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**Panel:** The Political Economy of Green Development

Food security: who sows? who reaps?

**Paper:**

**Will the seeds of technological advancements harvest food security?**

**Role of Trans-National Corporations.**

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## **Will the seeds of technological advancements harvest food security? Role of Trans-National Corporations.**

Increasing preference is given for technologically mediated solutions to solve developmental issues, such as hunger and scarcity of food. A classic example of this kind is the introduction of 'Green Revolution' in the early 1960's. To increase global food supply in order to feed the growing population has been a dominant policy discourse ever since but the emerging controversies over agricultural biotechnology and genetically modified Foods show how this remains a key issue. Is intensified 'production at all costs', a sustainable and viable method/solution to attain global food security? The following article is an attempt to present debates around food security in general, and linkages between agricultural biotechnology, intellectual property rights and trans-national seed corporations and implications to food security.

Two concurrent trajectories mould this article. First, it conceptualizes food security with an elementary approach: from the perspective of SEED. Seeds are knowledge intensive goods with direct linkages to food entitlements at all levels of the socio-economic sphere. Second, the article seeks to contextualize food security in an expanding 'knowledge-based economy'. A knowledge based economy is understood as production and services based on knowledge and technology-intensive activities that contributes to an accelerated pace of production and economic growth. Biotechnology for example is seen as an arena where knowledge is effectively turned into capital. Commodification<sup>1</sup> of genetic modified seeds on a global scale reveals that seeds are regarded as private property, which can be bought and sold especially by trans-national seed corporations, contrasting traditional ways of seed saving and farming methods. Simultaneously, internationalization of the Patency regime has set rules on the ownership, control and usage of seeds. Biotechnology research is resource intensive; hence most of the breakthroughs lie in the private sector. The Intellectual property Rights over transgenic seeds transfer full control of seeds over to the corporations. Farmers having to pay royalty or 'monopoly rents' in exchange of replanting seeds, to corporations signifies that these rules not only protect innovation and determine the 'who' but also the 'terms' of usage and control.

This phenomenon has alterations on the entire chain of food: from mode of farming, production, nutrition, distribution to sale of food including the environment, which are all significant elements contributing to a general wellbeing and food secure situation. At this point a very fundamental question arises: Is Knowledge capital embedded in the current international proprietary framework a driver for 'sustainable' development in agriculture and food security?

The case of Bt cotton in India is studied in the article to further illustrate the above analysis. As a way of conclusion, the article with aid of statistics and graphics presents a potential and possible future scenario of a monopolized global food market, where due to extensive consolidation processes in the private sector, monopoly power can come into play with total control over the food chain and food prices hindering sustainable development and food security.

**Key Words:** Food security, transgenic food, biotechnology, sustainable agriculture, intellectual property rights, trans-national corporations

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<sup>1</sup> To turn into a commodity: commercialization.

# 1. INTRODUCTION

## Food Security: A debate in transformation

”The power of population is indefinitely greater than the power in the earth to produce subsistence for man. Population, when unchecked, increases in a geometrical ratio. Subsistence increases only in an arithmetical ratio. A slight acquaintance with numbers will shew the immensity of the first power in comparison of the second by that law of our nature which makes food necessary to the life of man, the effects of these two unequal powers must be kept equal. This implies a strong and constantly operating check on population from the difficulty of subsistence. This difficulty must fall somewhere and must necessarily be severely felt by a large portion of mankind”<sup>2</sup> (Thomas Malthus, 1798)

Talking about the dangers of population growth, Malthus posited a theory as a causal process for famines in general: a constant decline and eventual scarcity in food availability due to over population. Malthusian optimism<sup>3</sup> as it is termed is the observation that, if there is surplus of food, meaning if food production is either equal to or more than the population or the rate of food production is either equal to or faster than the growth of population, then there shall be no food insecurity. The Malthusian ‘optimism’ refers to the dichotomist perspective of preventing famines by way of producing food in abundance. Another argument in relation to famines put forth by David Ricardo: in a situation of ‘superabundance’, a famine cannot occur<sup>4</sup>. The approach towards understanding famines and causes of food insecure situation was dominated by the discourse of producing abundant food on a global scale. A classic example of such a discourse translated into an international policy discourse is the Green Revolution of the 1960’s introduced in many parts of Asia and Latin America. The term ‘Green’ referred to the agrarian sector while ‘Revolution’ was to imply a drastic change in growing food crops and producing food, using intense industrial and technology based means and solutions.<sup>5</sup> The post years of the Green Revolution (GR) opened up a series of socio-economic-ecological issues and controversies. The GR was inherently capital intensive and favored rich farmers with large landholdings resulting in enhancing the class differences in the country side<sup>6</sup>. On the other hand, the GR was water intensive and detrimental to soil nutrition as it relied heavily on chemicals. The biggest success of the GR is however the desired increase in crop production. What can be noted from this example is that an

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<sup>2</sup> Thomas, Malthus, ‘*An Essay on the Principle of Population*’, 1798, <http://www.esp.org/books/malthus/population/malthus.pdf>, p4-5.

<sup>3</sup> ‘Malthusian Optimism,’ encountered in Sen’s *The Political Economy of Hunger*, p35

<sup>4</sup> Jean, Dreze, Amartya Sen, ‘*The Political Economy of Hunger*’, 2007, Oxford University press, P40.

<sup>5</sup> Term coined by William S. Gaud during a speech to The International Development Society, Washington DC, 1968: “these and other developments in the field of agriculture contain the makings of a new revolution. It is not a violet Red Revolution like that of the Soviets, nor is it a White Revolution like that of the Shah of Iran. I call it the Green Revolution”

<sup>6</sup> Lakshman S. Yapa, ‘*The Green Revolution: A diffusion model*’, *Annals of the Association of American Geographers*, 1977, 67/3, p350-359

international agriculture development program such as the GR had a single dimension of focus which was to multiply agricultural output. The local agrarian and realities<sup>7</sup> were however, not considered and hence the side effects are not included in the mainstream narratives around the GR<sup>8</sup>. However, the Food Availability Decline (FDA) hypothesis was dominant until early 1980's. World Bank report of 1986<sup>9</sup> included, for the first time, the element of nutritious food while describing individual wellbeing, thereby broadening the dimensions of understanding food-insecurity. By 1996, another dimension of food 'accessibility' was established in synergy with food 'availability' to combat food-insecure situations. 'Accessibility' was explained in terms of food 'distribution' at a larger level and at the individual level as the 'economic' capability of procuring food.<sup>10</sup> Eclectic debates around agricultural development and food security have surfaced since the GR and the controversies which it resulted. 'Sustainability' was introduced in debates around agriculture production. Sustainable agriculture production called for a more 'pro farmer' approach which integrated traditional and indigenous knowledge of cultivation with small scale organic farming methods. A 'production at all costs'<sup>11</sup> approach was heavily criticized from an environment protection perspective. Minimizing chemical based agriculture and subsidizing organic farming methods was announced to be the way towards renewable agriculture. However the biggest criticism to this approach based on the FDA hypothesis, was simply, 'Is this enough? Can such methods of farming produce enough to feed the world?'<sup>12</sup> Perspective of 'Trade' was applied to agriculture development. It was argued that importing cheap food while growing higher value commodities for the external market had better consequences in preventing food insecurity. Import substitution methods for agriculture sector were criticized and growing cash crops for export was advocated profusely. This perspective gained momentum and culminated in increased trade liberalization in the late 1980's<sup>13</sup>. On the one hand economic benefits at the national level can be enhanced if a country utilizes its comparative advantages over others, the pitfalls of export driven and dependent economies are strong. Long term availability of cheap food is questioned.<sup>14</sup> For example due to higher transportation costs on food imports, consumers might have to pay higher prices. Sudden changes in the international market over food preference could decrease the demand over a certain commodity affecting the country producing it extensively. This happens under situations of alternative choices: like root sugar over cane sugar.<sup>15</sup> Also, the assumption of

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<sup>7</sup> Unequal Land distribution and Feudal character of agrarian society.

