, that has implemented a farmers' variety registration and protection system since long, defines a farmers' variety as “a variety which (i) has been traditionally cultivated and evolved by the farmers in their fields; or (ii) is a wild relative or land race of a variety about which the farmers possess the common knowledge” (India, 2001, Article 2.1). In academic literature, a comprehensive study on common characteristics of a landrace or traditional variety defines this as “a dynamic population(s) of a cultivated plant that has historical origin, distinct identity and lacks formal crop improvement, as well as often being genetically diverse, locally adapted and associated with traditional farming systems.” (Villa et al., 2005, p. 373). Building on this and other definitions, Khoury et al. (2022) define landraces as being “A crop variety or population managed by farmers through cultivation, selection and diffusion, which is typically adapted to a local area and to traditional farming systems, has a recognizable identity and geographic origin, and is often genetically heterogeneous” (Table 1).

We adopted the latter definition since it provides clarity on the natural characteristics of farmers' varieties and the way they are maintained by and for farmers. In this context, it has been our choice not to limit the definition of farmers' varieties to those varieties that are exclusively developed by farmers. Instead, we propose, for the purpose of registration, to distinguish at least two categories of farmers' varieties. First, landraces or traditional varieties that have been exclusively developed and maintained by farmers. Second, novel varieties that have been developed with significant farmers' participation in collaboration with formal sector breeders, and often partially derived from traditional varieties, e.g., through participatory plant breeding or participatory

variety enhancement (Visser et al., 2020; Sperling et al., 2001; Weltzien et al., 2003).

Other categories may be added if considered useful in a specific country context. Moreover, countries may decide to specify the set of crops that are eligible for farmers' variety registration for biological, economic, conservation, socio-cultural, or other reasons.

In summary, a farmers' variety exhibits specific characteristics that distinguishes it from a variety developed within the formal seed sector and that warrants a separate and different definition in order to render a farmers' variety registration system feasible and effective.

3.2. A Farmers' variety registration system

3.2.1. What are the criteria for registration of a farmers' variety?

Since many farmers' varieties are less uniform and stable to adapt to local conditions and requirements, it would be counterproductive to apply all UPOV-type DUS requirements for their registration. Obviously, the requirement for 'distinctness' remains key as it is important that a variety (or population) can be recognized and distinguished from other varieties. In UPOV terminology, a candidate variety is defined as "clearly distinguishable from any other variety whose existence is a matter of common knowledge at the time of the filing of the application" (UPOV, 1991). The other UPOV criteria are not applicable. Some experts and countries (Leskien and Flitner, 1997; Rangnekar, 2002) have proposed to replace the criteria of 'uniformity' and 'stability' with 'identifiability', to identify the subject matter without prescribing in detail the physical properties a plant variety needs to have, in line with the motivation to keep the criterion for distinctness. The criterion of identifiability can be fulfilled by describing morphological and major agronomic attributes, particularly under specific agro-ecological conditions. The levels of uniformity or stability as observed in farmers' fields for certain major traits can be included in such a description to the extent that these traits and their maintenance are considered important to render the variety distinct.

Thus, the characteristics that can be included to identify and register a farmers' variety are:

- a. deposition of the vernacular name/common name;
- b. description of the range of expression within morphological traits, such as colour of flowers, colour of seeds, shape of leaves, height of plants, days until flowering, days until maturity, resistance against certain pests and diseases, and yield;
- c. level of adaptation to specific agro-ecological conditions and specific farming systems (typically low-input and/or organic production systems), and/or resilience to climate change and other adverse conditions;
- d. description of the origin and history of the variety, as far as known by the registrant. This may include a description of the breeding methods and parental material in the case of novel varieties developed through participatory plant breeding;
- e. socio-cultural and nutritional values and religious uses, and any other associated traditional knowledge that the registrant may wish to share.

