

# UPOV report on the impact of plant variety protection - *A critique*

 **BD**  
Berne Declaration  
Déclaration de Berne  
Erklärung von Bern



---

<b>UPOV report on the impact of plant variety protection - <i>A critique</i></b>	<b>2</b>
--	----------

---

<b>Introduction</b>	<b>3</b>
<b>The UPOV report</b>	<b>4</b>
<b>Underlying assumption: the more, the better?</b>	<b>5</b>
<b>Defining the scope: the rural economy?</b>	<b>6</b>
<b>Inherently biased from the start</b>	<b>6</b>
<b>Indicators</b>	<b>6</b>
<b>The missing counterfactual</b>	<b>8</b>
<b>Selling apples as oranges: UPOV 1978 and UPOV 1991</b>	<b>9</b>
<b>Conclusion: No basis for decision-making</b>	<b>9</b>
<b>Acknowledgement</b>	<b>9</b>
<b>References</b>	<b>10</b>

---

Authors:

Silva Lieberherr (MSc ETH Agr) is a PhD student at the University of Zurich, Switzerland

François Meienberg is Campaign Director at the Berne Declaration, [www.evb.ch](http://www.evb.ch)

Editor: Berne Declaration (DB), Dienerstrasse 12, Postfach, 8026 Zürich, [info@evb.ch](mailto:info@evb.ch), [evb.ch](http://evb.ch)

Picture Frontpage: iStock

## **Introduction**

In 2005, UPOV<sup>1</sup> published a report<sup>2</sup> that aims to assess the impact of plant variety protection (PVP) in line with the UPOV Convention. Up to now, this report has often been used to legitimize the introduction of laws on plant variety protection in line with the 1991 Act of the Convention. In the following comment, we critically analyse the methodology of the UPOV's impact assessment by pointing out its underlying assumptions, and by discussing the defined scope, the chosen indicators and the missing counterfactual. We conclude that the impact study made by UPOV does not fulfil certain basic requirements. It leaves unanswered the question whether the UPOV Conventions do or do not have positive impacts – in a broader sense – on the countries that have adopted them. The UPOV report used narrowly drafted indicators, without taking into account key issues like food security, agro-biodiversity, availability of seeds for small farmers, or defining what “for the benefit of society” is supposed to mean. Therefore, it does not provide a reliable basis for decision-making for countries that may be considering joining UPOV 1991. We will start with a brief summary of the report's conclusions.

Silva Lieberherr and François Meienberg

May 2014

<sup>1</sup>International Union for the Protection of New Varieties of Plants.

<sup>2</sup>UPOV report on the impact of plant variety protection, see UPOV (2005).

## The UPOV report

### Methodology

In order to assess the impact of the UPOV Convention, the report examines five countries: Argentina, China, Kenya, Poland and the Republic of Korea<sup>3</sup>. The report's title states that it wants to be a "*report on the impact of plant variety protection*." Interestingly, there are no references at all in the report, neither to other impact studies that have been conducted, nor to related literature. This illustrates the vacuum in which UPOV and its impact study are situated.

Several indicators are used to compare the situation before and after the introduction of the UPOV Convention. However, as there is no methodology chapter, it is not described which methodology<sup>4</sup> was used and what the basis was to select the indicators.

To understand our points of criticism, it is necessary to introduce the indicators the reports used.

The first group of indicators assesses the number of new plant varieties together with their benefit. The most important indicator is the number of titles for newly protected varieties that are granted/in force since 1980, and how this number has changed since UPOV membership. This data is split up into the main crops and further analysed on the quality of the new varieties (but restricted to conventional traits, important for industrial agriculture, such as herbicide resistance or baking quality). Apart from the number of new varieties, in some countries the report also considers the development of collected royalties as a proxy indicator for the diffusion of the new varieties and their benefit as anticipated by farmers. Another indicator going in the same direction is the market share of the new protected varieties as a proxy for the value these varieties have for farmers, and the resulting demand for certified seeds. The proportion of certified seeds to non-protected seeds is used

<sup>3</sup> At the time of the impact study, only Poland and the Republic of Korea were parties to the Act of 1991. The others were parties to the act of UPOV 1978.