<sup>8</sup> For example India and many other countries give high credit to GR and owe it to preventing famines.

<sup>9</sup> World bank report:

<sup>10</sup> FAO, World Food Summit - Rome, 1996: 'Food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life'.

<sup>11</sup> Ian Scoones, 'Agricultural biotechnology and food security: Exploring the debate', IDS working paper 145, 2002

<sup>12</sup> Lipton, M. 1999 quoted in Scoones, Ian: IDS WP 145.

<sup>13</sup> Uruguay Round of trade talks between 1986-1994 within the framework of General Agreement on Tariffs and Trade in Punta Del Este, Uruguay.

<sup>14</sup> Ian Scoones, 'Agricultural biotechnology and food security: Exploring the debate', IDS working paper 145, 2002.

<sup>15</sup> Ibid

‘efficient markets’ facilitate efficient distribution is challengeable. Another insight into deconstructing causes for food-insecurity is the ‘livelihoods approach’. Food-insecurity was no longer seen as a failure of agriculture to produce sufficient food at the national-international level, but instead a failure of livelihoods to generate stable access to sufficient food at a household/individual level.<sup>16</sup> Food availability and accessibility were considered to be one part of the equation. Holistic rural dynamics have to be included to ensure food security in the poorest of places.<sup>17</sup>

The discussion above points out to Food-in/security enmeshed in a macro, mesa and micro narratives weaved over time. This debate in its entirety was, if not deconstructed but definitely challenged by a mega narrative via the ‘entitlements approach’<sup>18</sup> In describing the entitlements approach, Sen argues that food supply and accessibility are however major influence factors of a famine developing but what is not considered is the food ‘acquirement’. It is not merely about not having enough food to eat or not having enough food to go around, rather of people having or not having enough command over food. The command over food is based on ‘endowment’<sup>19</sup>, ‘entitlement mapping’<sup>20</sup> and ‘entitlements’<sup>21</sup>. Sen draws upon the great Bengal famine example amongst others<sup>22</sup> to support his argument, that cause of famine was not due to decline of food availability, rather due to decline in food entitlements. Sen pointed out that famines can even occur in booming economic and ‘abundance’ conditions as well. *Economic disparities might lead to a large section of the population losing its command over food because of the worsening of their relative position vis-à-vis the groups favored by the boom.*<sup>23</sup>

The above discussion is an attempt to conceive a brief historical debate around the question of food-insecurity. The changing understandings and approaches evolved through time, place the issue in perspective and oblige a question to be asked: what is the current narrative around preventing hunger and food-insecurity?

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<sup>16</sup> Ibid

<sup>17</sup> Ibid

<sup>18</sup> Amartya, Sen, ‘*Poverty and Famines: An Essay on Entitlement and Deprivation*’, 1982, Oxford University Press

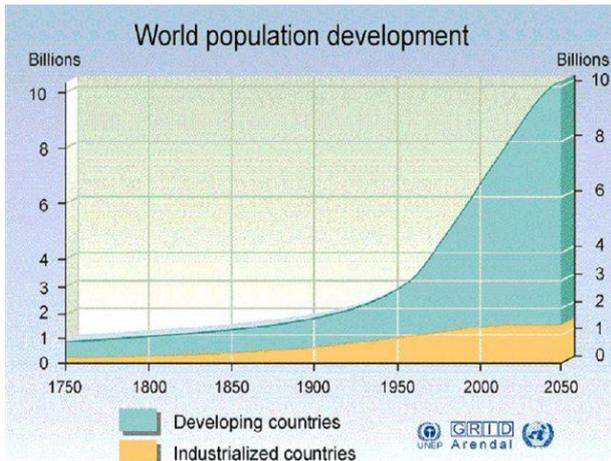
<sup>19</sup> A combination of all resources legally owned by a person, both tangible and intangible assets like land, animals, equipments and knowledge, skill, labor power, membership in a community respectively.

<sup>20</sup> Relationship between endowment set and entitlement set. Basically indicates the rates at which the resources of the endowment set can be converted into goods and services included in the entitlement set: fall in wages, loss of employment, and rise in food prices.

<sup>21</sup> A combination of goods and services that a person can legally obtain by using the resources from his/her endowment set.

<sup>22</sup> Famines in Africa and Asia.

<sup>23</sup> Sen, political economy of hunger, p38



The question diverts attention back to the population issue highlighted by Malthus. There has been a series of reports and studies about population growth over the past decade. Numbers and charts indicating a rapid, almost alarming growth rates are published. The web-pages of FAO and WB announce in big bold letters, how to feed the world in 2050<sup>24</sup>. These projections indicate that developing countries especially India and China are major contributors to accelerated population growth.

Malthusian prophecy of unchecked population culminating in a doom seems to be coming back. Current mainstream discourse is dominated by the Food Availability Decline hypothesis and recommends persuasively large scale food production as a solution in preventing future famines.

At this point it is only more than relevant to mention the theory of noted economist Utsa Patnaik which deconstructed the entire perspective on overpopulation as a myth! The commonly hyped equation of increase in population to increased stress and demand on the available resources has been termed as simplistic and strangely 'naïve'. Utsa Patnaik elucidates the concepts of 'real or effective population' which is missing in the popular 'population pressure' discourses. She asks the question: 'is the problem of excessive demand on resources a function of nominal population alone?' In a given situation where two populations are exactly the same in nominal terms and with same resources; but if one has twice the per head income of the other, its demands for resources will be twice as large and it is correct to think of it as a larger population in real or effective terms, exercising greater 'pressure' on resources.<sup>25</sup>

More than the question of which theory is more appropriate or what perspective is more 'right', the discussion above strikes out an important question which is a methodological one. To neglect any part of the 'macro-meso-micro-mega' narrative means asymmetric and undesired impacts. An integrated perspective approach is required. Denying any one of the perspectives is to romanticize the question of food security.

"Perhaps the most important thematic deficiency of traditional development economics is its concentration on national product, aggregate income and total supply of particular goods [...]"<sup>26</sup>

<sup>24</sup> <http://www.fao.org/wsfs/forum2050/wsfs-forum/en/>

<sup>25</sup> Utsa Patnaik, *The Republic of Hunger & Other Essays*, p.11-13, 2007, The Merlin Press.

<sup>26</sup> Amartya, Sen, '*Development: which way now*', 1983, *The Economic Journal*, Vol. 93/ 372, p 745-762.

The next part of this article looks upon a more contemporary solution seeking trajectory. There has been increasing preference towards knowledge based-technologically mediated solutions to solve hunger and prevent famines. The section attempts to not only discuss this trajectory but also analyze the impacts of such a phenomenon.

## **2. The green revolution revisited:**

When discussing the intervention of technology in agriculture sector, the Green Revolution comes back in the picture. The GR is probably the earliest and the most dominant policy narrative<sup>27</sup> associated strongly with the benefits of realizing such a method.