The information included under point c. may, to some extent, be compared with the Value for Cultivation and Use (VCU) requirements as included in the formal variety registration system in several countries. However, an important difference is that VCU tests are usually performed through field trials carried out in different regions of a country and over a period of at least two years or growing seasons. During these field trials, the candidate varieties are compared with the best (i.e. high yielding) formal varieties in existence. Also, the applied growing conditions resemble the high-input and irrigated environment in which commercial agriculture ideally takes place (Louwaars and Burgaud, 2016). In the case of farmers' varieties, this approach is neither feasible (due to the costs involved) nor desirable. On the contrary, farmers'

varieties are usually valued because of their adaptability to agro-ecological conditions, which are often characterized by little or no external inputs and irregular water supply. The requirements of the registration system should accommodate these specific characteristics and aim to capture the distinctive value of candidate farmers' varieties under such conditions.

Useful examples are provided by legislation from Nepal and the European Union (EU). The EU legislation established the first registration system that caters specifically for heterogeneous varieties. More specifically, EU Regulation n°2018/848 on organic production and labelling of organic products established a registration system for organic heterogeneous material, which is defined as a "plant grouping within a single botanical taxon of the lowest known rank which: a) presents common phenotypic characteristics; b) is characterised by a high level of genetic and phenotypic diversity between individual reproductive units, so that the plant grouping is represented by the material as a whole, and not by a small number of units; (...)" (EU, 2018, Article 3.18). It is explicitly mentioned that such material is not considered a 'variety' as defined in the UPOV-compliant Community Plant Variety Rights legislation (EU, 1994), and it can, as such, not be protected by plant breeders' rights.

In order to register such "heterogeneous organic material", applicants need to send a 'notification file' to the competent authority containing a) their contact details; b) the species and denomination of the organic heterogeneous material; c) the description of the main agronomic and phenotypic characteristics that are common to that plant grouping, including breeding methods, any available results from tests on those characteristics, the country of production and the parental material used", and a representative sample (EU, 2018, Article 13.2). The EU is currently discussing modalities to expand this framework to the non-organic market (Thanopoulos et al., 2024).

Nepal's seed legislation includes provisions for the registration of farmers' varieties since 2013 but few varieties were registered due to a cumbersome and unclear registration process, which proved difficult to navigate for farmers and policymakers alike (De Jonge et al., 2021). In 2020, Local Initiatives for Biodiversity, Research and Development (LI-BIRD) and Nepal's Seed Quality Control Center (SQCC), together with partners, developed a more user-friendly registration template which was tested by farmers for five rice varieties (Carampatana, 2021). The template requests farmers to fill in information about the history of the variety, its phenotypic and agronomic characteristics, seed availability and cultural practices. Farmers can attach photos and videos. After successful submission of applications using this form, the farmers are invited to present and defend the registration of their variety before the provincial or national registration committee.

To sum up, a farmers' variety registration system should recognize the special nature of farmers' varieties that distinguish these from formal sector crop varieties, related to their continuous adaptation to local agro-ecosystems and their responsiveness to growing conditions, to render such system effective and responsive to farmers' needs.

3.2.2. Who qualifies to register a farmers' variety?

Under a Farmers' Variety Registration System, any farmer should be able to register a farmers' variety that he or she has maintained over the years. Whereas this may be an individual farmer, it will usually be a group of farmers or even a community. This implies that both natural and legal persons should be able to register a farmers' variety, as applicable in registration systems designed for the formal sector. A legal person can, for example, be a farmer cooperative or community seed bank (CSB) and is treated in the same way as a human being for legal purposes. The registration process should be made as accessible as possible to any farmer or farmer grouping and include support options in the form of training or advice. To further facilitate the registration process, a distinction can be made between the 'registrant' and an authorized person or entity that can assist the registrant in the registration process and may operate on behalf of the registrant in whose name

(s) a particular variety is registered and who receives the main 'rights' (and responsibilities) over that variety, while the authorized person can be an advisor or organization such as a non-governmental organization (NGO) or parastatal agency that provides support to farmers.

Two main issues may complicate answering the question who can register a farmers' variety. Firstly, different communities may use different names for the (genetically) same variety or, vice versa, one and the same name used by different communities may refer to genetically different varieties (Nuijten and Almekinders, 2008). Secondly, due to the variability of many farmers' varieties over time and space, it may be difficult to demarcate the group of farmers or communities that have maintained a farmers' variety over time.

