universität wien

DIPLOMARBEIT

Titel der Diplomarbeit

„Sustaining India's agriculture under the perspective of the „Green Revolution" and the effects of it today. "

Verfasserin

Nira Dejust

angestrebter akademischer Grad

Magistra (Mag.)

Wien, 2011

Studienkennzahl lt. Studienblatt:	A 057 390
Studienrichtung lt. Zulassungsbescheid:	Individuelles Diplomstudium Internationale Entwicklung
Betreuerin ODER Betreuer:	V.-Professor Dr. Alejandro Cunat

Abstract

My thesis deals with the problem of how agriculture in India can establish food security while facing a fast growing population. For this purpose the "Green Revolution" was brought to India, its goal was to increase the productivity of the crops by the way of industrializing agriculture in order to uproot hunger in India.

To be able to increase farmland and productivity the land-reforms as well as the "Green Revolution" had to be examined. The Green Revolution needs good arable land which should be provided by the land reform. The "Green Revolution" uses high yield variety seeds which need a lot more water, artificial fertilizers, pesticide and moreover the seeds have to be replaced every 3 to 5 years thus the traditional low-cost agriculture with crop rotation had to give way to the new expensive capital-intensive mono-cultural-technique. The Green Revolution first was a great success, but although agricultural products were exported, it proved to be unable to feed the poor of India's fast growing population. On the short-run the "Green Revolution" proved to be a sustainable tool, on the long run however it exhausted the soil, the groundwater and polluted the water with the chemicals it used.

Foreword

The ancient cultural heritage

I lived in India for nine years and therefore I feel I must - before I start my thesis - give a glimpse of what India stands for in a holistic perspective. In my opinion one has to understand the whole of India's culture before investigating one part like agriculture - starting with the ancient cultural heritage, the talents, creativity, mentality, brain power in short the potential of these people. One has to consider also the ultimate goal Indian people strive for in their life - in this respect eastern thinking and western thinking differ a lot. Most Indians believe in rebirth; the karma- that destines every person for a good or bad life depending on the good and bad deeds of past lives, by avoiding bad deeds and behaviour the individual has the chance to evolve to a higher human being. The ultimate goal they desire to achieve is to overcome the circle of birth and rebirth and reach an eternal state of bliss and happiness – it is also called the Sat-Chitt-Ananda-State (Absolute Truth- Pure Consciousness- Pure Bliss). This belief imbedded in Hinduism and Buddhism is still prevailing, despite the influence of western civilisation. That may be one explanation for Indians why they can sacrifice themselves for the higher goal.[1]

If we hear about India we associate with this term negative as well as positive concepts like poverty, slums, dirt, hunger, illiteracy, cast-system- although abolished by law; Maharajas palaces, art, craft, seeking of spirituality, gurus, karma, Mahatma Gandhi, the non-violence campaign, the truth-force,… computer science, software or the like.

But all these characteristics describe India. India is a country of contrasts. India stands on one hand for a home for masses of illiterate, malnourished or starving people, on the other hand for a booming country, with a constantly growing middle-class and all this achieved by the brainpower of Indian people. On one side we have a growing middle class with the desire to fulfil the "American dream" of a high living standard, material satisfaction (although material wants can never be satisfied) on the other side we find a growing impetus to put into praxis the ideas of M. Gandhi of modesty and a simple life: philanthropy not greed, dedicated to improve the living conditions of the poor.

[1] See: Gandhi

India or Bharat (it is from Sanskrit, meaning: "bha" is the light and knowledge and "rata" devoted; devoted to light and knowledge) as is India's ancient name, is not just an underdeveloped, overpopulated country, that has to face the problem to feed its ever-growing population – but India has a great cultural heritage which stretches back to about 5 000 years.

Extensive archaeological excavations carried out at Mohenjodaro- situated in the Indus Valley of today's Pakistan- in 1922 brought light to the existence of a highly sophisticated and urbanized culture known as the Harappan Civilization in India, dating back to about 2600 – 2000 B.C., which dominated the north-western part of the Indian subcontinent (1100 km from north to south and 1600 km from east to west). The Indus-Valley- Civilization of Pakistan and North-India from around 2600 BC had a sophisticated canal irrigation system.

Agriculture was practised on a large scale and an extensive network of canals was used for irrigation as well as storage systems, reservoirs – like the one at Girnar in Gujarat (3660 feet above sea level) in 3000 B.C.

In flood- prone states like Assam, Bengal and Bihar there is evidence of a massive network of canals that allowed both: effective drainage to prevent flooding during the heavy monsoon months and provide for fishing, transportation and irrigation in the dry seasons.[2]

The next most important phase in Indian history came centuries later with the Aryans from north-west of India spreading gradually over centuries. The culture they developed was named Vedic culture. The earliest writing can be traced to the Rig Veda poetry in Sanskrit language – perhaps the earliest poetry in the world- composed around 1500 B.C. and codified around 600 B.C. The four parts of Vedas contain hymns, incantations and religious rituals from ancient India. Moreover Sanskrit is called the "Mother of all European languages" and is regarded the most suitable "computer language" for its syntax which is unambiguous and very precise, leaving no room for misinterpretations or errors.

India's contribution in the field of astronomy as well as mathematics and medicine is immense too. Ayurveda is the earliest school of medicine which was consolidated 2500 years ago by Charaka, the "Father of Medicine": Sushruta, the "Father of surgery" is believed to have

[2] See: Bedekar, (2009)

conducted complicated surgeries using over 125 surgical equipments, also anaesthesia was well known in ancient India. Detailed references to anatomy, physiology, embryology, digestion, metabolism, genetics and immunity are found in many ancient Indian texts.

The invention of the "number zero", not only as a placeholder but as actual number was also contributed to India as well as algebra, trigonometry and calculus. One of the best achievements of Indian mathematics is the decimal system. Its first occurrence was on a plate where the date 346 A.D. was written in decimal place-value notation. Aryabathia calculated the value of phi as 3,1416. Aryabhatia was the first human to state that the earth moves around the sun and how the eclipses can be explained.

The world's first university was established in Takshila now situated in Pakistan near Rawalpindi in 700 B.C., where more than 10.000 students from all over the world studied more than 60 different subjects. The University of Nalanda, near Padma in the state of Bihar, established in the 5th Century B.C. was probably the Centre of Learning in ancient India, described as the Oxford University of Mahayana-Buddhism. It offered a wide range of subjects like literature, logic, grammar, medicine, philosophy, astronomy and so on.[3]

The Subcontinent India is the 5th largest and with its approximately 1,2 billion people the 2nd populated country and the greatest democracy in the world. India was described as the "Mini World" since the diversity of India is unique - starting from its geological features, the fauna and flora, the demographic structure, different races, languages, religions, arts and crafts, customs and traditions. India presents a picture of "unity in diversity"; religion and philosophy are evident in India in form of all major religions in the world – Hinduism, Christianity, Islam, Buddhism, Jainism; Sikhism, Zoroastrianism, Judaism. Each state of India has its own language and set of tribes, festivals, arts and crafts and customs.

If we talk about agriculture which is - as the word says - an essential part of the Indian culture – human civilization started with agriculture - we should consider it in the whole context. Economy and agriculture are interwoven: first trade was with agricultural products. All ancient Indian evidence suggests India as a very powerful agricultural as well as commercial or industrial power

[3] See: Sayeed

prior to the advent of the British. Even the Roman Empire imported from India muslin and other fineries. The Indian exports to Europe of all commercial and agricultural products were much higher at the time of the arrival of the British than in the post British period.[4]

While Indian exports were so high, Europe had almost nothing to sell to India except bullion. The East India Company which was chartered in 1600 A.D. used to send until 500.000 pounds a year to buy Indian goods for exports before 1757 A.D.

India's culture was enriched by successive waves of migration which were absorbed into the Indian way of life: starting with the Indio-Greeks (2nd Century B.C.) followed by the Kushans (1st Century A.D.), followed by incursions of Arabs, Turkish, Persian and others in the beginning of the 8th Century A.D. and culminating with the Moghul Empire established in the 13th Century. All those migrants added up and enriched the Indian Culture, whereas with the advent of the Europeans: Portuguese, French, Dutch, Italian and especially the English, history took its own, far different course.[5]

The Europeans arrived in India first of all to establish trade with India, for it was a country rich in everything: agricultural products, spices, hand-craft, textiles, furniture, forests, timber etc. Yet they remained foreigners with no intention to integrate but to take advantage of this wealth and variety of goods as well as natural resources and forced their own life-style upon Indian people, showing no respect for the cultural achievements of this great people. The East-India Company appeared first as a trading company but in the year 1757 when the Battle of Plassey was won by the British, the situation changed dramatically: the Indian kingdoms one by one got subjugated by the British invaders and came under British authority.

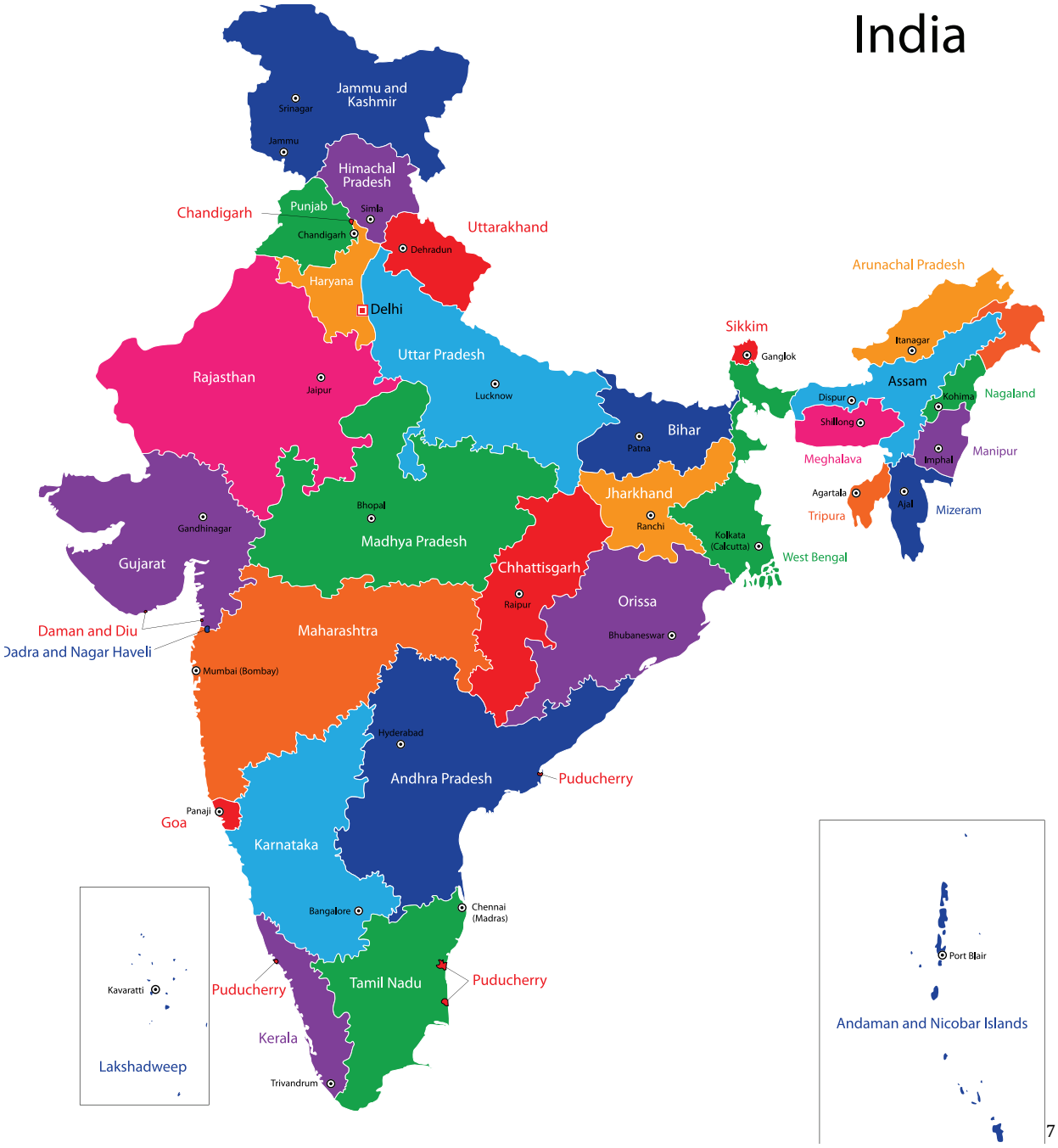
During the time of colonialism India was economically and ecologically exploited until the living conditions became so unbearable that India – formerly split into many, sometimes rivalling kingdoms, rose as one nation to shake off the foreign oppressor. Having been a highly developed country the Indian leadership at that time remembered the ancient, spiritual roots and started a new experiment: Satyagraha - the non-violence movement, to gain India's freedom. The concept of