The Rockefeller foundation and Ford foundation together focused research in upgrading agriculture techniques: especially at the 'seed' level. New varieties of cross bred Wheat seeds were produced and first planted in Mexico. In 1962, an International Rice Research Institute was established in the Philippines with a focus on producing new varieties of Rice seeds. Simultaneously the foundation pressed the issue of intense population growth to the governments and thereby creating a necessity to grow Rice much faster than traditional means and hence increase Rice production. The new varieties depended heavily on chemical fertilizers and pesticides. A 'fertilizer supply project' was set up from the Agency for International Development (A.I.D). As part of the project either direct loan were provided to countries involved in the GR or fertilizers and pesticides were supplied on a loan basis. \$60million was to be allotted to Pakistan in 1969 just for the purpose of buying fertilizers. \$200million worth fertilizers and related raw materials on loan basis was to be offered to India in 1969. The GR technology in conjunction with A.I.D's projects was extended to major parts of Asia and Central America. In order to gain the 'trust' of the farmers to plant new seeds and to buy expensive fertilizers and chemicals for an unknown effect and result, the foundations worked closely with the national governments. Community based groups would go into villages and households and demonstrate the project. In the Philippines for example, the A.I.D designed a 'Do It Yourself' Rice kit for farmers. As a persuasion strategy, the first 100kits were financed by the A.I.D. More than 20,000 were sold soon after.<sup>28</sup>

The post GR period saw great distress cropping up from almost all parts of the developing world. Ecologists pointed out to the negative effects on soil nutrition and depleting water tables due to thirsty 'miracle seeds', threat to biodiversity due to mono-cropping<sup>29</sup>. A growing alliance of peasants, activists, researchers voiced out harsh criticisms. The criticisms circled

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<sup>27</sup> Ian Scoones, 'Agricultural biotechnology and food security: Exploring the debate', IDS working paper 145, 2002, p9

<sup>28</sup> Description is based entirely on the official speech by William S. Gaud to the Society for International Development in 1968, <http://www.rockefellerfoundation.org/news/speeches-presentations/first-green-revolution-accomplishments>

<sup>29</sup> Vandana, Shiva, 'Monocultures of the mind: Perspectives on Biodiversity and Biotechnology', 1997, Zed books and Third World Network.

mainly around persisting ‘colonial’ and ‘exploitative’ tendencies also towards nature: ‘Telling the farmers and the governments of the poor world, what to do and to have found a viable market for post World War II technologies and research by extending it to agriculture especially indirectly via the sale of agricultural inputs like seeds, equipments, chemicals, fertilizers.’<sup>30</sup>

### **Concluding remarks:**

The Green Revolution throws out two trajectories with respect to agriculture development:

(1) A dichotomist ‘practical’ solution to prevent hunger and famines and (2) the first steps towards drawing solutions from intense Research and Technological innovations: Shift from traditional knowledge and conventional methods of farming and growing food towards more industrial, scientific- knowledge based methods.

The following part of this article brings about new implications to food security by discussing genetic modification of seeds and Intellectual Property Rights.

## **2.1 Biotechnology -- Knowledge based Economy:**

The application of bio-technology to agriculture is not a new phenomenon. Tissue culture was long used as a low technology method to increase productivity. Biotechnology is not a new stream in science either. Biotechnology can be talked about in various forms like ‘traditional technology’ like brewing beer and bread making, Louis Pasteur’s Production of antibiotics, tissue culture, modern plant and animal breeding to the more contemporary, sophisticated, ‘new biotechnologies’ which implies various genetic engineering techniques for transferring DNA from one life-form to another to make transgenic organisms which might possess new and desired traits<sup>31</sup>. An important point to mention here is that research and development of applications in the contemporary new biotechnology is generally capital intensive/ extensive and therefore most of the Research and Development (R&D) stays with the private sector. Since the liberalization of agriculture sector and institutionalizing of patency in the international trade regime at the World Trade Organization- Uruguay round<sup>32</sup> under the section of Trade Related Intellectual Property Rights (TRIP), there has been a rapid increase in the concentration of trans-national Corporation in the agribusiness sector. Using genetic engineering, miracle seeds and the infamously known ‘terminator seeds’<sup>33</sup> have been engineered by the corporations. Since genetic modification of seed gives rise to an altered

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<sup>30</sup> Shiva, Vandana, ‘The Violence of the Green Revolution: Third World Agriculture, Ecology and Politics’, 1991, Zed books. Lewontin, R.C.; Berlan, J.P, ‘*Technology, research and the penetration of capital: the case of U.S. agriculture*’, *Mon. Rev.* 1986, 38, 21-34.

<sup>31</sup> Ian Scoones, ‘Agricultural biotechnology and food security: Exploring the debate’, IDS working paper 145, 2002, p9

<sup>32</sup> Uruguay Round of trade talks between 1986-1994 within the framework of General Agreement on Tariffs and Trade in Punta Del Este, Uruguay.

<sup>33</sup> Coined by an activist, Pat Mooney. The produce of these seeds are sterile.

form of seed, it falls under the category of new invention. Intellectual Property Rights is a legal protection framework under Patent Law, granted to the owner of a creation or innovation. In which the owner is granted a limited monopoly for a fixed duration of time. The rights exclude others from making, using, selling and offering for sale<sup>34</sup>. Since a terminator seed, for example was genetically engineered by an agri-business corporation, the corporation now has complete ownership over the seed. IPR provides the IP holder with the possibility of charging monopoly rents over the invention that not only compensates for inventing and developing the invention but that allows him or her to profit<sup>35</sup>. Farmers could no longer ‘save’ their seeds or ‘replant’ saved seeds and neither ‘exchange’ seeds.

Diverse debates have surfaced regarding impacts of Genetic modified seeds. Fears regarding hidden health risks from consuming gene modified food and polluting nature with heavy chemicals. From the dimension of Patency it is argued that the entire concept of growing patented GM crops is based on: (1) reductionist science ideology which stops farmers from saving seeds (2) thereby creates closures and monoculture by destroying seed diversity and (3) Exploits indigenous and traditional knowledge.

### **Concluding remarks:**

Seeds are not only the first links and basic building blocks in the food chain. Seeds indicate food security. Moreover, Seeds symbolize ‘knowledge’. Farmers have carried out natural pollination methods and have bred multiple varieties of Rice, Corn etc. This knowledge has been ‘transferred’ over generations and farmers today have inherited it from their ancestors. In this perspective, knowledge about farming and its application is a ‘public’ good. The Intellectual Property Rights stands in contrast to the notion of public good. IPR works on the principles of exclusion and constructs individual/group ownerships. In this perspective, ‘knowledge’ is seen as a commodity with immense economic value and profit.

With the Intellectual Property Rights framework in action, a fundamental shift and transfer of seed sovereignty – ownership has taken place which has given rise to structural imbalances in agriculture and unequal and limited distribution of production power and wealth to the farmers. The impacts of imposing conflicting ideologies on each other are evident. The important question to be asked is not simply of: Is it necessary to have genetic modified seeds and therefore food? OR Should life forms be even patented? But more so a question arises as a consequence of acknowledging the elementary differences in the two knowledge systems of producing food: Should there even be attempts of interference between the two systems?

Seeds can indeed be altered but should Intellectual Property Rights be applied to seeds? By definition, IPR is applicable to a product of the intellect and clearly the Seed is a product of nature: Are Seeds a Public good or Private Property?

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<sup>34</sup> Ryan W. O’Donnell, John J. O’Malley, Randolph J. Huis ,Gerald B. Halt, Jr, ‘Intellectual Property in the Food Technology Industry: Protecting your Innovation’, 2008, Springer

<sup>35</sup> E. Richard Gold, Matthew Herder, Michel Trommetter, *The role of Biotechnology Intellectual Property Rights in the Bioeconomy of 2030*, OECD International Futures Program, 2007, p4:  
<http://www.oecd.org/dataoecd/11/58/40925999.pdf>

### **3. Trade, Agriculture and Food Security: Emergence of new actors in agriculture and implications to food security.**

With relevance to the article, this section provides a brief historical overview of major developments in agriculture which heralded new (international) actors in the sector, their implications to food security and the essential restructuring of social and ecological relations.