These issues can be largely resolved by the requirements in the registration form (discussed above), which requests the registrant to supply sufficient information to identify the candidate variety and to provide information about its history and use in time and place. This information can be supplemented with any supporting documentation maintained by CSBs, genebanks, seed traders, community support organizations, government extension services or breeding institutions where available. Taken together, this information can then be verified by the respective registration authority. In Nepal, for example, the registration authority will check whether the registrant is a farmer (or farmer group) that has indeed maintained the candidate variety over time; whether the candidate variety is a farmers' variety and not an adapted modern variety that has been officially released in the past; and evaluate the phenotypic description supplied by the registrant in order to assess the correct botanical and informal name(s) and to preclude duplications on the variety list. In case a farmer wishes to register a variety that has already been registered, the new registrant is simply added to the list of original registrants. Another option is to separately enlist additional registrants based on their distinct locality. Several countries only allow for the sale of, for example, QDS in the area or region of the producer (Dey et al., 2022).

Legislation may allow that in the initial absence or lack of full capacity of a national variety registration authority the option for a temporary 'light' registration version may be provided, in which - in its simplest form - a NGO or national agricultural research organization (NARO) could take up some of the functions awarded to the authority. In practice, such organizations may already offer support to smallholder farmers and their communities and be involved in participatory plant breeding, for example, participatory variety enhancement in which farmers work with appreciated local varieties to either restore particular traits that have deteriorated over time, improve preferred traits, or adapt the varieties to changing growing conditions (Salazar et al., 2020; Jarvis et al., 2011).

Who is to be recognized as a registrant depends to a large extent on the benefits (or burdens) that come with the act of registration. Policy wise, this is probably the most complex issue that a registration system for farmers' varieties needs to clarify to become both operational and acceptable to all parties involved. It relates to issues of ownership and access and benefit-sharing, which are much debated in the field of (plant) genetic resources and have proven to be very controversial (Mooney, 2012). Which 'rights' or 'benefits', for example, should a registrant receive vis-à-vis other farmers that use(d) to grow the same variety? And how can farmers that have developed and/or maintained the registered variety be protected against 'misappropriation' by other actors?

3.3. Rights, responsibilities, and benefit-sharing

3.3.1. Could a farmers' variety be protected by intellectual property rights?

Since the adoption of the Trade Related Aspects of Intellectual Property Rights (TRIPS) agreement of the WTO in 1994, most countries have established a *sui generis* plant variety protection (PVP) system to provide intellectual property rights (IPRs) over (new) plant varieties. The most common PVP system is that of the UPOV Convention. This and

most other *sui generis* PVP systems provide exclusive property rights to the creator of a plant variety that is new, distinct in its main characteristics from any existing varieties, sufficiently uniform in its characteristics, and stable over repeated cycles of propagation.

Several academics have explored the potential of applying a *sui generis* PVP system to farmers' varieties (Manzella and Louafi, 2020; Correa, 2016), and some countries such as India have implemented such a system (Lushington, 2012). Most authors conclude, however, that an intellectual property rights system does not fit farmers' varieties for several reasons. The first and most fundamental reason is that many indigenous peoples and farming communities "summarily oppose and reject 'Western' forms of intellectual property rights (...) as a deeply offensive, illegitimate and improper arrogation by humans of rights to and ownership of sacred and living beings with whom they believe they have a relationship of mutual responsibility and care" (Kloppenborg et al., 2024, p.13).

Other reasons relate to the characteristics of farmers' varieties. Regarding the first category of farmers' varieties that we discerned, i.e., landraces or traditional varieties that have exclusively been developed by farmers, such varieties cannot be considered new, making it difficult to appoint a start and end time of an exclusive right over any such variety. Another challenge relates to the multitude of actors involved. Even though PVP systems usually allow for joint ownership, they are not well-suited to the collective, social systems of innovation in which many farmers' varieties, including PPB varieties, are developed and maintained: "IP is designed to reward the final innovator in return for a benefit to society in general, and not so much those who have collaborated on the innovation." (Manzella and Louafi, 2020, p. 303).