<sup>4</sup> To make our point clear, there is a broad range of literature about regulatory impact assessments (see e.g. Kirkpatrick et al. 2007). But the UPOV Impact Assessment does not make any reference to any methodology.

as a proxy for the same goal – given the fact that non-protected seeds are still available for farmers after the implementation of the UPOV Convention.<sup>5</sup>

The report goes one step further, and assesses the proportion of registration of domestic versus foreign varieties, as well as the area under export crops and the export of those crops. This is used as a proxy for the increase of foreign direct investments and the country's competitiveness in the global market<sup>6</sup>.

The second group of indicators assesses the structure of the breeding industry. For this purpose, the report measures the number of applications by residents and non-resident breeders/companies for each crop. It then examines the number of breeding entities (public and private). Lastly, the report describes, in a somewhat qualitative manner, the structure of the industry in terms of vertical and horizontal integration and cooperation.

### Main findings

Generally, the report finds that the occurrence of protected varieties has increased in a range of crops. This is mainly based on the increase in the number of varieties for which breeders have sought protection after countries have adopted the UPOV Convention. The report points out that it is costly to seek protection. Thus, the report assumes that breeders would only seek protection if: (a) it is necessary in the given system; and (b) the varieties have a market value for them. Additionally, the report implies that the fact that farmers and growers are choosing the new, protected varieties over non-protected ones indicates that farmers must anticipate benefit of the protected varieties.<sup>7</sup>

Further, the report concludes that the protected varieties have improved in quality. They deduce this from two points: (a) breeders would only register those varieties and farmers would only grow them if their quality is superior; and (b) in many countries a superior quality has to be shown in order to register it.<sup>8</sup>

<sup>5</sup> See UPOV report, e.g. page 88.

<sup>6</sup> See UPOV report, e.g. page 40.

<sup>7</sup> UPOV report, page 17.

<sup>8</sup> UPOV report, pages 17-18.

The report recognizes that a large number of variety applications are submitted by non-resident breeders in each country, particularly in the ornamental sector.<sup>9</sup> From this, it concludes an increased competitiveness of the respective countries in the global market. There is a slight tendency towards an increasing number of breeding entities, although this data is quite sparse. So it is assumed that due to the introduction of PVP, the income generation for breeders (commercial, public research, agricultural universities) has improved and further investment in plant breeding is encouraged.<sup>10</sup>

The report concludes by stating that overall, the UPOV is important and beneficial for farmers and breeders. In our view, this conclusion is not warranted by the data presented in the report. In the following paragraphs, we present our view of the UPOV report analysis and give details of our critique.

### Underlying assumption: the more, the better?

The UPOV report states that “it [the report] provides an important incentive to continue its [UPOV’s] mission to provide and promote an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants, for the benefit of society as a whole.”<sup>11</sup> Further, it makes its conviction clear, that through plant protection, the availability of improved varieties for commercially viable crops will increase. This can then be “the key to overall economic development and, in particular in developing countries, the development of the rural economy in a way which helps farmers to break out of the cycle of subsistence farming.”<sup>12</sup> Yet the report does not assess the impact on the rural economy at all. UPOV’s limited understanding of the complex processes at work and the related economics is also illustrated by statements such as “improved income through improved yields”<sup>13</sup> – without talking about production costs, risk factors or price volatility.