[4] See: Bedekar, (2009)

[5] See: Sayeed

Satyagraha means civil disobedience to laws and the constituted authority when they come in conflict with the law of God. Gandhi disapproved any kind of exploitation from the core of his heart: in his opinion there should be no cooperation between the exploiter and exploited so long as the exploitation and the will to exploit persist. All exploitation is based on the cooperation, willing or forced of the exploited. However much we may detest admitting it, the fact remains that there would be no exploitation if people refused to obey the exploiter."[6]

[6] Dasgupta, (1996), paragraph 131



[7]

[7] The rights for this picture were bought from www.shutterstock.com [Accessed: 30.06.2011]

Index

INDEX OF ILLUSTRATIONS **10**

1. INTRODUCTION **11**

2. HISTORICAL BACKGROUND **14**

2.1. SEMI-FEUDALISM IN BRITISH INDIA 14
2.2. TAX SYSTEMS IN BRITISH INDIA 15
2.3. THE BENGAL FAMINE: REASONS AND CONSEQUENCES FOR THE FUTURE 18

3. LAND REFORM IN INDIA **21**

3.1. THE THEORETICAL BACKGROUND AND LEGISLATIVE FRAMEWORK OF THE LAND-REFORM 23
3.2. PRODUCTIVITY AND LAND-SIZE 25
3.3. THE LAND-REFORM IN PRACTICE 26
3.4. CONCLUSIVE REMARKS ON LAND REFORM 28

4. THE COMMERCIALISATION OF AGRICULTURE **29**

4.1. CAN COMMERCIALISATION HELP TO IMPROVE THE POVERTY IN INDIA? 31

5. THE GREEN REVOLUTION **31**

5.1. WEATHER IN INDIA 34
5.2. IRRIGATION 35
5.2.1 Groundwater irrigation *36*
5.2.2 The Benefits of Irrigation *37*
5.2.3 The Problems of Irrigation *38*
5.2.4 Managing Water Reservoirs *40*
5.3 CHEMICAL FERTILIZERS VERSUS TRADITIONAL METHOD 40
5.4 HIGH YIELD VARIETIES 43
5.4.1 The Wheat and Rice varieties *43*
5.4.2 Other Varieties *46*

6. INDIA IN THE WORLD AGRICULTURE **47**

7. THE GREEN REVOLUTION AFTER 50 YEARS – A CRITICAL REVIEW **50**

7.1. HUMAN COSTS OF GLOBALIZATION 52
7.2. ORGANIC SELLERS AND SEED SELLERS SUE MONSANTO, THE MULTINATIONAL SEED COMPANY. 53

8. THE BIO-VILLAGE CONCEPT, FUTURE PERSPECTIVE? **54**

9. THE NEED OF AN EVERGREEN REVOLUTION **55**

9.1. SWADESHI A REVOLUTIONARY BUT QUITE SIMPLE WAY ESPECIALLY IN INDIA TO IMPROVE LIVELIHOOD 59
9.2. HOW CAN THE GANDHIAN ECONOMY BASED CONCEPTS HELP TO AMELIORATE THE PRESENT SITUATION? 61

10. CONCLUSION AND SUMMARY **62**

11. APPENDIX **66**

11.1 ZUSAMMENFASSUNG 66
11.2 LEBENSLAUF 68

..... **70**

11.3 ILLUSTRATIONS 70

12. BIBLIOGRAPHY **73**

Index of illustrations

Figure 5.1 Production, Imports and Consumption of fertilizers, 1952-53 to 1975-75..... 41

Figure 5.2 The use of fertilizers in India in terms of nutrients (N&P) from 1951-52 to 2001-2002..... 42

Figure 5.3 Wheat growing zones of India and the recommended varieties..... 43

Figure 5.4 The gradual improvement in plant ideotype..... 44

Table 5.1 Area under different wheat based cropping systems in India..... 45

Figure 6.1 Main economic sectors share of Indian GDP..... 47

Table 6.1 The Top 10 sectors of India and World rank..... 48

Figure 6.2 India's agricultural-food exports by destination (in million US$)..... 49

Figure 6.3 India's agricultural-food imports by origin (in million US$)..... 49

Table 4 Indicators of groundwater irrigation development since 1951..... 70

Table 9 Anticipated and actual rates of return to private groundwater investment..... 71

Table 11 Water use efficiency and size of outlets..... 71

Table 12 Operating account of government irrgation system 1976/77-1978/79..... 72

Table 13 Groundwater development and rural electrification 1979/80..... 72

1. INTRODUCTION

Why did I choose this topic: “Sustaining India’s agriculture under the perspective of the Green Revolution and the effects of it today” for my thesis? In my opinion, agriculture in general should be able to establish food security, so nobody has to go to bed hungry and everyone gets enough nutritious and healthy food – one of the most important millennium goals. But the measures taken have to be considered very carefully because if scientists try a new method we do not know immediately what the effects are on the environment after a longer period of time.

What are the reasons for hunger and poverty? Which measures can be taken to overcome hunger and poverty?

How can agriculture contribute to poverty reduction and hunger? There are only two ways as far as I know to achieve food security: to remove and undo the injustice in agriculture during the British rule with the help of a land reform which may also take more time and to improve the productivity. Land reform means to restore the land that peasants lost during the British colonization due to high rents and to give tenants, sharecroppers and agricultural labourers the chance to own as well as to enhance the productivity of their farmland. So the revolution has to comprise: once to create more arable land and/or use high- yield seeds for increased productivity per acre farmland.

The Green Revolution in India was a quick solution if we take into consideration how fast it yielded amazing results, but is it also sustainable for the future? Does it reach the poor and if not what are the reasons for that? How does the agricultural sector look like after a few years or a decade or two decades as India keeps up with the goals of the Green Revolution?

First of all I want to find out what exactly the Green Revolution incidentally no Green Revolution under the European understanding of the term “green” stands for. The Green Revolution in this context is thought to be a so-called artificial, man-made “enhancement” of nature to raise the productivity in agriculture. It is science based and relies on artificial, genetically modified (Mendelian cross-bread) seeds, artificial fertilizers and insecticides.

This concept was applied in the years 1965 till 1978 by the government of India which had three basic elements: first the expansion of farming areas, second the doubling of the crops on the

existing farmland and third the use of seed with “improved” genetics, so called high-yield-varieties.

But do we know enough about the subtle, complicated network of nature and the consequences we might have to face in the long run, concerning such interference in the course of nature? My goal is to examine if the concept of the so-called Green Revolution was appropriate to improve the productivity of agriculture; especially of India in the long run or if it was not suitable to improve the food security in India for all future. Is the rise in quantity at the expense of quality?

I would like to find out why this Green Revolution that was launched by the government to innovate the agricultural sector has been leading to fundamental problems today.

My thesis should be a mix of different methods: qualitative analysis in the form of a data analysis from different sources of official statistic institutions, literature, scientific journals, scientific reports, commentaries, interviews, articles in scientific journals and different recent or current research projects as well as newspapers and internet.

India has suffered from several famines in the past, and still has a growing population. Thus the Indian government gave priority to fight against famine and made it the main topic of its first 5-year plans: the Land Reform to improve productivity and the situation for the poor to earn their living, and research in high-yield-cropping.

To investigate the topic of my thesis:” Indian Agriculture under the Perspective of the Green Revolution” - I have to first see how the situation of agriculture was under the British rule/ occupation, what India’s starting point was after India had achieved freedom, and what problems India was facing to begin with.

I will start with a historical background and give a short overview of the agricultural and economical heritage of the British with which India had to cope with. The great Bengal Famine must also be examined, what was the reason that it demanded so many victims among the poor. With a better understanding of the past we may learn to avoid it in future.
Later I will show the main points under which methods were taken to improve the productivity of agriculture:

- The Land Reform and its achievement

- The Green Revolution and its achievement
- Instruments to work out the Green Revolution: weather, water supply, irrigation
- The Industrialization of Agriculture and the economic and agricultural consequences of market- liberalization

What remains from the Green Revolution? What mistakes have been made? This will be examined. I would like to conclude the topic by suggesting possible solutions, for the situation today. A new movement in India: Back to the past, accepting and putting into practice the ancient village-system according to Gandhi's ideas.

2. Historical background

2.1. Semi-feudalism in British India

To begin with the Federal Republic of India inherited from the British colonialist, a semi-feudal agrarian system as it was called because the ownership and control of land was highly concentrated in the hands of a few landlords and intermediaries whose mere interests were to gain as much rent as possible.

In the literature on semi-feudalism in Indian agriculture it is described as "the nature of commercialisation where people are restricted by interlocking of credit, output and labour-markets".[8] A dominant party conjointly exploits the weaker party in two or more markets and the weaker party in the exchange loses the option to exercise choice in other markets due the commitment in one. This kind of situation is described as semi-feudalism.[9]

Furthermore Badhuri showed in a mathematical model that it is possible for semi-feudal landlords to inhibit technological change if they find it in their own interest to focus on extracting surplus rather than allowing to increase the overall productivity of the land they control. Some academic observers would not accept a simple characterisation of Indian agriculture as semi-feudal, semi-capitalist although all the rural studies show landlords and landlord-moneylenders using social power as well as economic position to extract surplus value. The semi-feudalism thesis per se sees the function of landlord's power as holding back agriculture.[10] But empirical studies show rapid technical change interacts with changing social and economic power relations over time. The social relations do not necessarily hold back technical change.

---

[8] Badhuri, (1973)

[9] See: Badhuri, (1973)

[10] See: Badhuri, (1983)

2.2. Tax systems in British India

As mentioned above: In the time of the British rule in India from 1818 to 1947 (nevertheless the colonisation started already in the 16th Century with the British East India Company)[11], land was under the control of a few landlords and intermediaries who extracted from their tenants maximum revenue. The situation became worse and less bearable when the British introduced a land tax system (Permanent Settlement Act 1793). Consequently tax revenue systems developed in different areas in India, amongst the most famous were: the zamindari system, the mahalwari system and the ryotwari system.

"A defining characteristic of each system was the attempt to incorporate elements of the preceding agrarian structure, and the interaction of colonial policy and existing systems produced widely different local results and hybrid forms: for example techniques and instruments used in land surveying remained in many parts of India till today substantially unchanged since their introduction by Emperor Akbar."[12]

The zamindari system prevailed over most of North India, including present day Uttar-Pradesh (except Avadh und Agra), Bihar, West Bengal, most of Orissa and Rajasthan (except Jaipur and Jodhpur) – it covered about 57% of the total cultivated area.

Under the "zamindari (the feudal landlords) or permanent settlement system"- introduced in 1793 - feudal lords were declared proprietors of the land on the condition of fixed revenue payments to the British colonists. So peasants were converted into tenant farmers; the rents were collected by intermediaries engaged by the zamindaris.

In zamindari areas rural society was even more hierarchically divided between landlords, tenants with hereditary rights (ryots or raiyats), subtenants, sharecroppers and agricultural labourers. Land distribution was even more unequal in zamindari-system than in ryotwari-systems. Early tenancy legislation (Bengal Rent Act 1859; Bengal Tenancy Act 1855) established occupancy rights for raiyats in zamindari areas and attempted with little success to limit rents paid by subtenants and

---

[11] Duden, (2003), p. 312

[12] Mearns, (1999), p.7

sharecroppers to 50 % of the gross produce with a written agreement and 25% without written agreements. In ryotwari areas tenancy was not officially recognized or regulated by the colonial regime. As a consequence a flow of distress sales, dispossession happened.

The ryotwari-system was introduced in Madras 1792 and in Bombay 1817. Here the individual cultivators called ryots or raiyats were accepted as proprietors of their land and were granted the right to sublet, mortgage or transfer for example by selling or by gift. As long as the tax-payments were flowing directly to the collectors of the colonial administration their tenure of land was secure.

The ryotwari-system prevailed over most of South India, including present Maharastra, Karnataka, Tamil Nadu, Kerala, Andhra Pradesh, most of Madhya Pradesh, Assam as well as the princely states of Jaipur and Jodhpur (Rajasthan). The ryotwari-system covered about 38% of the total cultivated area.

The third type of system was the mahalwari-system. The revenue settlement was done with the entire villages as collective units: peasant farmers contributed their share of revenue to the total revenue demand of the village (mahal) proportional to their land-holdings, the total of tax demanded was originally 83%, later on it was reduced to 66% of the gross produce in revenue.

The Mahalwari-system was introduced the latest from 1820-40 in Punjab (part of it is now Pakistan), Haryana (parts of it now Madhya Pradesh), Orissa and the princely states Avadh and Agra in Uttar Pradesh. This system accounted only for some 5% of the cultivated area.