Based on the premise of comparative advantage put forth by the economist David Ricardo<sup>36</sup> international trade was perceived as a viable tool for economic development. Reduced policy distortions and market failures was believed to pave way to more efficient allocation of resources and more sustainable patterns of production. Discourses were constructed to link trade with environment, sustainable development and food security. Agriculture trade was argued and advocated a key to attain food security. The agriculture trade fact sheet released in 1999 reads: ‘It augments domestic supplies to meet consumption needs; reduces supply variability; fosters economic growth; permits global production to take place in those regions most suited to it’<sup>37</sup>. In 1944, a Bretton Woods Conference resulted in the need for an International Trade Organization to have a rule based international trading system. Succeeding a series of rounds the General Agreement on Tariffs and Trade- GATT<sup>38</sup> came into being instead.

#### **3.1 The Uruguay round<sup>39</sup> of GATT: A critical juncture for agriculture and new implications to Food Security**

‘It took seven and a half years, almost twice the original schedule. By the end, 123 countries were taking part. It covered almost all trade, from toothbrushes to pleasure boats, from banking to telecommunications, from the genes of wild rice to AIDS treatments. It was quite simply the largest trade negotiation ever, and most probably the largest negotiation of any kind in history.’ (www.wto.org<sup>40</sup>)

The Uruguay round of GATT is important because the trading system and most trade agreements of today are based on the structure, rules and agreements finalized during the Uruguay round.

Two important reasons placed agriculture at its critical phase which paved in dramatic transformations in the sector especially in the non-industrialized countries or the so called

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<sup>36</sup> 1772 – 1823 proponent of free trade and most known for his law of comparative advantage. Basic premise of comparative advantage is that countries can gain by specializing in the good where it has comparative advantage and trading that good for the other.

<sup>37</sup> WTO Agricultural Trade Fact Sheet, ‘Agricultural Trade and Food Security’, December 1999.

<sup>38</sup> GATT part of the international monetary system was created at the end of second world war and lasted until it became the World Trade Organization in 1995.

<sup>39</sup> September 1986, in Punta del Este- Uruguay talks were launched to extend the trading system multi laterally touching several new areas prominently intellectual property, trade in services, reforming sensitive sectors of agriculture and textiles. The talks ended in April 1994. GATT was replaced by the World Trade Organization.

<sup>40</sup> [http://www.wto.org/english/thewto\\_e/whatis\\_e/tif\\_e/fact5\\_e.htm](http://www.wto.org/english/thewto_e/whatis_e/tif_e/fact5_e.htm)

developing countries. 1) Comprehensive liberalization reforms for the first time were applied to agriculture and 2) Trade Related Intellectual Property rights were formalized and extended to agriculture.

Prior to the Uruguay round of General Agreements on Tariffs and Trade, agriculture enjoyed a special status. Trade rules were applicable to manufactured and industrial products where as for agriculture; countries could offer subsidies or use other forms of non-tariff measures. This aspect was perceived as a distortion towards effective international trade. Agriculture was for the first time formally introduced in multilateral agreements which then underwent comprehensive reform process.<sup>41</sup> The agriculture sector was perceived to be a viable tool for economic growth via the means of a well sketched out trade rules. The key word was 'liberalization'. All barriers to successful agriculture trade had to be phased out. Domestic support and protection of internal markets, subsidies required to be cut down and eventually phased out within a set time period. Countries were asked to pursue domestic policies in favor of international markets for example growing cash crops of demand and favor free trade. To improve conditions for maximum market access there should be: less protectionism, reduced tariffs, impose import food requirement and reduce export subsidies. The following table offers numerical details on this matter.

**Numerical targets for cutting subsidies and protection in agriculture agreed in the Uruguay Round**<sup>42</sup>

	Developed countries	Developing countries
<b>Tariffs</b>		
Average cut for all Agricultural Products	-36%	-24%
Minimum cut per product	-15%	-10%
<b>Domestic support</b>		
Cuts in total 'AMS' Support For the sector	-20%	-13%
<b>Exports</b>		
Value of subsidies	-36%	-24%
Subsidized quantities	-21%	-14%

AMS = aggregate measurement of support

Most parts of the non-industrialized world thrive on agriculture for sustenance and contribution to national economy. With less than two hectares of land holdings small farmers and landless peasants form the majority in most parts of the non industrialized world. Nations states like India where agricultural policies have been pursued with a motive of national self sufficiency, the agrarian sector has been in distress due to structural adjustments as a result of the GATT. Companies like Pepsico, Cargill and Monsanto created channels for capital flow in

<sup>41</sup> [http://www.wto.org/english/thewto\\_e/whatis\\_e/tif\\_e/agrm3\\_e.htm](http://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm3_e.htm), accessed on 03.09.2011.

<sup>42</sup> WTO Agricultural Negotiations. The issues, and where we are now, December 2004: [http://www.wto.org/english/tratop\\_e/agric\\_e/agnegs\\_bkgnd\\_e.pdf](http://www.wto.org/english/tratop_e/agric_e/agnegs_bkgnd_e.pdf)

Indian agriculture especially in the realm of biotechnology research and harvesting biogenetic resources. The national policies pertaining to seeds, agriculture exports, growing cash crops underwent major changes to match with the “discipline” of the international market rules. These changes needless to say only strengthened the roofs of uncertainty over the agrarian sector. A side effect was the increase in agrarian populism in the country side. Populist farmer groups split into factions, either supporting the free market ideology by mobilizing farmers to participate affirmatively in the developments or to oppose and show dissent in the name of nationalism.<sup>43</sup>

### **3.2 Trade Related Intellectual Property Rights (TRIPS):**

The completion of the most recent round of GATT negotiations is significant for many reasons, not least because "TRIPS" (Trade Related Intellectual Property Rights) – such as patents, copyrights, trademarks, trade secrets – have been accepted as an area to which internationally-recognized rules and disciplines apply. Protection and enforcement of these rights are critical to many global industries, including research based pharmaceuticals, whose livelihood and ability to contribute to the world depend upon innovation. <sup>44</sup> - speech by Edmund T. Pratt, Jr. CEO Pfizer-1996

In 1986, six months before the Uruguay round commenced, an Intellectual Property Committee (IPC) was formed. It consisted of twelve chief executive officers from U.S based firms: Bristol-Meyers, CBS, Du Pont, General Electric, General Motors, Hewlett-Packard, IBM, Johnson & Johnson, Merck, Monsanto, and Pfizer. The purpose of the IPC was to develop an IPR framework (patents, copyrights, trademarks and trade secrets) and gather international support for it. Backed by their associates in Europe and Japan, the drafted proposal was put forth in the GATT-Uruguay round which later came to be the Trade Related Intellectual Property Rights.<sup>45</sup>

Knowledge and ideas were considered to be a vital part of international trade. By definition, “Intellectual property rights are the rights given to persons over the creations of their minds. They usually give the creator an exclusive right over the use of his/her creation for a certain period of time”.<sup>46</sup> Creators are given rights to prevent others from using their inventions, designs or other creations and to use that right to negotiate payment in return for others using them.

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<sup>43</sup> Akhil Gupta, Postcolonial Developments: Agriculture in the making of modern India, Duke University Press, 2000, p98-100

<sup>44</sup> [http://www.iatp.org/files/Intellectual\\_Property\\_Rights\\_and\\_International.htm](http://www.iatp.org/files/Intellectual_Property_Rights_and_International.htm), accessed on 02.09.2011.