Furthermore, an IPR system requires that the object of ownership can be clearly (and rather narrowly) defined and does not change (much) over time. This is the very rationale behind the requirements for distinctiveness, uniformity and stability (DUS), which next to novelty, are the main criteria for protection in the UPOV Convention and most other PVP systems. If a breeder could get an exclusive right over a heterogeneous variety that changes every planting cycle, this would result in a comprehensive monopoly, the coverage of which will change from season to season, creating legal uncertainty for all other entities that grow similar varieties.

Finally, what would be the use of assigning exclusive property rights to a resource (crop variety) that gains much of its value within the open and dynamic networks of exchange (among communities and among gene pools) in which it is maintained?

For all these reasons, i.e. cultural inaptness, lack of novelty, a wider genetic varietal base, and an undesirable brake on seed exchange, we do not consider a PVP system, or any other IPR regime, suitable to govern rights that a registrant may receive over a farmers' variety. Geographic Indications may be a tool to protect (the products of) farmers' varieties in well-developed markets, but this goes beyond the scope of this article (for more info see e.g., Blakeney et al., 2020). But what rights, privileges, or benefits could a registrant receive instead? In the section below, we elaborate four principles that can provide guidance in answering this question.

3.3.2. Which rights should a registrant receive over the registered variety vis-à-vis other stakeholders?

Principle 1. The act of registration of a variety should not affect any traditional practices of other farmers regarding such variety.

This principle implies that the successful registration of a particular variety by one farmer or community will not affect or undermine the right of any other farmer to use, exchange or sell farm-saved seed of that variety in the same way as before the act of registration. In other words, any farmer will be allowed to use, exchange and 'informally' trade farm-saved seed of any farmers' variety, including when registered as such.

The major difference with unregistered farmers' varieties is that in principle seed of registered farmers' varieties can be produced and marketed as certified or quality-declared seed (QDS). As discussed

above, the possibility to formally produce and commercialize seeds of farmers' varieties takes away a major hindrance to seed production and marketing by farmers.

By investing in the quality of the (starting) seed of the registered farmers' varieties, registrants may create demand in the market vis-à-vis the same variety being available through informal channels. Furthermore, the certified or quality-declared seed should be branded and labelled adequately with information on the attributes and adaptability of the variety, which can create demand beyond the locality where the seed is produced. While the problem of 'fake seed' is systemic for the entire sector, it may be less pressing for farmers' varieties given the relatively low profit margins.

Principle 2. Farmers who want to sell certified seed of a variety registered by a third-party registrant should buy their source seed from that registrant(s).

By applying this principle, the original registrant may benefit from having gone through the process of registration (and maintenance of the source seed) without creating marketing exclusivity within the farming community at large. The principle implies that any third-party farmer or farmer group (e.g., cooperative, CSB, farmer seed enterprise) is allowed to produce and commercialize certified seed of a registered variety but will need to buy the source seed from the registrant. In most cases, it will not be easy to establish a seed business for farmers' varieties that is profitable or at least cost neutral. Once a particular cooperative or farmer seed enterprise manages to do so, others may follow and aim to join in the production and sale of the popularized variety, improving the availability of quality seed of a bigger portfolio of adapted varieties for smallholder farmers.

In case of multiple registrants for a single farmers' variety, the regulation may require that interested parties get their source seed from the closest available registrant. Not all registrants, however, may be able to produce source seed in sufficiently large quantities, depending on their capacities and resources. In the latter case, the registrant should be allowed to assign this starting seed provider function to someone else, being another registrant of the same variety, a supporting NGO or NARO, that has been involved in the development and registration of the variety concerned (for free or against a minimal fee).

Principle 3. Seed companies that wish to commercialize a registered farmers' variety need to get permission from, and enter into an agreement with, the registrant.

Following this principle of prior informed consent (PIC) and mutually agreed terms (MAT), only farmer-owned cooperatives would be allowed to market certified seed of varieties included on the farmers' variety list, unless a seed company can show proof of a licensing agreement with the registrant of the relevant farmers' variety. This aims to protect farmers and their varieties from misappropriation and exploitation by other stakeholders.