Transfer of land was first introduced with the British land settlements, legislation introduced in ryotwari and mahalwari-systems (during 1850s) entitled moneylenders to recover debts on loans secured on land holdings. Since the land-tax-assessments were too high, particularly in ryotwari-areas, more and more lost their land as they became unable to repay their debts. When India had achieved independence some 40% of the total rural population were landless agricultural workers.[13]

[13] See. Mearns, (1999), p.8

"As the basis of economic activity land can either serve as an essential asset for the country to achieve economic growth and social equity" or as happened in India under the British rule, "it could be used as a tool in hands of a few to deprive a country of its economic independence and social equity."[14]

Thus the traditional land utilization was overthrown by the British rule. As a consequence the acquisition of land at a low price for British entrepreneurs was facilitated. The new institution of private property subverted social equity which had been imbedded in the old system - before the tribal societies had owned land as a community, until they became delegitimized by the institution of private property. The special relationship the landless shared with the land owning class, the jajmani-relationship, had granted them material security but that was lost under the new circumstances. Naturally agricultural productivity suffered. There was no more motivation for the tenant-farmers or sharecroppers to enhance the productivity of farmland by investing in soil improvement and high-yielding crop varieties for none were interested to benefit their oppressor. Consequently the landlords also showed no intention what so ever to enhance the economic condition and well-being of the cultivators.

The British tax-system ultimately left the peasants with nothing left to call their own.[15] Under these inherited conditions the implementation of reforms for higher productivity and a more equitable distribution of agricultural land for the livelihood of the poor became one of the national goals with highest priority in the endeavour to abolish hunger in India's rapidly growing population.[16]

But first one should analyse the land reform and the Green Revolution that derived from the "heritage of the British rule", and to take a closer look at the Bengal Famine for this might give an insight into the functioning of the Indian food market, for enhancing agricultural productivity is one aspect but bringing it there where it is most needed another, and this might be decisive over the Green Revolution's success.

---

[14] Sethi, (2003), Land Reform in India, Chapter 4, p.73

[15] See: Sethi, (2003), Land Reform in India, Chapter.4, p.73

[16] See: Mearns, (1999), p.1

2.3. The Bengal Famine: Reasons and Consequences for the Future

The Bengal Famine marked the beginning of the end of the British colonization in India. It took estimated 1.5 to 4 million lives in Bengal, mainly among the poorest. According to Amyrtia Sen this famine was more a human generated allocation problem than a mere consequence of natural catastrophes. To investigate this great Famine is interesting as well as necessary because although there were sufficient crops produced and even exported, so many people had to sacrifice their lives for they had no access to basic food. If we know why this happened or uncover and learn from it, such a disaster could be much more easily contended with or even avoided.

Since the famine hit Bengal in 1942/1943 it is quite natural to shift the responsibility to natural catastrophes: the cyclone, flooding, fungus disease and the loss of rice-imports from Burma which was then under control of Japan. At first glance the prevailing assumption was the central cause of all famines: a decline in food availability (FAD food availability decline).[17]

The "primary cause should be seen in the serious shortage of the total supply of rice available for consumption in Bengal as compared with the total supply of rice normally available".[18] But 1943 was neither a very good year in terms of crops availability nor a very severe one, only 5% lower than the average of the preceding five years – even 13% higher than in 1941 and there was no famine that year.[19]

The Famine Inquiry Commission supposed one reason could have been a shortage in the stock of old rice carried forward from 1942 to 1943. It was argued that the carry-over was substantially smaller than in 1941 which would possibly explain why there was no famine in 1941 but unluckily there is no data available regarding the stock position of rice or any other food-grain.

Yet all that did not explain why only a certain section of the population, such as agricultural labourers were affected by famine while others remained insulated.[20]

---

[17] See: Sen; Drèze, (1999)

[18] Sen; Drèze, (1999), p. 53

[19] See: Sen; Drèze, (1999), p. 53-58

[20] See: Devereux; (2004)

Sen expressed it as the inability of an agricultural labourer to exchange his primary entitlement, for example his labour, for rice.[21]

He adds a lack of democracy to the possible reasons provoking this Great Bengal Famine. He argues that the British did not react in an adequate way and the situation was aggravated when the British government suspended trade in rice and grains between various Indian provinces.[22]

A "person's entitlement set" according to Sen is the full range of goods and services that a person can acquire by converting his/her endowments (assets, resources incl. labour power) through "exchange entitlement mappings".[23] All legal sources of entitlement are either production based (growing food), trade based (buying food), own labour based (working for food), inheritance and transfer based (being given food by others).

The tendency to view distribution essentially as a transport problem rather than as a problem involving purchasing power and exchange was a persistent feature of official thinking on the subject.[24]

Another important aspect of the famine was associated with an uneven expansion in incomes and purchasing power. Those who were involved in military and civil defence works, in the army and in industries and commerce stimulated by war activities and the entire "normal" population of Calcutta that enjoyed special distribution arrangements at subsidized prices, could exercise strong demand pressures on food while others who were excluded from such benefits and protection suffered from the consequences of the high prices. In a study by the Famine Inquiry Commission the indices of exchange rate between agricultural labour and food-grains in Bengal between 1941 and 1944 were investigated: the daily wage of agricultural, male, unskilled labour and the price of rice and indices of exchange rates in a district around Bolpur (in Bengal) were examined in a monthly survey. This made it quite clear that agricultural labour did not share in the inflationary wage rise enjoyed by many other sections of the community.

---

[21] See: Sen, (1982a)

[22] See: Sen, (1962), p. 497

[23] See: Sen, (1982a), p. 2

[24] See: See. Sen; Drèze, (1999), p. 81

This analysis indicated that the rice-price rises considerably higher in comparison to the wages. For example from May 1943 to August 1943 which was the climax the rice-price-index averaged more than 500 (from a basis of 100) while the wage-index averaged only around 135 (from a basis of 100) also partly due to an increase in unemployment among agricultural labourers.

Those occupation groups involving crafts, services, superior foods like fish, milk and so on were dragged along by the distress that generally developed in the rural economy of Bengal, consequently the demand for those luxury goods declined sharply so that more groups plunged into destitution.

The rise in rice-prices was essentially related to the demand force, the supply was exceptionally high in 1942. The price increase was more acute in Bengal than elsewhere as a result of general inflationary pressure in a war-economy.

Vigorous speculation and panic hoardings resulted because the rice price had more than doubled in 1942, while the ”bazaar bill rate” (short term interest rate is one of the relevant rates which once determined the cost of bill finance) in Calcutta stood by 7% and the bank deposit rate was below 2% per annum – thus made the hoarding profitable.

Administrative chaos encouraged speculative withdrawal and panic purchase of rice stocks. Especially the inept handling of procurement schemes, hurriedly abandoned between December and March 1942 ended with the sudden abolition of price control in the wholesale market. Many of the groups had already suffered a severe decline in exchange entitlements.

The prohibition in 1942 of exports of cereals in general and of rice in particular from each province, prevented the price spiral in Bengal from being broken by imports from the other provinces. Also free trade in the eastern region which was then ordered by the Indian government failed because the prices in these neighbouring provinces soon reached the maximum levels that were laid down by the provincial governments. Only a Basic Plan of centralized inter-state grain movements successfully improved the supply position in Bengal in autumn of 1943 and ended the famine.[25]

[25] See: Sen; Drèze, (1999), p. 76-81

As we can derive out of this examination the decisive reasons for the famine was a market problem, the "purchasing power was limping" behind the rising prices, the wages of the (agricultural) labourers, service- and- craftsmen could not catch up with the inflation. Besides panic hoardings and speculations had become profitable because of the growing (double to four times higher) rice-price, low bank-deposit rate (under 2%) and a cost of bill finance interest rate of 7%. A situation the government could have avoided with a market analysis and if they had taken measures in time, for example giving the basic food for free to the poor, instead of experimenting with prices and to forbid hoarding of food-grains, then millions of lives could have been saved.

The Bengal Famine demonstrated how far a disproportion between wages and food-prices together with some other unfavourable circumstances among the poorest social class may lead. The same situation can repeat itself again and again, as often as such conditions prevail, the capital intensive commercialized agricultural technique of the Green Revolution is one example for this.

A good description of this situation is the statement of the Irish migrant Malone in G.B. S Shaw's play "Man and Superman" in a dialogue with Violet.
Malone: "Me father died of starvation in the black 47. Maybe you've heard of it"
Violet: "The famine?"
Malone: " No, the starvation. When a country is full of food and exporting it, there can be no famine."[26]

3. Land Reform in India

First of all we have to consider that nearly 55-58% (the percentage differs between Sethi and Chatterjee) of the work-force in India depends on agriculture and agriculture depends on land. [27]

The land reform has to guarantee that there will be enough land left for agriculture and forestry to achieve food security in future.

---

[26] Sen; Drèze, (1999), p. 40

[27] See: Sethi, (2003), p.75; Chatterjee, (2002)

What is the connection between land reform and Green Revolution?

Both strive for the same goal, to fight hunger by enhancing productivity and thereby sustain India's agriculture. But land reform strives for more still: to achieve more equity and to fight poverty by redistributing land. Simply spoken the Green Revolution needs good arable land which should be provided by the land reform, while the social equity aspect is not a concern of the Green Revolution on the contrary, its mere intention is to raise productivity in order to guarantee food security. Although from its conception this technique is meant to feed the poor, it replaces the cheap traditional, organic agriculture with the new, very capital-intensive method, without a security-net for the poor. However both Land reform and Green Revolution could theoretically complement one another in order to achieve better results. For instance the land reform offers a chance to the landless, or nearly landless or small scale peasants to obtain the right to own land (more land) for their livelihood, although they are more frequently trapped by the cost-spiral of the expensive Green Revolution-technology. And since they have no bargaining power, no access to cheap money and there exists no transparency about the real costs behind the new technology, small landowners are hardly able to profit from the Green Revolution. Moreover the Green Revolution is linked with the industrialization of agriculture and therefore prefers big units of land which could be a contradiction to the social mission of a land reform.

Small peasants however could be of great value to the amelioration of the soil and productivity if the share of farmland is operated in small units which are more equitable, labour-intensive (for they use no machines) and poverty reducing than large holdings (for they use machines) and at least as efficient per unit area. If we assume that family-farms are looking best after their own land, small size farms can be more efficient than large farms.[28] While the poor still want to take advantage of new technologies like the Green Revolution, the gains from technological innovation remain unequally distributed between those with access to land, water and inputs and those without and this should be alleviated through the land reform. [29]

[28] See: Rosenzweig; Binswanger, (1993)

[29] See: Mearns, (1999), p.1

Now that the Indian population exceeds one billion[30], arable land is taken from agriculture all the time for housing, infrastructure-building and so on. Especially with regard to the Green Revolution that is based on the expansion of farming areas, the land reform could be of great help too. Also if there is less arable land, the poor (nearly) landless who see agriculture as their livelihood would get access to land only with the help of the land reform. The land reform could be a back up for the sustainability of agriculture in the sense that more small peasants (tenants, sharecroppers) would be allotted land, who in turn care for the quality of their soil, raise the productivity of poor farmland, in short: look best after the land because they enjoy secure, enforceable property or tenancy right. Moreover if they could grow what they need and apply the technology they can afford, they could work their way out of poverty or at least be self-sufficient self-suppliers.

The Indian government began the land reform in 1951 with the first five year-plan and continued it until the 1990's (9^{th} and 10^{th} five-year plan). Then the land market was liberalized and entirely left to the market force.[31]

Under the Indian Constitution Land Reform is the responsibility of individual states. The federal government provides broad policy guidelines, the nature of land- reform-legislation, institutional support. The degree of success in implementing land-reforms however has varied considerably from state to state.

3.1. The Theoretical Background and Legislative Framework of the Land-reform

The objective to be achieved with this land-reform was a higher productivity and a social equitable distribution with regard to issues such as abolition of intermediaries, protection of tenants, rationalization of different tenure-systems and the imposition of ceilings on land-holdings in order to permit the poor, landless and nearly landless to have easier access to land for their livelihood.[32]

---

[30] CIA World Fact Book (2011), [Accessed: 19.06.2011]

[31] See: Indiaonline, [Accessed: 19.06.2011]

[32] See: Sethi, (2003), p. 74

For this reason a basic legal and institutional framework had to be established as to improve and secure property rights so that environmental resources might be protected and land transfers in rental and sales markets facilitated with the intention to enhance productivity, and to use land as a sustainable source of revenue for local governments. This land registration of before informal oral tenancy agreements and titling was supposed to bring about flourishing land-markets and allow the use of land as a security for credit. Banerjee comes to the conclusion that although the evidence is hardly definitive, redistributive land-reform seems to promote equity and efficiency. Where policymakers want to implement traditional reform, they should apply certain principles: land-reform programs should be accompanied by effective agricultural extension programs and empowerment strategies like emergency support programs that limit the need for emergency land sales and increase the willingness of peasants to take risks and improve the bargaining power of peasants who remain tenants. The government also needs to create an appropriate institutional environment for farmer's cooperatives and contract farming. Reform beneficiaries should be permitted to rent out redistributed land that means the landowners should be left the decision, whether they return to cultivation, what crops they grow etc. Tax distortions and distortions in the market for inputs that discriminate in favour of large farmers should be removed in the course of the land-reform.[33]

Rental markets are according to Mearns (1999) an important means for the poor to gain access to land but on the condition of strictly regulated land-ceilings and clearly defined enforceable contracts and a reduction of transaction costs (registration fees, stamps, bribes to expedite transactions, fees to informal land-valuers) which can altogether amount to one third of the total value of the land. Poor people easily risk losing their land if they have no title since they either cannot afford the transaction costs or cannot cope with the transfer-operations.