<sup>45</sup> Susan K. Sell, ‘Multinational Corporations as Agents of Change: The Globalization of Intellectual Property Rights’, [http://research.rmutp.ac.th/paper/cu/Multinational%20corporations%20as%20agents%20of%20chang](http://research.rmutp.ac.th/paper/cu/Multinational%20corporations%20as%20agents%20of%20change.pdf)e.pdf, 1999, p. 2

<sup>46</sup> [http://www.wto.org/english/thewto\\_e/whatis\\_e/tif\\_e/agrm7\\_e.htm](http://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm7_e.htm), accessed on 3.09.2011

Apart from Trademarks, copyrights, trade secrets etc falling under the purview of TRIPS, the clause on Patency is of interest in this paper. According to the agreement Patency should be granted for inventions for at least twenty years subject to renewal. Patent protection must be available for both products and processes, in almost all fields of technology provided that they are novel and have capabilities of industrial application. In addition, patents should be available and patents rights enjoyable without discrimination as to the place of invention, the field of technology and whether products are imported or locally produced<sup>47</sup>

The consequences of such a mandate would on the one hand offer protection to the producers but not necessarily to the rest involved in the societal chain. The producers in this case would be resource intense large firms, trans-national corporations who possess the know-how and advanced scientific capabilities to have novel 'creations' with varied industrial applications. This is where bio-technology gets its heightened recognition as a tool for capital advancements.

Biological matter became raw materials to produce something unique. The new produce or 'creation' is eligible for patent protection. Usage and application of Biotechnology lays in the hands of a privileged few corporations in the private sector: BASF, Monsanto etc. This obviously leads to a threat of monopoly creation, price exacerbation and devastating results on crucial essentials like some life saving drugs/medicines.

The entire IPR framework favors the industry. According to Susan K. Sell, noted author on the subject of TRIPS, 'the industry identified a trade problem, devised a solution, made a concrete proposal, advanced it to the governments for agreement which now enjoys the status of public international law'<sup>48</sup>.

The other consequence would be mainly to the parts of non-industrialized/ industrializing world where there is no well established patent system and governing laws falling in lines with the TRIPS standards. This posed a restriction on those countries to impose subject matter exclusions<sup>49</sup> that many European countries had in their patent laws such as on pharmaceuticals and food products. For example, France only allowed pharmaceuticals to be patented from 1960, Ireland from 1964, Germany from 1968, Japan from 1976, Switzerland from 1977, Italy and Sweden both from 1978 and Spain from as late as 1992.<sup>50</sup>

The Uruguay round of trade negotiations and agreements have been extremely controversial from the start. Debates around the necessity and credibility of the IPR framework have surfaced from multiple standpoints. Critics enunciate that currently contoured IPRs have devastating effects: for example with higher prices on essential drugs; availability of educational materials for developing country schools and university students; legitimizing the

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<sup>47</sup> Ibid.

<sup>48</sup> Susan K. Sell, 'Multinational Corporations as Agents of Change: The Globalization of Intellectual Property Rights', <http://research.rmutp.ac.th/paper/cu/Multinational%20corporations%20as%20agents%20of%20change.pdf>, 1999 p.3

<sup>50</sup> Christophe Bellman, Graham Dutfield & Ricardo Mele'ndez-Ortiz, 'Trading in Knowledge: Development Perspectives on TRIPS, Trade and Sustainability', Earthscan 2003, P.5-6

piracy of knowledge and undermining self sustenance of small and resource poor farmers<sup>51</sup>. Apologists argue that effective usage of the IPR which remains in the purview of the states and government institutions can bring benefits to all countries.

The article 27.3(b) of the Uruguay round agreement pertains to exceptions in patentability in the area of biotechnology and plant breeding. According to this subparagraph:

“Members may exclude plants and animals other than micro-organisms and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes. However, any country excluding plant varieties from patent protection must provide an effective sui generis system of protection”<sup>52</sup>

This basically means that plants and animals can be excluded from being patented but patents must be provided on micro-organisms and microbiological processes for producing plants or animals; for example the genes of a seed would be considered products necessary to create alterations at the microbial level so as to enhance the robustness/qualities of a given crop and its qualities and hence needs to be patented. Countries which exclude patenting plant varieties are however, obliged to offer some form of protection system. This could either be on the guidelines of UPOV- International Union for the Protection of New Varieties of Plants or a unique alternate system needs to be devised.

The evident challenge resulting from this especially for non-industrialized countries which did not have an effective patent system or a system in lines with the TRIPS framework, now had to integrate development policies in crucial areas of health, food security, education etc into IPR policies. At this point critics point out that costs incurring from administration, enforcement of such a complex system catering aspects of patents, trademarks, copyrights, designs etc. outweigh the benefits of the IPR system<sup>53</sup>

As the industry was involved in formulating the TRIPS, it is obvious that the successful completion of the GATT negotiations paved in the entry of numerous corporations to expand purview into and explore new international markets and especially into the agriculture sector. Corporations like Sygenta, Limagrain, DuPont, Cargill were traditionally chemical and pharmaceutical companies, nothing remotely to do with agriculture. The chemical and pharmaceutical firms were producing large quantities of chemicals and chemical based applications: for example the notorious defoliate, ‘Agent Orange’ used by the US army during the Vietnam war is a product of Monsanto which was one of the largest chemical producing company. 50% of agent orange composition is 2,4,5-T which Monsanto used in its leading herbicide called Roundup. The herbicide was first tested on crops of soya bean in the United States of America. The Roundup herbicide is a toxin which should do no harm to the actual

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<sup>51</sup> Ibid. P.2-3.

<sup>52</sup> [http://www.wto.org/english/tratop\\_e/trips\\_e/intel2\\_e.htm](http://www.wto.org/english/tratop_e/trips_e/intel2_e.htm), accessed on 4.09.2011

<sup>53</sup> Christophe Bellman, Graham Dutfield & Ricardo Mele'ndez-Ortiz, ‘Trading in Knowledge: Development Perspectives on TRIPS, Trade and Sustainability’, Earthscan 2003, P.210

soya bean crops but kill only the weeds. How would the Roundup herbicide which is purely a chemical product be able to recognize what to harm and what to let live? The answer lay in bio-technology. Soya bean seeds were genetically altered with a gene obtained from a bacterium. The gene produced a protein which showed resistance to the Roundup substance. Therefore when sprayed around the fields of soya bean crop, only the weeds were affected. In addition to Soy, Roundup ready Corn was introduced in parts of the USA. Sales of Roundup ready Corn, Soy seeds and the herbicide: brilliant product of unknown consequences rose rapidly. First quarter of 2008, Monsanto made a profit of 1 billion USD just by the sales of Roundup herbicide in Latin America<sup>54</sup>. Least to mention this application underwent a heavy controversy. According to Vandana Shiva, environmentalist and prominent scholar on the issue of bio technology-Genetic modified agriculture and its societal implications: weeds contribute to bio-diversity. They are part of a symbiotic relationship within their eco-system contributing significantly to bio-diversity and hence wellbeing of the crop. The farmers who used the Roundup could do away with the weeds much easily and save time. It also meant that the farmers had to not only buy the herbicide from Monsanto but also the herbicide tolerant soya bean seeds from Monsanto. Monsanto, on the other hand by producing and selling the herbicide created a necessity for GM soy bean seeds. It was able to expand its market share and profits. The technology and knowledge behind the Roundup and GM soy bean is brilliant and a mark of advancement but the point of contention here is its application, regulation, use and misuse. The soya bean has been infused with immunity towards Roundup but what about the rest of the environment? How about the effects on soil, air, water, birds, animals, humans? Would they all need to be infused with the resistant as well? The story of the roundup continues. Over time and regular usage of the herbicide, the weeds developed immunity towards Roundup. ‘Superweeds’<sup>55</sup> was how it came to be known as they spread across rapidly through the fields. A solution to stop the superweeds and put an end to it could not be devised overnight!