Instead, it bases its findings on a mere assumption concerning the role of PVP and intellectual property in rural development. This main underlying assumption is that an increasing number of new or existing varieties means a benefit for the society and therefore proof of the effectiveness of the UPOV Convention. This can be seen by the cited UPOV mission statement referring to “the aim of encouraging the development of new varieties of plants, for the benefit of society”<sup>14</sup>. Further, the report argues that “a strong argument can be made that the importance of the PVP system and protected varieties can be assessed simply by the occurrence of protected varieties.”<sup>15</sup>

The hidden assumption can be summarized as follows: the more varieties that come to market and are protected, the better for society. This needs to be questioned by raising the following issues:

- Who has access to the new seeds, both physically (where it is sold) as well as economically (i.e. who can afford the new seeds)?
- For whom do these new varieties bring better yields? Is their performance the same on small farms, where farmers lack simultaneous training and the appropriate technology?
- What are the crops that are being improved, and what does this mean for the food security of a country and its poor population?
- Which traits of crops are being improved/introduced, and what does this mean for the use of agrochemicals on the one hand, and for agro-biodiversity on the other?
- What is the impact of the PVP law on the informal seed sector (seed production, improvement and distribution in the hands of farmers) and the formal seed sector? Who has an advantage and who has a disadvantage? And what are the consequences?
- And last but not least: Has the new plant variety protection law been the reason that a specific variety has been registered? Or are there other explanations for the observed effects (e.g. the introduction

<sup>9</sup> UPOV report, e.g. page 31.

<sup>10</sup> UPOV report, e.g. page 14 for China.

<sup>11</sup> UPOV report page 11.

<sup>12</sup> UPOV report page 11.

<sup>13</sup> UPOV report page 24.

<sup>14</sup> UPOV report page 12.

<sup>15</sup> UPOV report page 17.

of GMOs in Argentina)?<sup>16</sup>

These issues are very important, considering that the report's motivation includes the benefit for society, which includes all kinds of farmers. Neglecting them is the most striking flaw of the report.<sup>17</sup>

### Defining the scope: the rural economy?

Disregarding the issues above is inexcusable, particularly because the report does not properly define its scope. The report is about the impact of PVP – but it is not clear on what. Is it simply an assessment of the impact on the number of newly protected or registered varieties? Is it about benefits to society, and if so, which benefits? Perhaps it is about the access to, or the use of, new varieties by farmers or breeders, or the rural economy as a whole? The report does not say.

And yet, defining the scope is crucial for any impact assessment. Without properly drawing these borders, it is not possible to choose indicators, nor is it possible to assess the appropriateness of these indicators. If the scope is left undefined and comprises benefits to society, or the rural economy as a whole, the range of the indicators would need to be much broader than those used in UPOV's 2005 report – *inter alia* including the above-mentioned points.

<sup>16</sup> The International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) has already highlighted this weakness of the UPOV report. On page 478, IAASTD says that “there are claims of positive effects of protection of breeder's rights for a selective number of cases; however, without taking into account alternative explanations for the observed effects and without providing data for other crops in the same case study countries (UPOV, 2005)” (IAASTD 2009).

<sup>17</sup> To be fair, the report acknowledges that the UPOV Convention influences only areas “*where there is no commercial market for a particular crop, but where plant breeding is still considered to be necessary, breeding may be supported by the public sector*” (UPOV report, page 11). However, no further thought is given to this point.

### Inherently biased from the start

This flaw becomes even more obvious when one reaches the report's first substantive section<sup>18</sup>. In discussing the role of PVP as well as its benefits, the report does not even allow for any possible negative impacts of PVP in general and the UPOV Convention in particular, although many scientific articles and reports about the limitations of the UPOV system – especially for developing countries – have been published<sup>19</sup>.

It is one of the fundamental rules of any impact assessment methodology that it should consider any possible outcome or result<sup>20</sup>. However, if a report examines only the possible positive impacts and the respective indicators, the report is biased from the beginning<sup>21</sup>. The results are highly likely to turn out positive – or at worst, neutral.

### Indicators

Considering the last two points, the indicators have to be chosen carefully. The indicators that the report uses (see introductory chapter) can be criticised on three major points that are outlined below.