Rent seeking among the government officers is widespread because of the fact that landholders are prepared to pay a price in order to receive the kind of service they have a right to expect. It is the complexity of the legislative framework governing land-reform and administration in many states that is responsible for discrimination of the rural poor as well as the high observed rates of rent-seeking of government officers. Only strong civil society institutions could guarantee for

[33] See: Banerjee, (1999)

transparent public access to information and ensure checks and balances on inappropriate use of state power and uphold safeguards for the poor in law enforcement. Most important is the support of the competencies of the constitutionally mandated panchayati raj institution[34] to perform the watchdog-role in relation between state and civil society. [35]

3.2. Productivity and Land-size

As already mentioned the small peasants/tenant farmers could greatly aid in ameliorating the soil. Rosenzweig und Biswanger estimated a relationship between farmer's wealth and profits based on the data set from Central India (KRISAT) and found out that the profit-wealth-ratio for the smallest category of farmers is always at least twice that for the largest farmer. An explanation for such a phenomenon might be that with small farmers crop failures are less likely for they place a higher value on security or they own better land for they may purchase land on which likelihood of crop failure is low. But an advantage of the small land size is that the land can be cultivated by the family which grants a higher motivation to do the best in order to reach the best result. As long as the land values correctly reflect differences in land quality, the fact that smaller farmers have better land should not bias the estimate. It is possible that best quality land may be undervalued so that small farmers would look excessively profitable.[36]

It seems to me not only possible but most likely that the owner's family has improved the soil with their own hand's work so it has become the best quality land; for it is not likely that the poor have a fair chance to choose best quality land from the land reform commission. This supposition is confirmed by the following example.

---

[34] Panchayats have been the backbone of Indian villages since the beginning of recorded history. The 73rd Amendment Act, 1992; passage of the Constitution Act, marka a new era in the federal democratic set-up of the country and provides constitutional status to the panchayat institutions. The members are elected every five years; reservation of seats for scheduled castes, scheduled tribes, women, not less than 1/3 of seats, elderly people and youth, appointment of State Finance Commission (to make recommendations as regards the financial powers of the panchayats and constitution of District Planning Committee to prepare development plans for the district. They have been endowed with such powers and authority as may be necessary to function as institutions of self-government in order to prepare plans for economic development and social justice.

[35] See: Mearns, (1999)

[36] See: Banerjee, (1999)

3.3. The Land-reform in Practice

Some examples show that the rights of the poor are often not respected and they really need the help of the "panchayati raj" or other institutions to exercise their right.

The writer Siddarth Dube wrote a book titled "Words like Freedom, The Memoirs of an impoverished Indian family 1947-1997" around the true experiences and life stories of over three generations of the low-caste family of Ram Dass Pasi in the village Baba Ka Gaon in Uttar Pradesh. He observes that throughout Uttar Pradesh and across India the battle over land continues, and that in the past half century those with large landholdings profited from the conflict and not the poor.[37]

S. Dube tells the true story of the poor Bhagwan who has had half of his land usurped by the reputable Brahmin lawyer from Lalganj (village in Uttar Pradesh). The Brahmin (high spiritual caste) got the village land-record keeper to draw a boundary across part of Bhagwan's land, on which he has been working for the last 20 years since he got it allotted from the land reform. It was very poor land when he got it, sloping, but Bhagwan cut it and worked on it till it was good. Then the Brahmin paid off the village-record-keeper and took possession of the land!

Though not all ills of India can be attributed to the land-reform failures, poverty and violence highly correlated to land access. Ten years of liberalization have not significantly alleviated the lives of the destitute. An extreme case is Bihar in East India, one of the poorest states, often in the newspapers in context of "caste carnage". "The lack of development is due to the almost total failure to implement land reforms and the lack of any real mass- movement against the existing landholding system."[38]

Land-reform has indeed divested prices and large landowners with hereditary estates of 10,000 to 20,000 acres. But it is the medium prosperous farmers just underneath, and not the tillers of the

[37] See: Chatterjee, (2002)

[38] See: Chatterjee, (2002)

soil that have gained. In Uttar Pradesh, and other states, former feudal lords still cling onto their vast land by exploiting legal loopholes or through illegal stratagems.[39]

Under the 9th Plan (1997-2002) the Government of India made a compromise by choosing the middle path between total liberalization and regulation concerning tenancy reforms and lease contracts.

In the 1990's according to the suggestion of World Bank and other foreign finance institutions India embraced economic liberalization so that land ceilings as well as all sale-purchase restrictions were removed since the vocal opinion-making class found ceilings on land to be inefficient tools that hampered the development of agro-business. The land-elite was not at all interested to vote themselves out of possession and to give up their status quo. The new focus was on liberalization, privatization and globalization. Now however an increasing number is pushing for revocation of land-ceilings.[40]

As to the study of Dr. Haque of the National Centre of Agricultural Economics and Policy Research in 1995 points out, it has become evident that those with ownership/occupancy-rights take greater interest in farming. Survey results from the south Indian state Karnataka indicate that such tenants invest in land improvement measures and thus raise their land-productivity. Nevertheless many of the occupant tenants and informal tenants continue to borrow at higher rates from local money-lenders that often complicitly sell genetically modified seeds, artificial fertilizers and pesticides together with the big companies out of fear of harassment.

A big success story of the land-reform in Marxist-ruled West Bengal was "Operation Barga". This operation launched in 1978 led to the emergence of 1.5 million share-croppers, or "bargadars", who are provided with permanent heritable rights by the West Bengal tenancy laws.[41] The operation greatly contributed to agricultural growth in the state while other states like Kerala, Andhra Pradesh, Bihar, Himachal Pradesh, Madhya Pradesh and Uttar Pradesh that have a ban on

---

[39] See: Chatterjee, (2002)

[40] See: Sethi, (2003), Chatterjee, (2002)

[41] Operation Barga was the registration of names of sharecroppers, started in an unprecedented scale along with the distribution of ceiling surplus land. Sharecroppers were the direct beneficiaries. By implication the poorest section of peasantry, marginal and small farmers benefited the most. Agricultural labourer benefitted directly from redistribution of confiscated land and indirectly from any wage-rate-rise; the major section to lose were the absentee land lords.

leasing out agricultural land, fail to achieve the desired results due to "concealed tenancy". Haque points out that agriculturally developed pockets of the country such as Punjab, Haryana, show a growing tendency towards reverse tenancy: large and medium farm-owners that lease in land from marginal and small landowners. Computerization of land records could close such loopholes.

Chatterjee believes that land-reform is a necessary instrument for sustaining India's agriculture but is not sufficient to fight poverty.[42] I would add that the Green Revolution produces more than enough to feed the poor, but does not reach those that cannot afford to buy.

About 58% of India's population still depend on agriculture for livelihood, despite the share of agriculture in GDP is declining. Among those who live on agriculture nearly two thirds own less than one hectare land, out of which 40% are nearly landless owning up to 0,2 hectare or no land at all. Conversely 2% dispose of land parcels of 10 hectares or more.[43]

3.4. Conclusive Remarks on Land Reform

On one extreme there are rules banning all transfers of redistributed land except through inheritance. More common and less extreme are permanent land ceiling regulations which, if properly enforced, restrict the number of acres a landowner can own. On the other extreme there are one-shot efforts that redistribute land without imposing constraints on subsequent transactions. Those programs could end with the largest farmer owning all the land.

But efficient, social equitable reforms do not improve the situation for poor farmers if they get too indebted because many have to take credits to afford the costs of purchasing hybrid high yield seeds, the chemical fertilizers and the pesticides and moreover the irrigation and the high interest so that in the end they are forced to sell their land. Like this the whole process of land reform seems to be in vain. The small farmers have to be supported by NGO's or panchayati raj institutions. Now there are various projects to help the poor whom the Green Revolution and the liberalisation of markets left behind, as I will show in the course of this thesis.

---

[42] See: Chatterjee, (2002)

[43] See: Sethi, (2003)

If the patterns of landowning are conceived as fair, it strengthens the community. If on the other hand there is an unjust and unequal land distribution, poverty eventually would lead to discontentment and violent abreaction of frustration, all of which could eventually cause social tension, rural exodus and an increased migration to the big cities of India.

4. The Commercialisation of Agriculture

Creation of land-markets for private profit is challenged by the reality of India's ongoing food insecurity despite of the Green Revolution.

The strategy of the IMF and other IFI's (International Finance Institution) is to urge the government to shift India's agricultural policy towards export and to increasingly accept neo-liberal economic models.

There are two controversial realities: one is the substantial growth in agricultural productivity and the other the individual in the typical Indian villages starving to death and an increasing number of suicides among "failed" farmers.

The commercialization of agriculture started in Punjab in the 1960s with the Green Revolution – driven by the World Bank and USAID to promote agricultural productivity through import of artificial fertilizers, hybrid seed, pesticides and last but not least new foreign technologies like farm machinery – that were costly and made India dependent on foreign money supply. The bank provided the credits to replace the traditional low-cost, low-input agriculture in order to substitute it for a capital-intensive, chemical, fossil fuel- intensive agricultural industry (five year plan 1966-1971). The profit through export had to be reinvested in imports of fertilizers, etc.; the Indian Rupee was devaluated to support exports that would on the other hand have to be spent on imports to keep the market-driven machinery, the Green Revolution going, and made imports moreover more expensive.[44]

[44] See: Shiva, (1991)

The transformation of the system of land-tenure to the conceptualization of agriculture as an industry that must yield maximum profit while neglecting social and ecological consequences has been promoted since the 1980s.

In the past, agriculture was a family or community affair, now being commercialised, the agricultural industry produces for the global market. Modern methods and techniques have transformed agriculture into a science of food production. This new concept yielded at first substantial agricultural output.

Those imports were subsidized by the Indian Government. Moreover, the World Bank exerted pressure on the Indian Government in order to grant favourable conditions for foreign investments in India's fertilizer (as well as pestizide) industry. Sandoz, Continental, Monsanto, Cargill, Pioneer, Hoechst; Ciba-Geigy and DuPont. are among the multinational companies with major investments in the Indian seed-sector.

The World Bank also insisted on import liberalization and abolishment of most price-controls for basic agricultural products like grains and milk and on monocultures grown from imported varieties of seeds.

Since the 1950s around 130 agricultural projects in India have received about $10 billion USD financing by the World Bank and the government was urged to accept the liberalistic method of minimum state's intervention, leaving any regulation to the market in order to receive further payment for the sector of agriculture by the IMF.

The system of subsidizing imports had an impact that made the situation worse for it helped rich farming communities to politicise subsidies and thus increase dependence on more capital inputs such as credit, technology, seed and fertilizers.[45]

[45] See: Sethi, (2003), p.78

4.1. Can Commercialisation help to improve the Poverty in India?

This is a rightful question for the liberalistic agrarian policy which was forced upon Indian government by the World Bank, IFI's and multinational companies - which has yielded neither equity nor food security so far. Foreign multinational institutions and companies decide what has to be planted, mixed cultivation or crop rotation that would improve the soil in a natural way, was exchanged in favour of monoculture that leaches the soil in order to achieve more profit. But more profits for whom, who is benefiting from it? The so-called financial-aid has turned out the contrary, a financial dependence that only those who are strong, meaning who are equipped with sufficient capital, can benefit from the new technology; the "failed" farmers are committing suicide, because they step into the trap of moneylenders who eventually take away their land and livelihood, and those form the great masses in India. It is not only human duty but also necessary from the point of social security to protect their livelihood.

The land reform was one attempt to fight against hunger and poverty and the other experiment is the implementation of the so called "Green Revolution".

5. The Green Revolution

After India had achieved its independence, it needed to expand and strengthen its agricultural sector in the sense of achieving independence from foreign "help". After the Bengal famine when more died than were killed in the two World Wars - the Indian government desired to avoid history repeating itself. According to Amartya Sen the reason was not found in the shortage of food but in the poor food supply due to an uneven distribution between incomes and purchasing power. After the Bengal famine in 1943 (still under British reign), food security became important.[46] The Green Revolution is simply a technique to increase the output, while food allocation is left to the market.