In many countries, any registered seed producer and seller can freely start commercializing seed of a registered variety, as long as that variety is not protected by IPRs. If this approach were applied to registered farmers' variety as well, the registrant would have no means to stop others from commercializing the varieties it has registered. The principle requiring a commercial third party to license may also facilitate collaboration between farmers and commercial stakeholders in the seed value chain. Established seed companies may be much better positioned to commercialize a registered farmers' variety, whereas not all farmers who have developed and maintained a farmers' variety may be interested or capable in setting-up and maintaining a seed business.

In order to keep monitoring costs on such license agreements down, the seed certification agency could be charged to verify the existence of a signed contract with the registrant in case a seed company requests to certify and market seed of a registered farmers' variety. The registration authority or a supportive organization (e.g., NARO, NGO) may assist farmers in the negotiation and licensing process with third parties. Standard licensing agreements can be established to govern transactions between the registrant and a seed company that aims to commercialize

the registered farmers' variety, in case resources or capacities for these functions are not yet available. Whereas it may be difficult to develop profitable markets for most farmers' varieties, a simple, cascading set of benefit-sharing requirements or royalty fees that starts with a modest, up-front payment to acquire production rights and source materials, after which market-conform royalty rates can be linked to increasing levels of commercialization, may be of major assistance.

Principle 4. Any party should be free to use a registered farmers' variety for further breeding but a protected commons may have to be created to keep the genetic material in the public domain.

Considering the underlying motives behind a system for farmers' variety registration, any farmers' variety should remain freely available for further breeding. However, in a context in which certain elements of genetic materials may be appropriated by other parties in the form of patents, one may opt to try to guarantee the continued availability of the traits incorporated in farmers' varieties by including a so-called copyleft provision in material transfer agreements with third parties. Such copyleft provision would demand that the received material remains freely available for further breeding by any third party and that the user of such material is held to apply the same licensing terms to any distribution of any varieties that have been bred with use of the received material. The Open-Source Seed Initiative (OSSI) and others have written extensively about such licensing provisions and the establishment of a protected commons (Kotschi and Horneburg, 2018; Luby et al., 2015). One approach that may be particularly suitable to the developers and users of farmers' varieties is the use of the so-called OSSI Pledge (OSSI, 2024). Still, patents pose challenges for farmers and breeders alike and urge governments to incorporate exemptions for breeding and/or plant genetic material in their patent laws (Kock, 2022; Correa et al., 2020). We are less concerned about plant breeder rights (PBRs) because 1) PBRs only protect a particular variety and not the underlying genetic material, 2) PBR laws include a breeder's exemption, which allows anyone to continue breeding with the protected variety, and 3) a farmers' variety registration system precludes that third parties can claim plant breeder rights over the registered varieties.

In summary, a farmers' variety registration framework may contain the following regulations, as well as rights and access and benefit-sharing principles (see Fig. 2):

- The registrant does not acquire any intellectual property right over a farmers' variety, nor does the registration affect the traditional practices of any other farmer that grows the same variety.
- The act of registration allows the registrant to produce and sell certified seed of the registered variety. The right to produce and sell certified seed, including source seed, may be the exclusive right of the registrant, or of any other farmer allowed to market registered varieties on the condition that source seed is exclusively obtained from the registrant.
- Seed companies may only produce and commercialize farmers' varieties after explicit approval of and signing an agreement with the registrant. This will protect farmers and their varieties from misappropriation and/or the inappropriate loss of market shares.
- By applying standard licensing agreements with market-conform rates, transaction costs can be kept to a minimum and collaboration between different seed sector actors can be facilitated.
- Farmers' varieties should remain freely available for further breeding. To that end breeders who use registered farmers' varieties in their breeding programs can be requested, by means of the OSSI pledge or otherwise, not to restrict the use of any resulting varieties by third parties.