#### Nature of indicators

The first point is that indicators should be as complete as possible, unbiased, and clearly justified by the assessment's subject and goal. None of this can be said about the indicators used. Because the scope of the report is not defined, and negative impacts are ignored, it is impossible to see if the chosen indicators match these requirements. However, the indicators fail to assess the issues mentioned before (see paragraph about underlying assumptions). The omission of these issues rather suggests that completeness and lack of bias cannot be assumed, and the indicators have been chosen in an unbalanced manner.

<sup>18</sup> UPOV report, page 23.

<sup>19</sup> See e.g. IPR Commission (2002), Crucible II Group (2004); World Bank (2005).

<sup>20</sup> See e.g. Baker (2000), Patton (2007).

<sup>21</sup> In this context it is striking that terms such as „negative“ or „problem“ do not even appear in the report.

Furthermore, the report includes hardly any qualitative indicators. In this rather explorative setting without a proper counterfactual (see later), this is a flaw. According to literature, in explorative contexts it is crucial to combine qualitative and quantitative data. This permits working inductively as well as deductively. It allows the authors to go beyond the already anticipated and expected results and effects, and to also detect those that are unexpected or even unthought-of.<sup>22</sup>

#### *What numbers can say*

The second point is that the indicators the report uses can be questioned *per se*. The *number* of protected varieties does not *per se* show any improvement in the varieties available – at least not without a thorough assessment of the traits of the varieties. The report does include the traits of the newly protected varieties to some extent, but not systematically – nor beyond conventional/industrial traits. Thus, the report leaves aside crucial concerns such as the varieties' applicability for different agricultural systems. Thereby, the report ignores the pluriformity of farming and seed systems, and neglects the position of smallholder farmers.

The report splits up the new varieties by different crops, but gives little thought to what the shift towards ornamental or cash crops in general means for an agro-economical system. Consequently, it does not question whether it is appropriate to take the amount of foreign direct investment and the amount of exported crops as a proxy (albeit an indirect one) for an improved agricultural situation within a country. It may be safe to assume that higher exports and higher foreign direct investments increase the country's competitiveness on the global market. However, it requires a leap of faith to automatically translate this into benefits for the society as a whole or even for the farming population – particularly for small-scale farmers or farm labourers.

Last but not least, the report takes the market share of the newly protected varieties as a proxy for the value these varieties have for farmers. This (together with the proxy indicator of royalties) leads to the omission of a very important point, namely the availability of the new varieties for different groups of farmers (e.g. small scale farmers versus big landholders). When

focussing on the numbers of newly protected varieties and the related implied monetary benefit they generate for farmers and breeders (e.g. through royalties), the report is biased towards well-off farmers who are able to express their needs in monetary terms: the more hectares a farmer cultivates and therefore the more seeds he or she purchases, the more he or she will influence these statistics. The situation that small-scale farmers or breeders might face is neglected.

#### *Temporal scope*

The third point of criticism is that the temporal scope of the indicators varies between the individual case studies. No reason is given for this variation, leaving the reader with the question whether the different temporal scopes have been chosen on the basis of the most impressive effects. Let us give a few examples to make this point clear. On page 36, on Argentina, the report states that "*in the 10-year period prior to those developments (1982-1991) [in 1991, Argentina's PVP system was amended to conform with the 1978 UPOV Act] the average annual number of titles granted to domestic breeders was 26, which more than doubled to 70 (267%) for the subsequent 10-year period (1992-2001)*". On page 75, the report says that "*the Republic of Korea recorded a high number of PVP applications by domestic residents immediately after the introduction of PVP in 1997. The second peak in the number of applications was recorded in 2002, the year in which the Republic of Korea acceded to the UPOV Convention.*" On page 47, on Poland, it then states that "*the number of protected potato varieties has increased continuously since the introduction of the PVP system*".

This is not to say that these analyses and conclusions are wrong *per se*. But the report should define at the outset how data will be analysed. If the authors take the yearly average over a 10-year period for one case, and interpret peaks or continuous increases in other cases, this might lead to tendentious conclusions, which can be questioned. It should be made transparent why a specific temporal scope (10 years, 5 years) for the indicators has been chosen, and then the same scope should be used for all case studies.