Indeed the population was growing faster than the food production, therefore actions were taken first with land reforms and then to improve the agricultural situation to increase the yield of crops.

[46] See: Ganguly

During the 1965-1966 famine and after severe droughts in the mid 1960's India opened its doors to new plans for fertilizers and plants.

The Green Revolution in the beginning stood for a significant increase in agricultural productivity with the use of high yield varieties mainly rice and wheat, pesticides, heavy fertilizers, carefully controlled irrigation, and improved technologies.

Without controlled irrigation and fertilizers the high yield varieties would yield no more than the traditional grains. But by their implementation these varieties showed outstanding productivity.[47] Nevertheless India again took to dependence from foreign companies, foreign capital and as a consequence foreign economic policy.

The roots of the Green Revolution go back to 1944 where the Mexican government and the Rockefeller Foundation established a cooperative wheat research and production program to improve the productivity. The results of the program turned Mexico from being an importer of its wheat to become not only self-sufficient but also to export wheat. Later the technologies were exported all over the world, also India also got it's hands on it.[48]

Dr. Norman Borlaug from the CIMMYT (Centro Internacional de Mejoramiento de Maiz y Trigo) is known to be the father of the Green Revolution worldwide. The dwarf seeds that were created by Borlaug were the result of nine years of experimenting with a wheat type from Japan called "Norin".[49] Dr. Borlaug's Indian counterpart was Dr.M.S. Swaminathan, who received himself the title " Father of the Green Revolution" in India.[50]

The Indian Agricultural Research Institute received high yield seed of wheat from Borlaug, from Mexico. These seeds were tested and experimented with. The problem that India faced when it came to wheat and rice was that with the use of fertilizers the crops grew to an unnatural height, when reaching maturity - they had a very thin stem, this stem could not hold the heavy grains and would break or bend. With the HYV's (high yielding varieties) the crop was dwarfed and made

---

[47] See: Cleaver, (1972)

[48] See: Cleaver, (1972)

[49] See: Shiva, (2000)

[50] See: Kavanagh

smaller, so that the stem was shorter, stronger and would not break, no matter how many fertilizers one uses. The results showed a very high yield of the crops when harvested. In 1963 after Borlaug's visit to India, the Ministry of Agriculture, the Government of India decided to import 18.000 tons of seeds of 150 dwarf varieties from Mexico. This marked the beginning of the Green Revolution in India. [51]

Indian breeders then developed different wheat types such as "Kalyan Sona 227", "WG 377" and "WG 357".

In the year 1970 Dr. Norman Borlaug was awarded the Nobel Peace Prize for his work in food production and prevention of hunger.

The problem that then arose was that of the seed, as these high yield seeds had to be bought, the government resorted to loans from banks to buy these seeds and then sell them to the farmers. The farmers had to buy these seeds and therefore take loans themselves. This was an important issue due to the fact that the HYV's of the Green Revolution were only viable for at most three to five years before they got exhausted and vulnerable to pests and plant-diseases, therefore new seeds needed to be bought every few years. [52]

In 1963 the National Seeds Corporation (NSC) was established. This Corporation was responsible for the production, the distribution and the marketing of the agricultural seeds and was controlled by the Ministry of Agriculture. It is situated in Andhra Pradesh, Karnataka, Rajasthan, Punjab, Gujarat, Haryana, Uttar Pradesh, West Bengal, Madhya Pradesh, Orissa, Bihar and Maharashtra.[53] The NSC was founded as a response to the enormous wheat production that created a problem of warehousing and storage of the grains.

These high yield varieties of the Green Revolution brought about a monoculture-agricultural system in India. The seeds were of a very narrow genetic base and replaced mixtures and rotation-

---

[51] See: Nagarajan, (2004/3)

[52] See: Shiva, (2000), p. 36 ff.

[53] See: National Seeds Corporation

cropping as were the native/ traditional cropping systems. This loss of diversity led to a loss in stability and a higher vulnerability to diseases.[54]

But it has to be made clear: the HYV-seeds need a lot more water than conventional ones because conventional seeds are chosen by nature to be most suitable for this climate and soil. They could adapt to this environment over time and are therefore robust and not as vulnerable to diseases as the HYV which are entirely depending on irrigation. So any draught period, which occurs in India is a great challenge. This has to be counterbalanced by a well-functioning irrigation system that on the other hand adds up to the costs of the Green Revolution.

5.1. Weather in India

India is dependent on the rainfall for its agriculture. The main crop production season is from June to September, this season is known as the Kharif season which receives 80% of the southwest monsoon rainfall. In the pre-monsoon season from April to May the water level is the lowest. The post monsoon period also known as the northeast monsoon in the southern peninsula is from October to December.[55] The climate in India is affected by two seasonal winds: the northeast monsoon known as the winter monsoon which blows from land to sea and the southwest monsoon, known as the summer monsoon which blows from sea to land and brings the most rainfall during the year. [56]

The weather is an important factor that is unreliable as it is difficult to predict. In the past century India has experienced 21 severe droughts. A drought occurs with the absence of rain over a longer period of time. In India the droughts are mostly due to the absence of rains from the southwest monsoon. For example the drought in 1987 affected the states Rajasthan and Gujarat the most, where the rainfall was less than 50% of the normal rainfall. Almost 54.000 villages had acute problems with drinking water. The agricultural production decreased and the livestock suffered

---

[54] See: Shiva, (2000), p. 78 ff.

[55] See: Vepa, (2004)

[56] See: National Portal of India

severely under the drought. Another example is the drought of 1999 where the monsoon was delayed by 3 weeks in Rajasthan. It affected 12 states and around 100 millions of people as well as 60 millions livestock. All the water resources dried up by February 2000, the water level in deep wells dropped to 15m and the ground water quality decreased. The crops grown in the Kharif season were affected the strongest by the drought. The yields of agriculture were only half of the normally obtained yields with rain. [57]

Especially because India is very dependant on the rainfall, irrigation systems become even more important and crucial for the agricultural productivity, in order to satisfy the growing demand of the fast growing population. Weather can be seen as an important variable that influences the productivity of agriculture.

5.2. Irrigation

The river Ganga has the highest potential for utilizable water. Other rivers such as the Godavari, the Mahanadi, the Narmada, the Tapti and the Brahmaputra have lower levels of flow compared to the Ganga and a utilizable flow of 20 to 40%. Small rivers such as the Krishna and the Pennar have a utilization-potential of up to 100%. There are four rivers that form the water resource subregion in India, these rivers are the Mahanadi, the Godavari, the Krishna and the Cauvery. They flow through eight states and open to the Bay of Bengal. The major irrigation sources in India are the surface water through canals and tanks, and groundwater through dug wells and deep tube wells. [58]

India has practiced irrigation for many centuries. In the 18th century almost 1 million hectares were irrigated with tanks, wells and dams. During the British period the irrigation system was renovated and new irrigation works were constructed. Irrigation was generally designed to provide water to the farmers in the long periods without rain. These irrigation systems delivered river water through canals.

---

[57] See: Narain; Rao; Abrole

[58] See: Vepa, (2004)

After the British divided the country in 1947, India faced a problem as over half of the irrigated area was later located in Pakistan. The need to develop a larger irrigation system in India was strong. With the beginning of the new Federal Government of India and the Five Year plans in 1951, irrigation plans were also developed. In each of these plan periods the irrigation system had a place. Along with irrigation the essential infrastructure and institutions had to be instated.

The irrigation projects can be categorised into major and medium projects in the form of canals and tanks, with the first plan in 1951 where the goal was to irrigate 9.7 million hectares with major and medium projects. 75% of this goal was weighed in 24 major projects which were mostly concentrated in Andhra Pradesh, Punjab, Tamil Nadu and Uttar Pradesh. With each of the following five year plans new projects were started and by 1980 the goal of 1 million hectares irrigation was created in all major states. The minor irrigation projects are mostly in the form of tanks; this has slowly declined over the last years due to inefficiencies (80% of the tanks have been infested by weeds).

5.2.1 Groundwater irrigation

The groundwater irrigation is mostly a private investment of farmers, but over time the government became more present with its activities in the infrastructure, subsidy programs for small farmers and technical groundwater services (see Appendix, Table 4: the groundwater irrigation development). In the late 1960's and early 1970's there was a major growth in groundwater irrigation; electric pumps operated almost 60% of mechanized wells. Refer to Table 9 which demonstrates the anticipated and actual rates of return to private groundwater investment in the Appendix. The investment varied over different states and regions.

This trend in groundwater irrigation has a correlation with the Green Revolution which started in 1965, since one essential condition for the Green Revolution was an adaquate irrigation system, as the high yield varieties required a larger amount of water, (much more than before). With the help of a good irrigation system farmers can grow crops through out the year and not only in monsoon-dependent seasons. With the spreading of the high yield varieties in Punjab, Haryana, western Uttar Pradesh, Andhra Pradesh and Tamil Nadu there was a growth in private tube-wells to be observed. In regions such as Bihar, West Bengal, Orissa and Assam which have agro-climatic

conditions there was no trend in a tube-well growth due to higher rainfall, weaker support services and less rural electrification.

The capital costs for ground water varied from estimated Rs 5000 (value of 1985) for a shallow tube-well to around Rs 9000 (value of 1985) per hectare for a dug-well.

In the mid 1960's there was an expansion in the technical progress in pump-sets and well constructions. Industries brought cheaper equipment on the market which made it possible for small farmers to profit from the irrigation systems.[59] During this period " […] the main engine of growth was the greatly enhanced profit from newly available high-yielding wheat and rice varieties under conditions of high fertilization and good water management." [60]

The government started programs which had the purpose to give rural regions access to electricity, with the priority of increasing the power supply for agricultural purposes. Table 13 in the Appendix shows the groundwater development and the rural electrification. Later in 1979 the Rural Electrification Corporation (REC) was established.

With the growing population combined with the shrinking of arable land, ground water is also getting depleted, in many cases polluted. "They are drawing water from lower strata in Bengal and Bangladesh with the result that arsenic is coming up. The greatest internal threat to agriculture is now the problem of conserving our soil fertility, land and water."[61]

5.2.2 The Benefits of Irrigation

The most important benefit of a good irrigation system was the fact that the farmers can rely on water supplies to come at the right times. This on the other hand made it possible for farmers to practice double cropping, where crops could be grown in more than one season and get higher yields from the high yielding varieties as well as higher yields from the normal crops with the help

---

[59] See: Abbie; Harrison; Wall, (1985)

[60] Abbie; Harrison; Wall, (1985), p.8

[61] See: Swaminathan, (2010)

of more water and complementarities such as fertilizers. Irrigation also made it possible to turn the wastelands into new land that could be cultivated.

5.2.3 The Problems of Irrigation

In an interview with Mrs. Vandana Shiva - (Director of the "Research Foundation for Science, Technology and Ecology" in Delhi; awarded the Right Livelihood Award which is the Alternative Nobel Prize and environmental activist) she confesses: "Water Wars (book written by Shiva) is my synthesis of 25 years of ecological engagement where every environmental conflict has been created around the devastation of our water systems by wasteful, abusive development. For example, large dams have flooded out tens of millions of people. These dams do not really contribute to long-term development in the areas that get the water. There is salinization, there is water-logging. Agricultural systems which use five-times more water to produce the same amount of food are called productive and efficient. The Green Revolution's so called miracle is one very big reason for the disappearance of our groundwater as well as surface water in areas that should never have had extensive irrigation."[62]

In addition to the change in agriculture where drought resistant crops where replaced by thirsty monocultures, there are new threats coming from the water privatisation plans financed by the World Bank. This lead to a shift in India's water use to a non sustainable usage of water.[63]

"In spite of the large investment made in the irrigation sector and the phenomenal growth of irrigation during the past 30 years, the return from the investment both in terms of yield as well as finance is very disappointing."[64]

Irrigation-systems in the North are built as "run-of-the-river" canals and were made only for very low irrigation intensities giving the farmers only enough water for them to irrigate 30% of their area in each season. The water supply is scheduled and distributed to the farmers according to

---

[62] Barsmian, (2002)

[63] See: Barsmian, (2002)

[64] Abbie; Harrison; Wall, (1985), p. 18

their proportion of land. Farmers had to learn how to use the water economically and insist on their right to water-access as they very well know about their rights for water. The farmers of the North have higher incentives to use their water wisely and efficiently because of the water-limitation.

On the other hand the irrigation systems of the South were built for high irrigation intensities and ideal for crops that need a lot of water such as paddy and sugarcane. Here the water is distributed according to cropping patterns, which are first approved by the irrigation authorities and according to these patterns water is distributed. Here the water is supplied at specific times and in the quantities required for the cropping pattern. The problem with the southern systems is that the farmer living closest to the outlet would receive the most water, where as the farmer living the furthest away from the outlet would receive almost none and must therefore rely on rainfall. This causes an unequal share of water, as farmers close to the outlets get good yields at the expense of the farmers further away.