4. Discussion

This paper elaborates the approaches and principles presented along the regulatory value chain (as illustrated in Section 2) that could potentially assist in developing a farmers' variety registration system. In

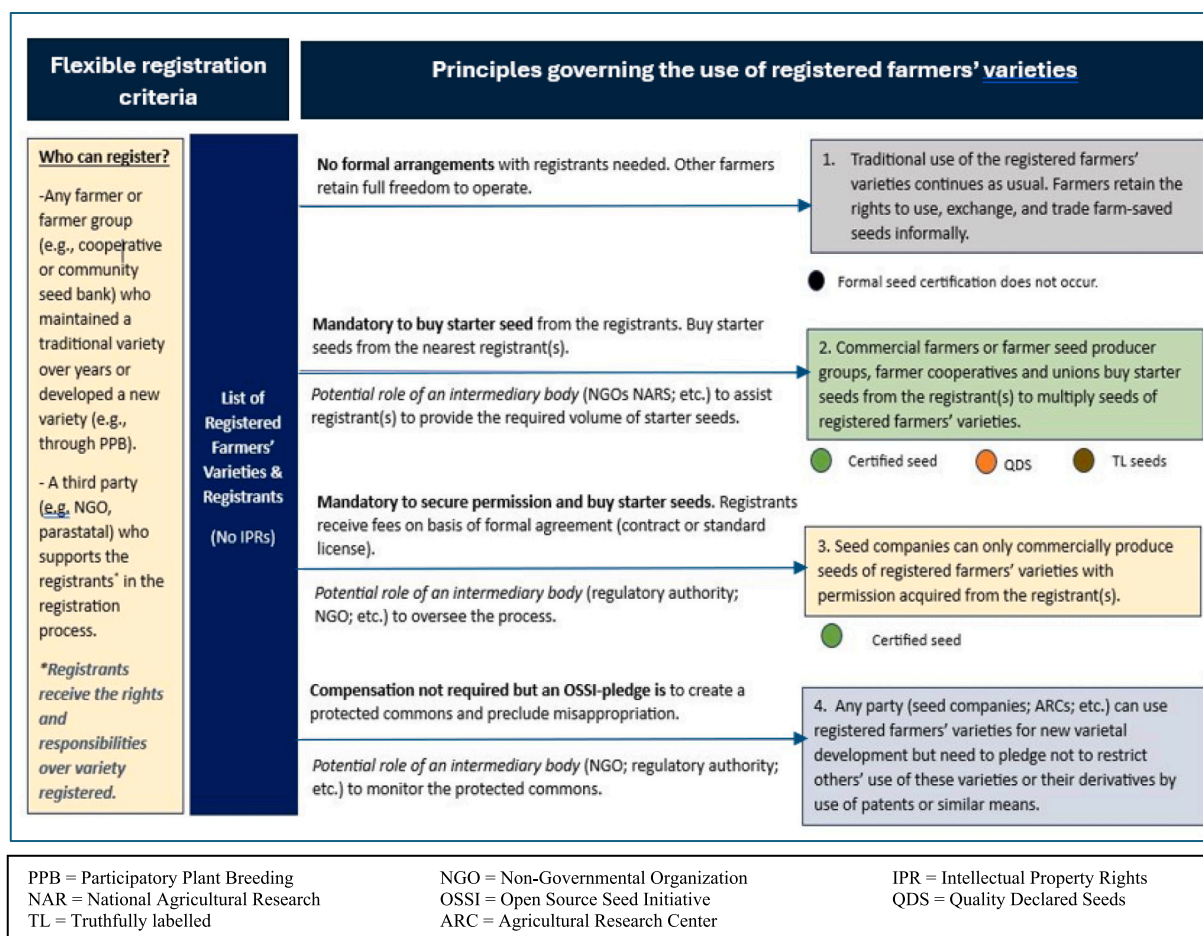


Fig. 2. Principles to govern rights, access, and benefit-sharing of farmers' varieties.

this section, we reflect on some key issues related to nodes one to three, which were analyzed above, and present some additional issues which may arise once facilitation and implementation of a farmers' variety registration system is initiated within the framework of a national system. For example, practical issues regarding seed multiplication, inspection, certification, marketing, and distribution of such varieties may arise related to availability of budgetary resources, diversity of seed system actors, and regulatory capacity of governments.