“Since the scientific and industrial revolution, technology and economics have mutually reinforced the assumption that nature’s limits must be broken for the creation of abundance”<sup>56</sup>

Traditionally manufactured and industrial goods had the status of most economic value and return. Given the raw materials and certain degree of infrastructure necessary for production and storage, desired goods are manufactured in a quantity and quality of desire. They can be stored and transported long distance with lesser risks. Agriculture and farm production on the other hand depended on a lot of external factors like climate and weather conditions, rain, diseases and pest attack thereby making it highly unpredictable. Agriculture was time consuming and relied on crude methods for cultivation. Due to the perishability of food

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<sup>54</sup> <http://monsanto.mediaroom.com/index.php?s=43&item=562>

<sup>55</sup> <http://www.guardian.co.uk/science/2005/jul/25/gm.food>, accessed on 08.09.2011

<sup>56</sup> Vandana Shiva, Resources in The Development Dictionary, A Guide to Knowledge as Power ed. Wolfgang Sachs, 2010, Zedbooks P. 236

products, not all what was produced could be traded long distance.<sup>57</sup> Moreover, agriculture was taking place on a small scale with most peasants and farmers having small landholdings aiming for self sustenance. These factors posed restrictions to the capitalist logic of accumulation<sup>58</sup>. The sphere of agriculture posed risks to seek profit. The limits and hurdles had to be stretched and overcome by restructuring agriculture towards a factory model<sup>59</sup>. The restructuring process was fuelled by the application of post world war two technologies indirectly to agriculture. The sale of agricultural inputs like herbicides, pesticides, fertilizers, enhanced hybrid seeds, new equipments; have all favored the process of accumulation.<sup>60</sup> The perception of Nature as the provider of raw materials and resources expanded to the one where Nature became the raw material. Commoditization of Nature in its entirety reaches a new dimension with the introduction of Intellectual Property Rights. When analyzed on purely ethical and moral grounds, questions arise on the ownership over Nature, who has more rights over Nature, who is entitled to have more rights over Nature.

Coming back to food security, agricultural biotechnology is globally recognized as a highly beneficial tool to create food abundance and thereby food security. The natural species barrier to regulate reproduction and maintain integrity has been perceived as limits and hindrances of nature towards efficiency and abundance creation<sup>61</sup>. The transgenic technology is argued to enhance linkages between increased efficiency in farming practices and environmentally sustainable development. In this view, biotechnology promotes ecologically sustainable way of food production by reducing the application of chemicals and pesticides to the soil since transgenic insertion leads to the development of crops with reduced dependency on pesticides, water, fertilizers. It is supposedly more sustainable than any other form of farming in the sense of decreased soil erosion and gas emissions and improving the production capability of a small cropland. In addition to the above another widespread reasoning by those in favor of the above discourse is the 'population pressure'. It is said that rapidly growing population especially in countries like India and China is exerting an immense pressure on the limited resources in those regions. Therefore in order to match the order of current times, agriculture has to be intensified and food needs to be produced using the limited resources yet in a sustainable manner.

In lines with the discussion of the article, the next section offers an example of Bt Cotton- the first transgenic crop commercialized in India and implications to the seed sector and how it translates to the international level impacting food security.

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<sup>57</sup> Mann, S.A; Dickinson, J.M Obstacles to the development of a capitalist agriculture. *Journal of peasant studies*, 1978, 5, 466-481

<sup>58</sup> Kautsky, K. (1988), *The Agrarian Question*, Zwan Publications.

<sup>59</sup> Goodman, D; Sorj, B; Wilkinson, J, *from farming to bio-technology: A theory of agro-industrial development*. Basil Blackwell: new york, USA 1987

<sup>60</sup> Lewontin, R.C; Berlan, J.P *technology, research and the penetration of capital: The case of U.S agriculture*. *Mon. Rev.* 1986, 38, 21-34

<sup>61</sup> Vandana Shiva, *Resources in The Development Dictionary, A Guide to Knowledge as Power* ed. Wolfgang Sachs, 2010, Zedbooks P. 236

#### 4. The case of Bt Cotton in India:

The Green Revolution period in India during the 1960's made way to trans-national corporations like Cargill and Monsanto in India. However transgenic seeds or genetically modified seeds were introduced in 2002 for large scale agriculture. The involvement of private sector in the Indian seed industry has been at bay until the period of rigorous economic reforms in India starting from 1991 onwards co-relating to the agreements made in the Uruguay round of trade.

As part of the liberalization and economic reforms, India pursued progressive industrial policies. Pertaining to agriculture, the policy identified, especially the seed sector as a 'high priority industry'<sup>62</sup>. Amongst other developments in the seed sector, the policy facilitated foreign investments and overtly encouraged trans-national seed companies to enter the seed business in India. Due to the GATT agreements on assuring proprietary rights, more than 24 international agriculture oriented companies initiated research and development activities in India.<sup>63</sup>

Being the second largest cotton producer in the world, cotton is one of the most important cash crops in India. At the same time, cotton is prone to frequent pest and insect attacks which prompted farmers to use large quantities of pesticides. The international market price for cotton inhibits fluctuations impacting cotton farmers with high risks. As a solution to maximize cotton yield by controlling pest attacks, in 2002, the Government of India approved its very first large scale cultivation of genetically modified cotton from the Bt cotton seeds.

Bt stands for *Bacillus thuringiensis*. It is a naturally occurring soil bacterium which releases a toxin showing resistance capabilities towards controlling pests. Traditionally farmers have used the soil containing this bacterium as a natural pesticide. Monsanto, the US based agro-chemical trans-national company engineered the Bt cotton. The gene in the bacteria responsible for producing the toxin was harvested and introduced into the genes of cotton seeds using advanced bio-technology applications.<sup>64</sup> The new improved seeds were called Bt Seeds by Monsanto which were tested and approved to work against particular pest specie: the Bollworm. The transgenic Bt cotton also came to be known as Bollgard cotton seeds. With the official sanction in India, the Bt cotton seeds were almost offensively advertized. Local Indian religious deities were pictured bringing into the homes of farmers a bag of miracle seeds which would put an end to their woes, reduce costs of pesticides and multiply yields. Sales of Bt cotton in India went up. The cultivation began in South and Central Indian states and gradually covered the rest of the regions as well. Monsanto set a price on the Bt cotton seeds. The price included a 'trait fee' and an additional 'technology provider fee'. The total price came to Rs.1,600 for 450gms of Bt Seeds. Current exchanges rates converts to Euro 24.5 0 for a 450gm. The cost of similar amounts of non Bt seeds were in the range of Rs. 200-

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<sup>62</sup> V. R Gadwal, The Indian Seed Industry: Its history, current status and future. In Current Science, 84/3, Feb.2003

<sup>63</sup> Ibid.