In 1970 the Command Area Development (CAD) was established to solve the problems of the inefficient water distribution. It deals with managing land, water, agriculture inputs and outputs. The CAD authority had to make sure, the farmers paid their part of the cost for the irrigation system, but the farmers were not willing to pay as the water supply was not reliable and remained a promise of the government. The problem was that only more bureaucracy developed instead of actually improving the services. As the strategy of CAD was later changed and the focus was put on delivering water efficiently and on time, farmers were more willing to pay their part. The government constructed field channels and started a disciplined water distribution.

Even before the irrigation systems were built, problems arose, such as land acquisition. Very often this is done too late which delays/hinders the project from its completion. Lack of proper and detailed planning is another issue. Small projects get delayed and lag behind whereas major projects that have higher costs are also completed faster. The economic aspect also plays a role, states are pressured to located projects in areas that have a higher return, as the area affects the cost of the project as well as the investments.[65]

[65] See: Abbie; Harrison; Wall, (1985)

5.2.4 Managing Water Reservoirs

The constitution gives the control of irrigation to every state. In other words, it is a state subject whether or how much a state spends on its irrigation and the maintenance of the systems. However there is a recommended minimum standard of at least Rs 75 (value of 1985) per hectare for the maintenance. In order to receive higher yields the kahrif (wet season) crops were planted in June instead of July. This change in the planting method requires the water reservoirs to open early and supply the land with water in June which is before the monsoon rainfall. This means that the water has to be stored in the hot and dry season in order to supply the lands with water in June and to get higher yields. In this way both the kahrif and the rabi seasons could benefit from early planting. Table 11 in the Appendix shows the water use efficiency and the size of outlets. [66]

5.3 Chemical fertilizers versus traditional method

One main idea of the Green Revolution was that through chemical fertilizers the soil could regain the nutrients and minerals it lost through monoculture.

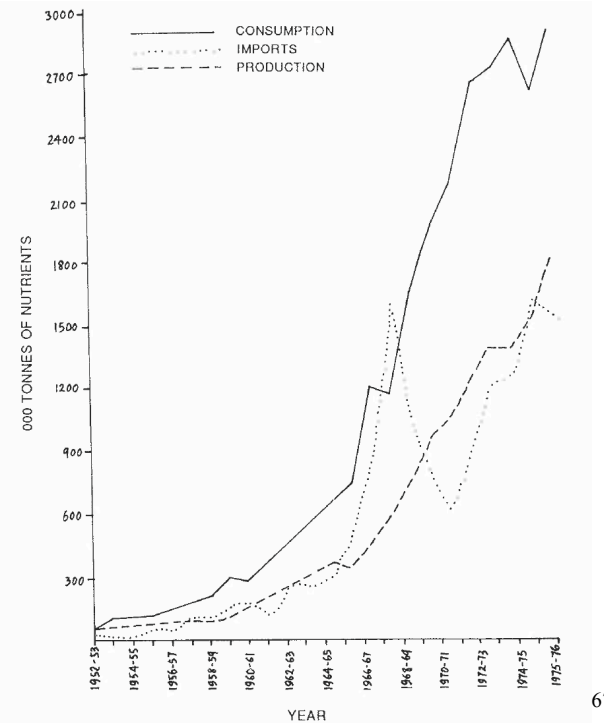
The use of chemical fertilizers for the new HYV's was a must, because these varieties consume three to four times more nutrients than the traditional varieties. In the 1960's India was pressured to open up its market to chemical companies such as the Ford Foundation that started producing chemical fertilizers in the country. The demand for chemical fertilizers was growing. The government started subsidising fertilizers such as Nitrogen (N), Potassium (K), and Phosphorous (P).

Traditional cultivation such as rotational cropping allowed that the soil could regenerate and recycle its nutrients. Crops such as pulses (beans) and coarse grains (maize, pearl millet, chickpeas and sorghum) are a source of nitrogen for the soil. With the Green Revolution these crops where not grown in the same quantity as before and were often replaced by wheat or rice. At this point the soil lost its natural way of regaining its nutrients and chemical fertilizers became a must. The

[66] See: Abbie; Harrison; Wall, (1985)

traditional way of fertilizing the soil with the use of animal manure was thus replaced by chemical fertilizers.

Figure 5.1: Production, Imports and Consumption of fertilizers, 1952-53 to 1975-76



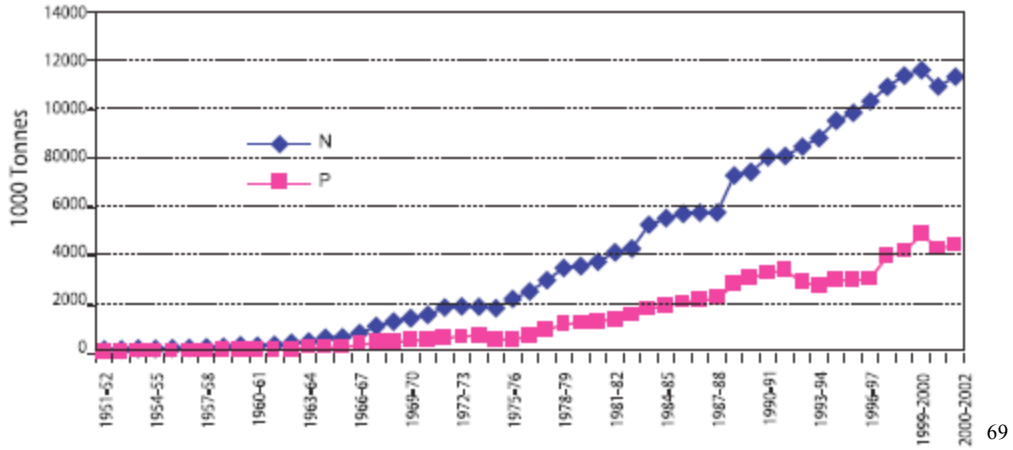
[67]

Due to the increase in the use of chemical fertilizers India became dependent on the imports of its fertilizers.[68] Nitrogen has different forms, in the northern states urea is the cheapest and therefore used the most. Wheat in the north-west region has a recommended dose for fertilizers which is 150 N, 60 P and 40 K.

Figure 5.2: The use of fertilizers in India in terms of nutrients (N & P) from 1951-52 to 2001-2002

[67] Shiva, (2001), p.106

[68] See: Shiva, (2000)



69

These fertilizers are used in an over dose, there is an increase in the usage as we can see in figure 1. What is also to be noted is that since 1966 we can notice an increase in the use of fertilizers, this has a correlation with the Green Revolution, since with an increase in cultivating under HYV's there is a larger demand for fertilizers. The problem is that with the unequal usage of fertilizers the nutrients, zinc and sulphur decrease and can cause deficiency. To make it easier to picture I will give an example. "A ten tonne cereal harvest following the rice/wheat annual sequence removes 250 g of zinc, 190 g of copper and 3.4 kg of iron from the soil under recommended fertilizer dose." [70]

[69] Nagarajan, (2004/3), p. 18

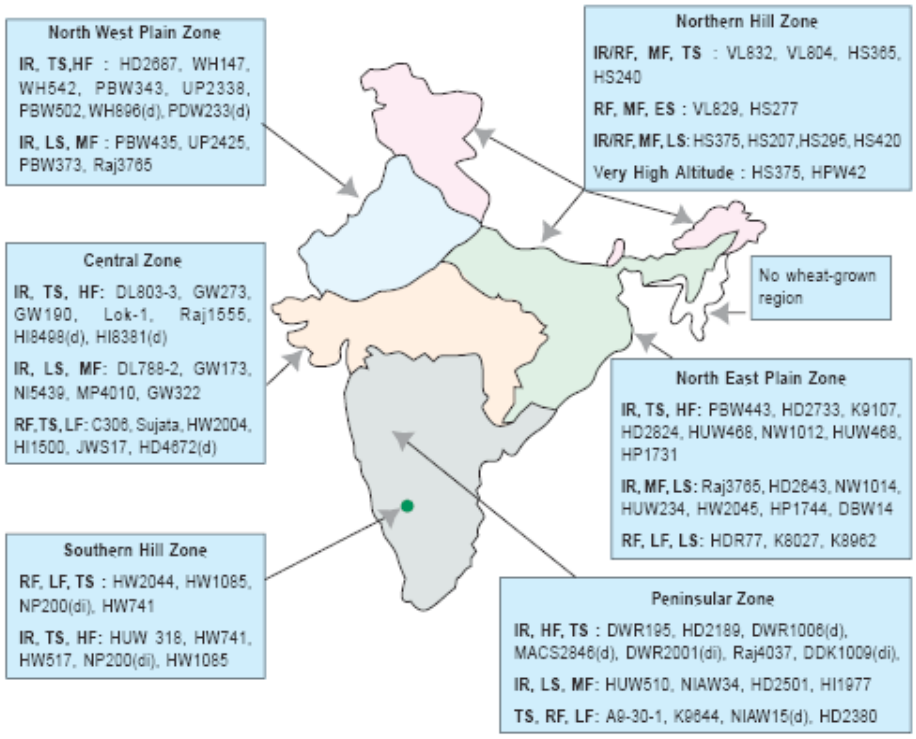
[70] Nagarajan, (2004/3), p. 19

5.4 High Yield Varieties

5.4.1 The Wheat and Rice varieties

Since the Green Revolution started with wheat and continued with rice and only later on went to other crops, I will first address wheat.

Figure 5.3: Wheat growing zones of India and the recommended varieties



[71]

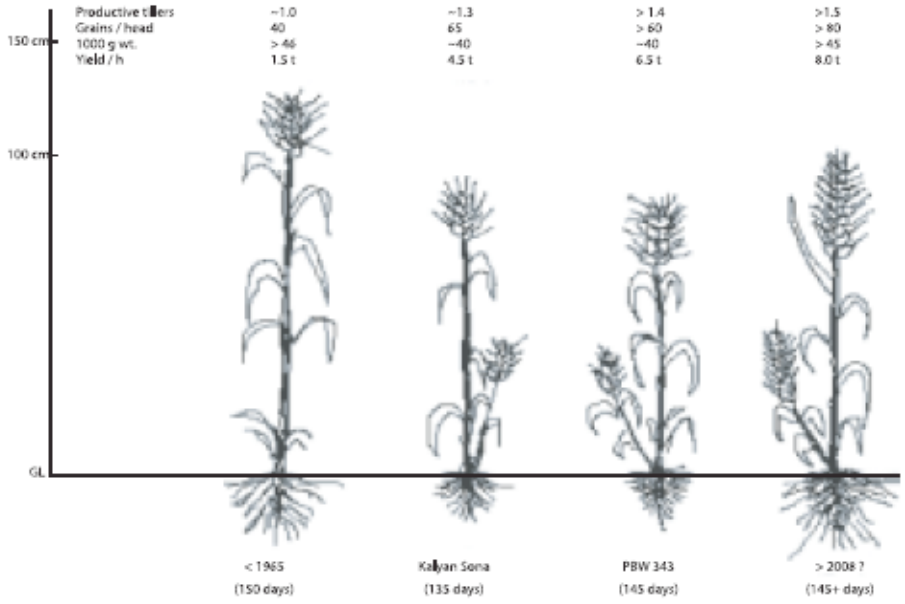
India is divided into six wheat growing regions: the North West Plain Zone (NWPZ), the Northern Hill Zone (NHZ), the Central Zone (CZ), the North East Plain Zone (NEPZ), the Southern Hill Zone (SHZ) and the Peninsular Zone (PZ). These six zones each have their own characteristics and can produce different amounts of wheat a year. In the NWPZ the wheat is most productive where it matures in 140 days, it is vulnerable to terminal heat and other diseases such as rust and can have severe crop losses. The NEPZ is the area with many rivers and is therefore humid. In the

[71] Nagarajan (2004/3), p. 10

NHZ the wheat is grown on slopes. The CZ and the PZ have deep black soil, where the wheat matures in 110 days.

In general there have been over 200 different varieties for cultivation. Wheat is sown end of October or early November, by 1970 four million hectares were of the dwarf HYVs were sown These new HYV's were 90 cm tall and carried more grain.

Figure 5.4: The gradual improvement in plant ideotype



[72]

In figure 5.4 we can see the development of crops used until 1965 and then the improvement made to the crops until 2008. The crops in 2008 were smaller and yielded more corn as mentioned above. Out of the seeds produced by the public system in 2000 the varieties PBW 343 and Lok 1 were the most desired. This changed in 2003 when UP 2338 and Raj 3077 rose in popularity. Varieties such as Lok 1, UP 262 and Raj 1555 were spread over a large area for many years. When new varieties came on the market they spread very quickly, one farmer would buy the newest seeds, multiply them and sell them in the neighbourhood. Now that there was such an increase in the yield of wheat grains there was also a growing expectance that these new varieties yield more

[72] Nagarajan, (2004/3), p. 14

than the older ones. This trend was increasing and on average the yield increased by 1% per year which was an impressive development.