First, the national seed sector and the regulatory context (first node of the seed regulatory value chain in Fig. 1) may influence the objectives of such a system. These may vary among countries and range from crop diversity conservation to the establishment of farmers' rights over such varieties. One may argue that given farmer-managed seed systems are based on farmer-to-farmer exchange and trade, a farmers' variety registration system could potentially lead to restrictions to access and use of genetic materials by other farmers. However, this article asserts that smallholders should have the option and legal allowance to conduct seed businesses using farmers' varieties to respond to market signals showing a demand for seed of such varieties, especially when those are not supplied through the formal seed system. For most countries that implies registration of such varieties before entering any markets for trade, thus necessitating the establishment of a farmers' variety registration system. In addition to the objective and need for such a system, the political will of stakeholders should be explored and documented. Whereas stakeholders may not always be aware of the possibilities and pros and cons of such a system, creating awareness and acquiring political will is a must. Furthermore, the crop portfolio for which this system would cater to could also differ. In Ethiopia, for example, the existing seed policy requires such for crops and varieties that are of

Ethiopian origin and diversity (Amsalu and Dey, 2023).

Second, the overall objective may influence how the registration system for farmers' varieties (second node in the regulatory value chain in Fig. 1) will be implemented. Considering that many farmers' varieties exist, how many and which of those should qualify for immediate registration? In case conservation is the prime objective of the registration system, all farmers' varieties may be deemed subject to registration, which will necessitate a very light registration procedure. Another option is to limit (or sequentially develop) the registration to those farmers' varieties whose seeds are in demand but not widely available to farmers interested in growing such varieties. We postulate that whenever demand is observed in the seed market, national and local systems should have the capability to respond to such market signals – in this case, meet the demand by providing quality seed of varieties for its consumers (farmers). It should be noted that varieties that are in demand may not always be those that demonstrate maximum yield. In fact, cultural norms, medicinal properties, taste, and culinary preferences often dictate the demand for farmers' varieties in local markets. In the same vein, if multiple farmers are growing the same variety and would like to register simultaneously, there could be a need to determine which farmer could do so and in which order. It might be advisable that those farmers who can maintain the starter seed for such varieties be the first to be allowed to register. Such a process would ascertain continuous access to starter seed for multiplication purposes.

Third, no matter how the registration system will look like or what objective it aims to achieve, ownership and benefit-sharing issues will likely come up in some form (third node). The principles described in Section 3.3.2 (see Fig. 2) are simply one approach to address these issues. We argue that registration per se provides insufficient protection

against misappropriation since small adaptations or the underlying genetic material can be protected by intellectual property rights in many countries around the world (Correa et al., 2020). Nevertheless, variety registration can help to clarify from which sources public and private sector breeders may have attained new traits in their breeding efforts (Lopez-Noriega, 2016). Furthermore, the act of registration can allow the registrant to set the terms and conditions of use for the registered variety in the form of a licensing agreement, which can include the aforementioned open-source conditions or OSSI pledge.

Fourth, there are various issues that concern effective and affordable seed production and marketing (fourth and fifth nodes in the regulatory value chain, Fig. 1). Sometimes, the extent of market penetration is limited by seed class. According to the Ethiopian policy (Amsalu and Dey, 2023), for example, seed lots of farmers' varieties must follow a Quality Declared Seed (QDS) procedure by which most of the burden of quality assurance falls on the farmers rather than on the regulatory authorities. However, it also suggests that QDS seed may only be marketed within the boundaries of a "community", thus limiting the options for an economically successful marketing of a farmers' variety (Amsalu and Dey, 2023).