In addition, and in relation to the considerations about the report's underlying assumptions, more indicators would need to be included for the impact assessment to be credible.

<sup>22</sup> See Patton (2007), Mackay (2003), Becker (2001).

## The missing counterfactual

When doing an impact assessment of any sort, constructing a counterfactual is crucial. A counterfactual is a "without scenario" – what can we expect would have happened without the measure/policy/convention in place? To construct a realistic and accurate counterfactual means to think carefully about possible comparisons. Research and development of new varieties is a complex process that is influenced by many factors internally and externally – let alone agriculture or rural development where complexity is overwhelming.

The UPOV report was designed as an ex-post impact assessment, and the nature of the problem makes experimental approaches impossible. One approach might then have been to adopt a "with versus without" approach. This would mean to compare similar countries, of which some have joined UPOV and others have not. Or the same impact assessment could have been done for a series of countries that adopted other *sui generis* measures, which are in compliance with WTO's TRIPS Agreement<sup>23</sup> but not with UPOV, and did e.g. rely more on state support in plant breeding. To name an example, India would have been an interesting example that is further described in the box.

However, the report does compare the time before UPOV with the time after UPOV. This means that a temporal counterfactual is applied to a certain extent, but remains completely unquestioned. For an ex-post assessment, temporal counterfactuals are considered to be of limited use, as another development that happened during the same time might have had a bigger influence on the system in question<sup>24</sup>. This is known as attribution gap, and describes the difficulty of attributing a development or trend to one particular policy, event or condition. Indeed, in the present instance, some evidence suggests that the increase in improved new plant varieties in recent decades can be attributed more to scientific developments than to intellectual property<sup>25</sup>.

If no counterfactual scenarios are created, an impact assessment can make guesses about what may or may not have been the

impacts of the measure in question, but a guess is far from being a credible argument. Thus, the report can – if at all – show a correlation between the introduction of the UPOV Convention and certain trends, but it fails to make convincing arguments in favour of causality. Consequently, the so-called impact study is rather an input-output analysis, in that it does not really report on impact but on output (e.g. number of protected varieties) and partly on outcome (e.g. diffusion of those varieties, measured as collected royalties).

### *India: without UPOV*

India is an interesting case to exemplify the importance of counterfactual scenarios. The country is not a member of UPOV. Traditionally, plant-breeding policies in India mostly target the public sector. The main goal is to ensure food security and breeding relies heavily on the state. India has issued *sui generis* policies trying to balance the interests of all national players like traders, breeders or farmers – with an exceptionally strong focus on farmers' rights. In 2001, the Indian Agricultural Ministry introduced the Protection of Plant Varieties and Farmers' Rights Act (PPVFRA) in order to comply with the requirements of the TRIPS Agreement. India's law is unique in that it simultaneously aims to protect both breeders and farmers, while farmers have extraordinarily strong rights. (For more information about the Indian case, see e.g. Lushington 2012, Ragavan and Mayer 2007.)

The PPVFRA started to be implemented on the ground in 2005. Since 2007 6852 Varieties have been registered under the PPVFRA: 1265 from public entities, 2430 from private companies and 3157 Farmer Varieties (PPV & FR Authority 2014). These figures also include "extant varieties" and "farmer varieties" which do not have to fulfill the requirement of novelty.

Presenting the Indian example does not aim to make any conclusion about the impacts of the Indian Act, but at exemplifying the inadequacy of the UPOV report's methodology and the need for "with versus without" counterfactual scenarios.

<sup>23</sup> See WTO (2013).

<sup>24</sup> CGIAR (2013), Baker (2000).

<sup>25</sup> See Wright and Pardey (2006).