In order to spread this so called wheat revolution to as many farmers as possible the Ministry of Agriculture funded on-farm- research-operations named the "Front-line Demonstrations" which had the purpose of introducing the new varieties, which were then sown on the fields and shown how to use and assess the cultivation technologies. Farmers from neighbouring areas all interacted with each other exchanging questions and experiences. The knowledge was also passed on through farm shows, radio and TV programmes.

In 1966 the International Rice Research Institute (IRRI) crossed "Peta" an Indonesian rice variety and "Dee-Geo-Woo-Gen" a Taiwanese rice variety to create a new variety IR-8. This was one of the first rice varieties that was brought to India and is now wide spread all over the country.
Since wheat was growing in importance and bringing higher yields than other crops the rotational or multi cropping systems was replaced by mono cropping systems. Table 5.1 depicts the different crop sequences that are mostly used which are the rice-wheat, the wheat-cotton, the wheat-pearl millet and the wheat-berseem. During the monsoon seasons the crops like rice, cotton, pearl millet etc are grown as soon as the monsoon is over. The field is prepared for the wheat in late October, early November.

Table 5.1: Area under different wheat based cropping systems in India

Crop sequence	*Rabi*	*Kharif*	Million ha (system area)
Wheat/Rice	Wheat	Rice	10.0
Wheat/Cotton	Wheat	Cotton	3.0
Wheat/Soybean	Wheat	Soybean	2.0
Wheat/Pearl millet or Sorghum	Wheat	Millet or Sorghum	5.0
Other systems			5.0
Total			~ 25.0

[73]

One of the most planted cropping systems found in the NWPZ is the rice-wheat cropping system. During the monsoon season when there is sufficient water the rice is grown, when the rice is

[73] Nagarajan (2004/3), p. 25

harvested the field is quickly prepared in order to start the next harvesting of wheat. The traditional method was to burn the straw that was left over after the rice harvest in order to quickly clear the field for sowing the wheat. Now with the Green Revolution new technologies are used such as the zero-tillage. This machine enabled the farmer to prepare the field fast for the next cropping. The zero-tillage slits the soil 2 to 3 cm deep and a 1.5 cm wide making a channel while simultaneously placing the seed inside. With this method the seeds are protected from birds, the rice straw is kept on the field. [74]

5.4.2 Other Varieties

Coarse cereal such are maize, sorghum and pearl millet also experienced the effects of the Green Revolution. Hybrids for theses crops where developed before the hybrids of wheat and rice (the fine cereals). In the past years from 1970-2001 the cropped area for coarse cereals decreased from 44% to 30%. Although the coarse cereals are decreasing, they show higher yields in irrigated areas than the rain-fed crops.

The Green Revolution began in the areas that had irrigation and later moved further to rain-fed areas where coarse cereals are grown. With the adoption of modern varieties there was a trend towards high yield.

Maize experienced a growth that can be explained with the help of the modern varieties and new technologies. Maize is grown mostly in Madhya Pradesh and Rajasthan under semi-irrigated areas, with the help of the new technologies the production costs could be reduced.

Sorghum on the other hand is mostly grown in Andhra Pradesh, Madhya Pradesh, Maharashtra and Karnataka, here the productivity has increased in the early Green Revolution stages. In 1960 the early hybrids for sorghum were released amongst the farmers. In the later stages of the Green Revolution the productivity however slowed down. In areas where the crops are rain-fed there was a moderate productivity growth whereas in areas with irrigation the productivity was high.

---

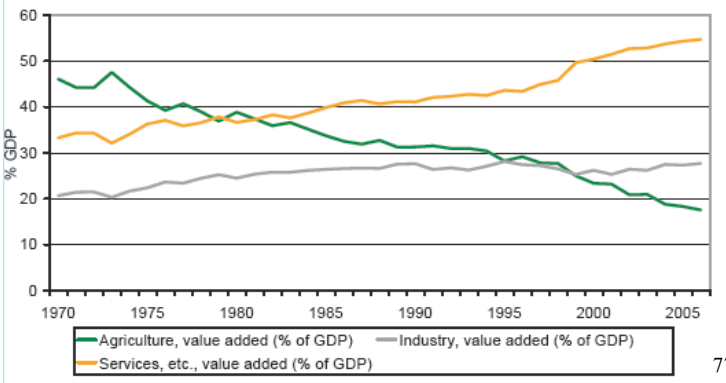
[74] See: Nagarajan, (2004/3)

70% of the pearl millet of the country is grown in Rajasthan, Gujarat and Haryana. Pearl millet is experiencing an increase in the productivity in the late Green Revolution stages and is still growing at about 4% per year in Haryana. These results show that pearl millet is the winner of the Green Revolution as it is still growing and not in a stagnant or a declining phase. The Green Revolution contributed to the growth of coarse cereals over the years with the input of technologies, irrigation and fertilizers. [75]

6. India in the World Agriculture

India's arable and cropland area accounts for 170 million hectares (value 2003). After the United States it is the second largest arable area in the world. "Out of India's 116 million farmers, around 60% have less than 1 hectare and together they farm 17% of the land. The share of medium to large farms (above 4 hectares) is very small at just over 7% of all holdings, but these farms account for around 40% of the land. The implication is that many of the very small farms are subsistence holdings, with low investment and little productivity growth."[76] As shown in Figure 6.1 the share of agriculture in the GDP has decreased from 1970 till 2005. Compared to other countries such as China and Brazil the agricultural share of India's GDP is still high.

Figure 6.1: Main economic sectors share of Indian GDP



[77]

[75] Janaiah; Achoth; Bantilan, (2005)

[76] European Commission, (2007), p. 3

[77] See. European Commission, (2007), p. 3

The government supports agriculture not only with investments in agriculture and infrastructure but also with measures such as the minimum support prices (MSP) for major agricultural crops, as well as with subsidies. These MSP are set to protect producers from drastic price falls and to hold the process stable. It is annually set in order to adjust to the present situation of prices.

After independence India was an importer of wheat, now due to the Green Revolution with its high yield varieties, it is the second largest exporter in the world as we can see in the table 6.1 below.

Table 6.1: The top 10 sectors of India and world rank

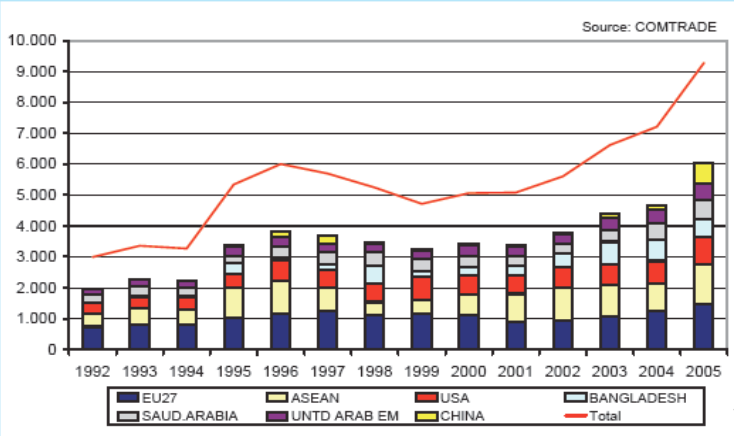
Commodity	Rank India	World Rank 2005	Production Avg 2003-2005	
			Billion $	Million T
Paddy rice	1	2	27.5	129.2
Buffalo milk	2	1	25.2	50.5
Wheat	3	2	10.9	69.7
Cow milk	4	2	10.0	37.5
Fresh vegetables	5	2	6.6	34.9
Sugar cane	6	2	5.2	250.0
Potatoes	7	3	3.6	25.0
Groundnuts	8	2	3.4	7.1
Pimento	9	1	3.3	1.1
Buffalo meat	10	9	3.1	1.5

[78]

As table 6.1 above shows us, India is the largest exporter of Buffalo milk, followed by paddy rice, wheat, cow milk, sugar cane etc. As we can see India is a large producer of these products, but the quantity varies depending on the demand and the size of the crop.

[78] See. European Commission p. 4

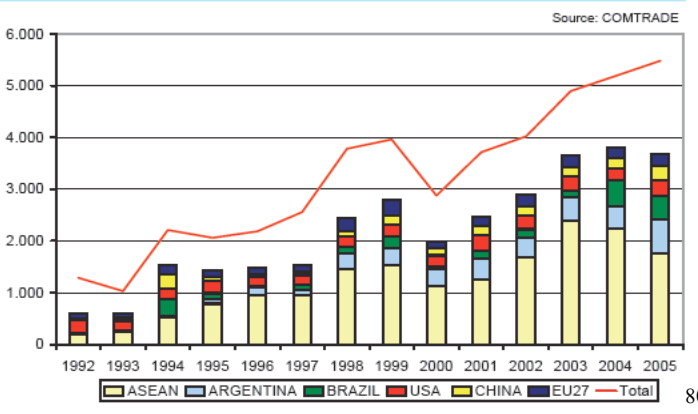
Figure 6.2: India's agricultural-food exports by destination (in million US $)



79

The figure 6.2 above shows us that the EU is the largest destination for exports from India, followed by ASEAN and the USA. Trade with Bangladesh and China on the other hand is growing fast. If we look at the imports of India we can see that ASEAN is the largest origin for India's import products accounting for 40% of its imports (2003-2005). This is followed by Argentina and Brazil. The ASEAN and Argentina have increased their market share in India at the expense of the USA, the EU, Brazil and China. The imports are mainly intermediate agricultural products such as palm oil and soybean oils. Although Cashew nuts are amongst the top export products of India, they are also imported for further processing, the same goes for silk and cotton which are used in the textile industry.

Figure 6.3: India's agricultural-food imports by origin (in million $)



80

[79] See. European Commission p. 5

7. The Green Revolution after 50 years – a Critical Review

Despite the remarkable achievements of the Green Revolution and of India's high–technology-sector poverty still prevails. According to UNICEF India is home to the largest number of malnourished children in the world. Although the food is physically abundant today, the problem is: the poorest cannot afford to buy it.

"For a country, the size and population of India, food-security is an especially crucial component of national security and until recently it was on an upswing due to technological breakthrough in rice and wheat production, a price policy ensuring minimum support prices, agricultural subsidies providing cheaper modern inputs and a closed market."[81] However with economic liberalisation cheaper foreign agricultural goods entered into the country and combined with the removal of agricultural subsidies for Indian farmers that might threaten food security in the future. With the reduction of state-interference to ensure food-security and the eventual takeover by market forces, there is sure to be a decrease in the access of food for the poorest Indian citizen. Policies do not tackle the problem of land and labour in the rural sector if they are aimed at market liberalization and privatization of natural resources.[82]

Criticism from environmentalists say that heavy reliance on pesticides, artificial fertilizers and intrusive irrigation cause not only soil-exhaustion, salination etc. but also high costs – compared to the old system – unaffordable by the poor farmers. As is now well known if one rotates crops, artificial fertilizers could be neglected for example maize consumes a lot of nitrogen which is produced by beans in abundance. But in a monoculture-agricultural industry beans may not be asked for on the global market, although it is an important nutrient for the poor and was therefore traditionally grown. The increase in production of wheat and rice was substantial but crops like chickpeas and millet which were traditionally planted by the poor to live on, were reduced in favour of commercial crops such as cotton and sugarcane. Industrial agriculture robs the crops of nutrients and loads it with chemicals and toxins. Synthetic nitrogen-, phosphorus- and potassium-

---

[80] See: European Commission, p. 6

[81] Sethi, (2003), p.86.

[82] See: Sethi, (2003), p.86.

based fertilizers lead to the depletion of vital micronutrients and trace elements (magnesium, zinc, calcium and iron). High-yield varieties extract micronutrients from the soil at a speed rate creating deficiencies of such micronutrients as zinc, iron, copper, manganese, magnesium, molybdenum and boron, those deficiency symptoms would not occur with the use of organic manure or natural dung.

The Green Revolution was more about selling chemicals according to V. Shiva. We can see this when looking at the commercialization of crops. The first category of crops are resistant herbicide crops which are able to absorb high doses of chemicals and still survive. The second crop category is called Bt: Bacillus thuringiensis, which is a bacterium that produces a toxin. This toxin-producing gene from that bacterium is implanted in the crops. There it goes on producing the toxin in every cell of the plant, so these plants become pesticide - producing plants. They enter the food chain poisoning the "web of life". But when nature is hit, it hits back. For the earthworm family of pests that is supposed to be controlled by the toxin has already evolved and developed resistance against the toxin. These plants releasing the toxin undergo mutations as well. It is a vicious cycle as the pests become resistant to the pesticides leading to more and/or stronger pesticides.