<sup>64</sup> <http://www.frontlineonnet.com/fl2011/stories/20030606006012600.htm>, accessed on 06.09.2011

300 which is Euro 3 to Euro4.5. Despite the high price cotton farmers were convinced of the promised output and financial return. From various sources it is gathered that the farmers who indulged in Bt cotton cultivation did experience a growth in their overall production: from 189Kg/hectare and 212Kg/hectare in 2001-02 and 2002-03 it increased to 307Kg/hectare in 2003-04. The success did not last long as signs of pest resistance to Bt cotton by the bollworms surfaced and quickly spread like wild fire destroying the mature cotton crops. Monsanto in 2006 released a second generation of transgenic Bt Cotton seeds which included an additional protein to resist pest attack. The BollgardII were tested and authorized to be more the fix for the cotton farmer's distress. The newer and improved varieties have an improved price as well. A packet of 450gms of BGII seeds were sold at Rs.1700.

This time around, the farmers had no choice than to opt for the newer version of cotton seeds as they had already invested in the BGI. Falling under the auspices of the TRIPS, Monsanto is the sole owner of the transgenic Bt seeds. Breeding and production of further Bt seeds are done by authorized farmers only for the purpose of seed production and sales. Monsanto acquired a 50:50 partnership with India's biggest seed corporation becoming Mahyco-Monsanto Biotech (India). Mahyco has the legacy since the Green Revolution period as it acted as a major distributor of hybrid seeds in association with the Rockefeller foundation.<sup>65</sup> With this partnership Monsanto-Mahyco Biotech has the largest share in the Indian seed market.

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<sup>65</sup> [http://www.mahyco.com/legacy\\_of\\_mahyco.html](http://www.mahyco.com/legacy_of_mahyco.html), accessed on 06.09.2011

## 5. Analysis and conclusion:

The extensive usage and production of transgenic cotton seeds parallelly brought in a closure to the production of non-transgenic cotton seeds. Monsanto with its subsidiary in India successfully established a niche in the agriculture industry becoming the biggest supplier of pesticides, fertilizers and the most important transgenic seeds. The cotton crop in general has many natural enemies. The transgenic varieties of cotton showed resistance to only the bollworm and precisely American bollworm and not to others in the species like pink bollworm and spotted bollworms most common in India. Farmers continued to invest in pesticides in spite of the transgenic variety to keep the numerous other pests away: Aphids, Thrips, Jassids etc. What can be noted here is the asymmetry of information dissipated in general. Complex advertisements and partial information confuses the audience and makes decision making hard<sup>66</sup>. Farmers have not been counseled with risk assessments and there have been no noted instance of any information talks where the marketing involved the dangers of transgenic seeds. The transgenic seeds markets are under the monopoly of Monsanto which has patency over its Bt cotton seeds. According to statistics of 2006<sup>67</sup>, a total area of 3,800,000 hectares was used to cultivate Bt seeds with an overall production of 24 million bales. As the dependence on transgenic cotton seeds and thereby on Monsanto increased, in the year of 2006 - 2007, some of the federal states in southern India acknowledging the plea of farmer associations filed a case against Monsanto's monopolistic market control and ordered the company and its distributors to bring down the prices. After a long court trial the prices did decrease to Rs. 410 and Rs.660 for BGI and BGII respectively. The price control was successfully implemented in 3 federal states. In other states the price control had to be withdrawn as the Monsanto Mahyco group defeated the case. In the states where there are no price control, the price of BGI and BGII are Rs. 750 and Rs. 925 respectively.<sup>68</sup>

This is a classic case of imbalance in power between the state and non-state actors (Trans-national corporations plus national companies which act trans-national due to mergers: ex. Monsanto with Indian Mahyco) and control over crucial segments of the economy like food. The intervention of state which takes over the role of maintaining the welfare of its population in other cases failed to compete and resist the corporate power.

As the seeds are produced solely by the corporation and as the knowledge behind the production is tightly protected by the corporation the Indian farmers have no other choice than to purchase the high priced seeds from Monsanto. It is also claimed that the preference of farmers to expensive Bt seeds represents their satisfaction and continued indulgence in transgenic cotton cultivation. What is ignored or rather left obscured in mainstream sources is that the farmers are now facing a severe shortage of non Bt seeds or other hybrid seeds<sup>69</sup>. This is due to the process of consolidation taken place since 1991. There have been a series of

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<sup>66</sup> <http://www.apaari.org/wp-content/uploads/2009/10/bt-cotton-2nd-edition.pdf> p.27

<sup>67</sup> IFPRI report, Bt Cotton and Farmer Suicides in India, 2008

<sup>68</sup> <http://www.agbioforum.org/v13n4/v13n4a02-pray.htm>, accessed on 06.09.2011

<sup>69</sup> <http://www.hindu.com/2010/11/14/stories/2010111458980100.htm>, accessed on 06.09.2011

mergers and acquisitions in the private seeds and agriculture sector with two major actors: Monsanto and Mahyco.

Currently 80% of the cotton produced in India is with transgenic Bt seeds. The dependency on private sector and the monopoly of Monsanto is represented in its recent subtle threat/announcement of a potential shortage of Bt seeds<sup>70</sup>. The announcement can be interpreted in the way that if the governments do not back off with the price control order, the corporation would decrease the supply of transgenic seeds. In this case negatively impacting the production of India's most important cash crop and hence its status in the international economy simultaneously having a brutal impact on the cotton farmers in India.

Moreover the situation takes dangerous inclinations as the same pattern can be traced in other transgenic seeds which are not a cash crop but are seeds of basic food crops like Brinjal and tomatoes in the case of India and many other varieties of vegetables, fruits and milk globally. For example in 2005, 60%<sup>71</sup> of the total soya bean production in the world was genetically modified. The consumption of soya bean is rapidly increasing and the above number denotes serious implications to food security. Moreover soya bean, maize, corn, cotton etc forms part of cash crops in the countries of production. These crops relate to a high consumption and international demand hence more and more farmers are shifting cultivation towards growing cash crops. Such a tendency is leading to mono-cropping as opposed to traditional ways of multi cropping which helped the soil maintain its fertility, avoiding erosion and maintaining a vibrant bio-sphere. Intense indulgence in mono-cropping is a tendency with transgenic crops and reveals detriments towards sustainable agriculture which in turn has a negative impact on food security.

The following table is a compilation of top 5 trans-national corporations who are also the leading biotechnology based solution providers. Their net sales give an idea of their financial might and power:

Top 5 global seed Corporations:

1. Monsanto (US)- Pharmaceutical Company. World's biggest seed company. Net Sales (2009): US \$11,724million (homepage)
2. DuPont (US) - Chemical Industry. Net Sales (2009): US \$1,755 million (home page)
3. Sygenta (Switzerland) -Chemical Industry. Net sales (2009): US \$1,374million (home page)
4. Groupe Limagrain (France) -Horticulture Industry. Net sales (2009): US\$ 1,240 million (home page)
5. Land O' Lakes (US) -Agriculture products. Net sales (2009): US\$ 10.4billion (home page)

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<sup>70</sup> <http://www.business-standard.com/india/news/shortagebt-cotton-seeds-may-hit-2011-12-production-able/125831/on>

<sup>71</sup> <http://ftp.jrc.es/EURdoc/eur22547en.pdf>, p.13

The following table offers a comprehensive global picture of the amount of transgenic crops produced. It becomes clear that production of transgenic crops has increased and these are not only non consumption crops like Cotton but most are for regular direct consumption.