## Selling apples as oranges: UPOV 1978 and UPOV 1991

Related to this, the report does not specify clearly enough that the two Acts of the UPOV Convention in question, Act 1978 and Act 1991, differ in several crucial points. One of the most important is certainly that the 1978 Act does not restrict the right of farmers to grow their own seeds and to exchange them with other farmers. This right is strongly restricted in the 1991 Act<sup>26</sup>.

This difference is crucial, particularly when it comes to possible negative impacts on informal seed systems<sup>27</sup> and the rural economy. Given the importance of this difference, it is hard to justify why the report treats these two Acts of the Convention as one and does not differentiate the outcomes according to the different UPOV Acts.

Moreover, UPOV officials continue to regularly cite the report as “*providing countries considering the introduction of a plant variety protection system with information on the impact of PVP systems according to the UPOV Convention*”.<sup>28</sup> This claim stands on shaky ground. The report considers the situation in developing and emerging countries (China, Kenya and Argentina) that are parties to UPOV 1978, which is now closed to new ratifications. Countries that join now would have to sign UPOV 1991. Consequently, the report is misleading when it claims to have studied the benefits of the current UPOV system for developing or emerging countries. The results of the report could even be seen as an argument for *not* joining UPOV, and instead implementing a PVP law in line with the Act of 1978.

## Conclusion: No basis for decision-making

It is of great importance to analyse the impact of policy options. Such analyses, if done properly, can be important instruments for governments to decide on policies. However, the UPOV impact report does not fulfil these expectations. While it seems

indisputable that the number of protected varieties has increased as noted by the report, that is the only conclusion one can draw from it. Indeed, the report leaves unanswered the question whether the UPOV Conventions do or do not have positive impacts on the countries that adopt them. Our analysis shows that the report is methodologically flawed and grossly insufficient to meaningfully inform policy-making processes.

It is important to state that the impacts observed by the report could be seen both in the case of UPOV Act 1978 as well as Act 1991. Because the report fails to properly discuss these two acts independently, it is not possible to show which Act would be more beneficial for a country. Therefore, it does not provide a reliable basis for decision-making for countries that may be considering joining UPOV by ratifying the Act of 1991.

The UPOV report used narrowly drafted indicators, without taking into account key issues like food security, agro-biodiversity, availability of seeds for small farmers, or defining what “for the benefit of society” means. It would be crucial to assess the impact on all stakeholders – especially farmers – and to have a specific assessment on possible impacts on human rights<sup>29</sup>. If this is not done, the report can easily lead to wrong conclusions. An impact assessment that aims to convince governments to sign a convention that affects their farming populations to such an extent should surely be conducted with more care.

## Acknowledgement

We would like to thank all the people who have contributed to this paper with their valuable comments. Namely, our thanks go to Bram de Jonge, University of Wageningen; James Harrison, University of Warwick; Caroline Dommen, Quaker United Nations Office Geneva; and Thomas Braunschweig, Berne Declaration.

<sup>26</sup> See e.g. Boehm (2013).

<sup>27</sup> See Rice Knowledge Bank (2014).

<sup>28</sup> Citation UPOV report, page 5; see also Sanderson (2013) or Jördens and Button (2011).

<sup>29</sup> See Berne Declaration et al. (2010).