Given the local adaptability of farmers' varieties, where should such seed be sold? To resolve that issue, without limiting the marketable area too stringently, one plausible solution could be adequate labeling information made available with the packages, meaning that seed labels should appropriately reflect the required conditions of growth and agroecological suitability. Proper packaging determines the accessibility and quality of seed lots of varieties, whereas proper labeling of seed lots provides the buyer with essential performance information (Dey et al., 2022). Key information to be shown on labels of seed packages may include but not limited to: name of the variety, agro-ecological conditions under which the variety would perform well; any specific climate-adaptive properties; date of packaging, place of packaging; expected yield of the crop; maturity length; expected cooking time or taste or colour, identity of the unit by which the seed lot is marketed or distributed.

Fifth, the conditions of regulation should not diminish effectiveness of the farmers' variety registration system. It is key that regulatory costs and burdens are held to a minimum. This could be made possible through decentralized seed inspection and certification by empowering local authorities, research centers, well-respected nodal farmers, seed producer cooperatives or unions that may replace the need for external seed inspectors operating from distant locations, saving on travel time and transport costs, and bringing de facto regulators closer to the farmer whose crop is to be certified. Local authorities bring greater rapport to local seed producer groups and grassroot organizations and allow for greater collaboration than geographically removed federal counterparts which often lack sufficient local context or relationships. Greater social cohesion may result when local authorities are empowered to take responsibility for their local communities and their performance regarding major agricultural policies.

Sixth, in addition to seed quality, defining access to markets plays an important role in scaling up the availability and reach of a variety. Often seed laws dictate which class of seed could be sold at which venues and outlets. For example, in Ethiopia and Uganda, QDS seed cannot be sold by seed companies or by agro-dealers. National policies should allow for a wide array of market venues and outlets to sell seed of farmers' varieties that would push out the market frontier allowing more consumers and buyers to avail of seeds they prefer, as long as seed packages are clearly labelled to inform the buyer of their origin and normal growing conditions. Research has shown evidence of effective models of seed delivery at the last mile (Nagarajan et al., 2019; Sperling et al., 2017).

Finally, diversity of seed varieties also implies an environment that supports and promotes diversity of actors. Efforts from nationally operating NGOs may be helpful to promote and support a farmers' variety registration system. At the African continent level, the Africa Seed Network and the Africa Seed and Biotechnology Program could also act

as potential supporters. Such supporting organizations may play a role in taking away misunderstandings regarding the registration of farmers' varieties and reduce fears among those policy makers who may for instance, expect productivity gaps between new improved varieties from the formal sector and farmers' varieties. Similarly, a reorganization of the National Variety Release Committee by incorporating farmer organization representatives, local NGOs, local research institute members and women farmers, may guarantee that proper knowledge on local seed systems and local crop diversity is better represented and reflected in decision-making. Farmer-friendly easy to comprehend application templates should also be adopted for the purpose of smooth registration of farmers' varieties and of legal entities producing seeds of registered varieties.

5. Conclusion

The current article highlights the tenets of a farmers' variety registration system. The expositions and principles outlined in this article keep contextual scenarios realistic and thus provide practical and feasible options with low regulatory costs. A farmers' variety registration system does not replace nor threaten existing registration processes that govern varieties developed and released by the formal seed system. It merely allows farmers the option to legally sell and scale-up production of quality seed of farmers' varieties, that are demanded in the local and national markets but not supplied through formal channels of seed production mechanisms. Additional benefits of having a farmers' variety registration system can be many – supporting agro-biodiversity, improving quality of seed of varieties that are not provided by the formal seed system, expanding dissemination channels of farmer-preferred seed, greater availability of starter seeds for seed multiplication and commercialization, upholding social and cultural values, promoting conservation, and recognizing variety developer and maintainer. Creating such a registration framework and enabling its implementation with minimum regulatory burdens offer a plausible entry point for farmers and farming communities who are commercially oriented and would like to multiply and sell seed of farmers' varieties, thus expanding crop variety choices at the community level.

CRedit authorship contribution statement

Bram De Jonge: Writing – original draft, Validation, Investigation, Conceptualization. **Bhramar Dey:** Writing – original draft, Visualization, Methodology, Investigation. **Bert Visser:** Writing – review & editing, Supervision.

Declaration of competing interest

There is no conflict of interest.

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Data availability

Data will be made available on request.

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