Rank	Country	2010 – Area (million hectares) ▾	2009 – Area (million hectares)	Biotech Crops
1	USA	66.8	64	Soybean, Maize, Cotton, Canola, Squash Alfalfa, Sugarbeet
2	Brazil	25.4	21.4	Soybean, Maize, Cotton
3	Argentina	22.9	21.3	Soybean, Maize, Cotton
4	India	9.4	8.4	Cotton
5	Canada	8.8	8.2	Maize, Soybean, Canola, Sugarbeet
6	China	3.5	3.7	Cotton, Tomato, Poplar, Payaya, Sweet P
7	Paraguay	2.6	2.2	Soybean
8	Pakistan	2.4		Cotton
9	South africa	2.2	2.1	Soybean, Maize, Cotton
10	Uruguay	1.1	0.8	Maize, Soybean
11	Bolivia	0.9	0.8	Soybean
12	Australia	0.7	0.3	Cotton, Canola
13	Philippines	0.5	0.5	Maize
15	Burkina Faso	0.3	0.1	Cotton
14	Myanmar	0.3		Cotton
29	Germany	0.1		Potato
28	Sweden	0.1		Potato
27	Slovakia	0.1	0.1	Maize
26	Egypt	0.1	0.1	Maize
25	Costa Rica	0.1	0.1	Cotton, Soybean
24	Poland	0.1	0.1	Maize
23	Romania	0.1	0.1	Maize
22	Portugal	0.1	0.1	Maize
21	Czech Republic	0.1	0.1	Maize, Potato
20	Honduras	0.1	0.1	Maize
19	Colombia	0.1	0.1	Cotton
18	Chile	0.1	0.1	Maize, Soybean, Canola
17	Mexico	0.1	0.1	Cotton, Soybean
16	Spain	0.1	0.1	Maize

Source: <http://chartsbin.com/view/578>

The following is a graphic representation of global distribution of genetically modified crops. The numerals have a unit of million hectares and indicate growing of GM crops.

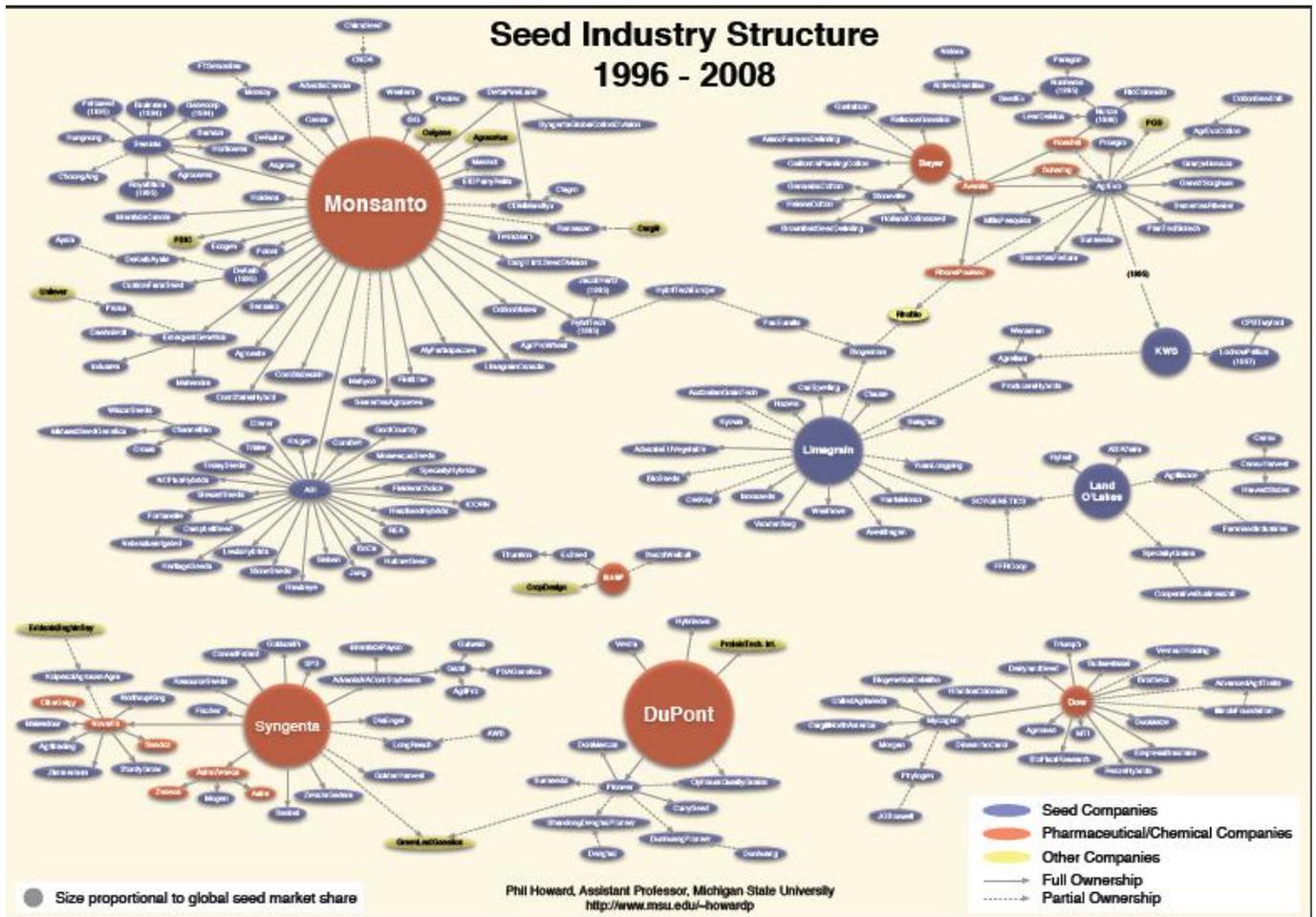


Source: <http://chartsbin.com/view/578>

The most important element here is not only the increasing inclination towards production, distribution and consumption of transgenic food. As transgenic foods are considered creations of the mind under the current international proprietary framework, there exist clear definitions of ‘who’ the owners are, thereby rendering them the privilege of defining the ‘terms’ of usage and control.

The following graphic is perhaps the most important one to indicate the concentration of economic- international market power and a potential creation of monopoly at an international level. The graphic represents the process of global consolidation process which has taken place since 1998 until 2008 in the seed sector. The solid lines represent full ownership while the dotted lines indicate partial ownership. The graphic represents acquisitions between various firms over the years while it is clear that Monsanto Corporation has undergone an immense consolidation<sup>72</sup> process and is occupying the biggest share in the seeds and agriculture inputs market.

<sup>72</sup> Consolidation process indicates to mergers or unions of corporations.



Source: <https://www.msu.edu/~howardp/seedindustry.html>

Such a concentration of market power transfers control of price setting over to the corporation. When the concentration reaches a certain threshold, it hinders market competition. Such a large cluster and concentration of power can *simply signal their intention to raise prices or restrict output, with others following suit*<sup>73</sup>. This would unleash a stark dependency jeopardizing the availability and affordability of basic and important food and food security.

In addition to the risk of price setting which could either fluctuate or just remain high, there is also a potential artificial creation of abundance or scarcity of a certain crop or food product. Such a monopoly and concentration of power is an instrument of political power possessing very serious potentials to undermine the state. Whether national laws relating to monopoly control and price discrimination can resist and control such activity is an interesting aspect for further study.

<sup>73</sup> Howard, H. Philip. (2009), Visualizing Consolidation in the Global Seed Industry: 1996-2008, *Sustainability*, Vol. 1, 1266-1287, pp: 1270

The issue calls for re-structuring the current regulatory framework and IPR at the international level while at the national level adequate protection needs to be observed and implemented. A more balanced public - private sector relation needs to be established where national companies have more leverage in their partnerships with trans-national actors. In countries like India where agriculture still plays a vital role in the economy, offers employment and where the farmers as both producers and consumers form the biggest chunk of the society are faced with a dilemma of choice with serious implications on their food security.

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