## References

- Baker, J. L. (2000). *Evaluating the impact of development projects on poverty - handbook for practitioners*. Washington D.C., USA: The International Bank for Reconstruction and Development / World Bank.
- Becker, H.A. (2001). *Social impact assessment*. European Journal of Operational Research 128 (pp. 311-321).
- Berne Declaration, Canadian Council for International Co-operation, and MISEREOR, (2010). *Human Rights Impact Assessment for Trade and Investment Agreements*. Geneva, Switzerland: Report of the Expert Seminar, June 23-24.
- Boehm, T. (2013). *Farmer's privilege and UPOV '91*. The Union Farmer Quarterly Spring 2013 (p. 17).
- CGIAR (Consultative Group on International Agricultural Research - Standing Panel on Impact Assessment) (2011). *Methodology of ex-post impact assessment*. <http://impact.cgiar.org/methodology> (access: 2 May 2013).
- Crucible II Group, (2004). *Seeding solutions. Policy options for genetic resources: People, plants, and patents revisited (Vol. 1)*. Rome and Ottawa: International Plant Genetic Resources Institute and IDRC .
- DAC (Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India). <http://seedvariety.dacnet.nic.in/AcropGrp.aspx> (access: 29 July 2013).
- IAASTD (International Assessment of Agricultural Knowledge, Science and Technology for Development), (2009). *Global report IAASTD*. [http://www.weltagrabericht.de/reports/Global\\_Report/Global\\_7\\_478.html](http://www.weltagrabericht.de/reports/Global_Report/Global_7_478.html) (access: 08 Jan 2014).
- IPR Commission (Commission on Intellectual Property Rights, UK), (2002), Integrating Intellectual Property Rights and Development Policy. [http://www.iprcommission.org/papers/text/final\\_report/reportwebfinal.htm](http://www.iprcommission.org/papers/text/final_report/reportwebfinal.htm)
- Jördens, R. and P. Button, (2011). *Effective System of Plant Variety Protection in Responding to Challenges of a Changing World: UPOV Perspective*. Journal of Intellectual Property Rights 16 (pp. 74-83).
- Kirkpatrick, C. and D. Parker, (2007). *Regulatory impact assessment: towards better regulation?* Cheltenham, UK: Edward Elgar Publishing Ltd.
- Lushington, K. (2012). *The registration of plant varieties by farmers in India - a status report*. Review of Agrarian Studies 2(1) (pp. 112-128).
- Mackay, R. and D. Horton (2004). *Expanding the use of impact assessment and evaluation in agricultural research and development*. Agricultural Systems 78.2 (pp. 143-165).
- Patton, M. (2004). *Impact assessment*. In M. Lewis-Beck, A. Bryman, & T. Liao (Eds.), *Encyclopedia of social science research methods*. (pp. 476-477). Thousand Oaks, CA: SAGE Publications.
- PPV & FR Authority (2014). *Status of the Total Applications received Crop Wise upto 15.04.14*. <http://plantauthority.gov.in/pdf/Status%20Crop%20wise%20Application.pdf>. (access: 22 May 2014).
- Ragavan, S. and J.Mayer (2007). *Has India addressed its farmers' woes? A story of plant protection issues*. Georgetown Environmental Law Review 20.1 (pp. 97-128).
- Sanderson, J. (2013). *Why UPOV is relevant, transparent and looking to the future*. Journal of Intellectual Property Law & Practice 8(8), (pp. 615-623).
- Rice Knowledge Bank. <http://www.knowledgebank.irri.org/qualityseedcourse-module6/lesson1> (access 8 Jan 2014).
- UPOV (International Union for the Protection of New Varieties of Plants) (2005), *UPOV report on the impact of plant variety protection*, [http://www.upov.int/export/sites/upov/about/en/pdf/353\\_upov\\_report.pdf](http://www.upov.int/export/sites/upov/about/en/pdf/353_upov_report.pdf) (access: 2 Aug 2013).
- Wright, B. and Pardey, P. B. (2006). *The evolving rights to intellectual property protection in the agricultural biosciences*. International Journal of Technology & Globalization 2(1/2), (pp. 12-29).
- World Bank (2005). Impacts of Strengthened Intellectual Property Rights Regimes on the Plant Breeding Industry in Developing Countries. [http://www.iprsonline.org/resources/docs/LouwaarsCGN\\_Plants\\_05.pdf](http://www.iprsonline.org/resources/docs/LouwaarsCGN_Plants_05.pdf)
- WTO (World Trade Organisation). *Agreement on Trade-Related Aspects of Intellectual Property Rights*. [http://www.wto.org/english/docs\\_e/legal\\_e/legal\\_e.htm#TRIPs](http://www.wto.org/english/docs_e/legal_e/legal_e.htm#TRIPs) (access 18 Oct 13).