V. Shiva argues that instead of chemicals and Bt. the "Neem" tree, a tree growing all over India, in every eco-system across the country, should be revived as its oil works as an excellent, potent, non-violent pesticide as well as fungicide that has also mosquito repellent properties thus protecting against malaria.[83]

"The miracles of providing India with nutritious crops are a myth"[84], is the opinion of V. Shiva. She gives an example of "Golden Rice" which was "designed" to deliver vitamin A to the poor but proved to be inefficient. Even the World Bank, the WHO and the Food and Agriculture Organization stated that the only way vitamin A deficiency in poor communities could be overcome was by giving women a variety of seeds such as coriander leaves, curry leaves and

[83] See: Shiva, (2001)

[84] Shiva, (2001)

fennel that are rich sources of vitamin containing considerably more of the vitamin than Golden Rice. [85]

The Green Revolution increased the Indian food production by 5,4% while the new agricultural production practises resulted in a loss of nearly 8,5 million hectares by soil degradation, which amounts to 6% of the crop base due to exploiting and polluting of groundwater, consequently salinity or excess alkalinity develops.[86]

The World Bank tried to repair some negative effects of agricultural industrialization and Green Revolution by launching new joint projects to improve water-supply-management and irrigation also to consequently create new jobs in rural areas like transfer operation- and management responsibilities to farmers who form water-user associations and conduct financial reforms in order to make state-irrigation systems self-sufficient. See the critical remarks under 4.2.3. Problems of irrigation.

7.1. Human Costs of Globalization

In 1997 the first reports about farmer suicides appeared in the media. V. Shiva spoke of a particular case in Andhra Pradesh, one of the e most integrated states with a global economy. Why did the farmers become indebted, and what was the actual cause for suicide? Detailed studies have shown that it was the shift from staple food crops difficult to afford to cash crops such as cotton which accounted for 99% of these regions since globalisation changed India's agriculture. New seeds and hybrid seeds can't be renewed by farmers and the companies neglect to tell the farmers of this. The hybrid seed is more pest-prone and therefore the farmers need pesticides that they cannot afford.

The same companies have agents at the village level who are often moneylenders and landlords that provide farmers with credits at extortionate interest rates. Within a year or two farmers become highly indebted. In traditional agriculture in Third- World Societies, farming is a

[85] See: Shiva, (2001)

[86] See. World Ressource Institute, (1994)

collective effort of the community. The decision what crop to plant depends on the expected weather, the rainfall and the water supply. In the new economy, the farmer has become singularly dependant on those companies that convert the producer into a consumer of hybrid seeds, fertilizers and pesticides. Incidentally in those villages the use of pesticides has increased 2000% during the last decade (based on 1997).[87]

7.2. Organic Sellers and Seed Sellers sue Monsanto, the Multinational Seed Company.

To show the difficulty organic farmers are facing I would like to give an example. This example is from a court case which began in New York on March the 29, 2011 where 60 family farmers, seed businesses and organic agricultural organisations from the USA and Canada, the Public Patent Foundation (PUBAT) sued the Monsanto Company. Monsanto is one of the largest chemical company regarding genetically modified seeds. This case was filed in the Federal District Court in Manhattan.

"The organic plaintiffs were forced to sue pre-emptively to protect themselves from being accused of patent infringement should they ever become contaminated by Monsanto's genetically modified seed, something Monsanto has done to others in the past."[88]

The problem here is that once genetically modified seeds are released into the environment, they mix with the organic seeds. These organic seeds can no longer be called organic as they are destroyed or contaminated by the genetically modified seeds.

With this court case the plaintiffs want to avoid that organic corn, soybeans, cotton, sugar beets and alfalfa (belonging to the pea family) face the same fate as organic canola (rapeseed), which was virtually extinct as a result of the contamination.

This court case marks a rise of the individual farmers against the power of the bio technological industry. [89]

---

[87] See: Shiva, (2001)

[88] Navdanya International, [accessed: 03.04.2011]

8. The Bio-Village Concept, Future Perspective?

When M.S. Swaminathan was confronted with this reproach of the negative effects of the Green Revolution that are growing more and more evident, he admitted that the scientists are aware of that and he suggests a bio-village concept, which he is convinced of, would link ecological security with small business enterprises at the village level, which is an idea he derives from Gandhi's sarvodaya, antodaya philosophy. The bio-village concept consists of two components: one is conservation of natural resources and enhancement of soil-fertility, water, flora and fauna; the other is livelihood-security. For example in rice-growing areas, there is a whole series of rice by-products such as rice bran, rice husks, rice straw. The latter can be used to grow rice-straw-mushrooms, it can be made into paper and board. The purpose of bio-villages is to convert natural resources into jobs and wealth. Most of the villages in the state of Pondicherry are now bio-villages. "The bio-village concept brings together small-scale farming and micro-retail. The idea behind is to have sustainable societies where one uses the natural resources wisely while creating more opportunities for on farm employment such as retail." [90]

India needs a new culture of working with the poor, one of providing them with human dignity and not with subsidies. The National Network on Biovillages and Community Banking was inaugurated by the M.S. Swaminathan Research Foundation on February 18th 2000 in Chennai (formerly Madras). This bio-village concept was introduced in 19 villages in the Union Territory of Pondicherry and found to be successful: it provides not only livelihood systems comprising technical knowledge and skills, a self-perpetuating system of micro-credit within the community and access to the market, but makes the villages self-sufficient and human-centric. One project is for example the mushroom cultivation.

The Network should offer hope for the people of countries that have adopted the policy of liberalisation and the free market-economy but where the ills of inequality have been accentuated, life support systems have been damaged und unemployment levels have risen.

---

[89] See. Navdanya International, [accessed: 03.04.2011]

[90] Kavanagh

Swaminathan means "that the development pursued by India over the last 50 years has been proved wrong as all poverty alleviation programs focused on the target groups approach and did not spread the message of asset building or community and human development" [91] The New Economic Policy, according to him is not designed to protect small enterprises.

According to Swaminathan in a bio-village the local people take the decisions, the activities are more market-driven. In order to be a sustainable concept, asset creation is important. Community banking is crucial, for it is built on trust and builds up people's self-esteem. It is characterized by low transaction costs, high repayment record, timely and effective availability of credit and is accompanied by appropriate services to sustain small enterprises/farms with technical and marketing knowledge. Priority is given to villages at the border of bio-sphere-reserves and National Parks as it would take care of strengthening livelihood opportunities and conservation of the "genetic treasures". The Network initiates a new management-system for bio-reserves.

A trust has been formed with people depending on natural resources for their livelihood such as fishermen and the landless poor as its major stakeholders. The first trust was formed in Tamil Nadus Gulf of Mannar area funded by Global Environment Facility, the Government of India and the UN Development project.

The Biosphere Reserves contain genetic elements evolved over millions of years that hold the key to future adaptions. The high degree of diversity and endemism and associated traditional farming systems and knowledge held by the people of these reserves are product of centuries of human experimenting and innovating.[92]

9. The Need of an Evergreen Revolution

Since the peak of the Green Revolution years, agriculture continues to face serious challenges on account of input resource imbalance and stagnating yield levels. The excessive usage of chemicals and pesticides has adversely affected the soil fertility. The varieties used during the Green

[91] Krishna, Kumar, (2000)

[92] See: Krishna, Kumar, (2000)

Revolution have also attained the maximum yield potential; so despite the continuous rise in inputs, there is no productivity gain.[93]

Similarly biotechnology indicators should help in identifying the needs of the poorest of the poor for example through so called "orphan crops" chickpea, millet, sorghum, etc. These crops may play a crucial role in ensuring food security in several rural areas. Another important dimension in the agricultural sector could be to generate indicators which may reflect on non-farm rural income such as tissue culture, bio-fertilisers, bio-pesticides, etc.

The Swaminathan Task Force on Application of Biotechnology in Agriculture was set up in 2003 under the chairmanship of Dr. M.S. Swaminathan. In his report submitted to the Ministry of Agriculture in 2004 the bio-safety regulatory mechanism has come up to the centre stage of the policy debate. In this report he suggests the setting up of agricultural biotechnology parks in every state and agro-biodiversity sanctuaries in areas considered to be the habitat centres of genetic diversity of different crops to conserve this germ-plasm for posterity.

The issue of genetic modification is not really related to the Green Revolution, for the Green Revolution was not a product of genetic modification but of Mendelian breeding (after Gregor Mendel), cross-breeding of different varieties with different qualities while the genetic revolution is at the level of molecular manipulation with DNA-technology. There are many differences of opinion here but what is important is the safe and responsible use of biotechnology. In food-biotechnology there are real environmental concerns, impact on bio-diversity, impact on human health, but every country has a biotechnology regulatory authority which examines the product and says whether it is safe or not. In India so far only the genetically modified Bt-cotton was approved for cultivation.[94]

The bio-safety and agronomic evaluation can be done concurrently to save on time taken for approval of genetically modified products (GM). This transgenic technology should impart resistance to crops against pests, diseases and other stresses. However transgenic research in crops

---

[93] See: Chaturvedi, (2005/6), p. 9

[94] See: Swaminathan, (2009)

is barred where India's trade interests are jeopardized like basmati rice, soybean and Darjeeling tea.[95]

The regulatory authority for transgenic crops in India, the Genetic Engineering Approval Committee GEAC has permitted a seed company: Mahyco to commercially release genetic modified hybrid cotton (Bt cotton) varieties on little more than half a million hectare. While Mayco is Monsanto's partner in India, Rasi Seeds and Ankur Seeds are the sub-licensees of Bt seed technology. The proposal of Monsanto-Mahyco for approval of a Bt-cotton variety for commercial cultivation in North India was turned down by the GEAC as the variety was susceptible to the deadly leaf curl virus.

The next genetically modified crop to be cleared for commercialisation may be mustard.[96]

At the moment indigenous firms are under heavy pressure to technologically improve their seeds. This pressure emanates not only from consumers but also because of the growing market penetration by multinational seed corporations which have high technology seed.

One Indian Company Nath Seeds has forged a strategic alliance with Biocentury Transgene Company, a Chinese biotechnology company in order to introduce transgenic technology in cotton crop. Currently transgenic technology is a monopoly of multinational firms such as Monsanto, Novartis und DuPont.

Evergreen Revolution and sustainable food security: productivity in perpetuity without associated ecological and/or social harm. Intensive cultivation without conservation of soil fertility would lead to springing up of deserts; irrigation without arrangements for drainage would end in soils becoming alkaline or saline. Indiscriminate use of herbicides, pesticides and fungicides would cause an imbalance of biological nature and as well lead to an increase in the incidence of cancer and other diseases because of the toxic residues present in the edible parts of the plant.[97]

---

[95] See: Chaturvedi, (2005/6), p. 25

[96] See: Chaturvedi, (2005/6), p. 13

[97] See: Swaminathan, (2010)

The rapid replacement of numerous, locally adapted varieties with one or two high-yielding strains in large, contiguous areas would result in the spread of serious diseases capable of wiping out entire crops. "Therefore the initiation of exploitive agriculture without a proper understanding of the various consequences of everyone of the changes introduced into traditional agriculture, […] may only lead us, in the long run, into an era of agricultural diseases rather than one of agricultural prosperity."[98]

Since the earlier traditional methods like shifting cultivation are "out" due to population pressure on land (more land for non-agricultural use or less land for agriculture available) other methods have to be taken into account. In order to improve Soil-Health, cereal-legume rotations and intercropping are important for replenishing soil fertility.[99] A healthy soil yields healthy food.

Efficient green manure plants like 'Sesbania rostrata' esp. applicable for rice (a plant growing in clayey, alluvial or water-logged soils with a high nitrogen fixing ability: per ha/year the pure nitrogen added is evaluated at 60-240 kg) and bio-fertilizers comprising compost as well as efficient micro-organisms have to be integrated in a nutrient-supply-system. Organic manures and plant residues, phosphorus, potassium and micronutrients have to be guaranteed in the soil by regular inspections of the soil-health. If all organic farmers would be provided with soil-health cards the quality could be examined regularly to care for a productive, healthy agriculture.

In the opposite case of degraded, exhausted, eroded soil, productive genotypes of crop plants will be needed that can perform well under conditions of soil salinity, alkalinity and acidity. Scientists at the MSSRF (M.S.Swaminathan Research Foundation) have developed salt tolerant genotypes of rice (salt-resistant wild rice), mustard and legumes using the mangrove species 'Avicennia marina' as donor. Similarly, Prosopis juliflora is used as a donor of genes for drought tolerance. "Such pre-breeding […] needs to be integrated with participatory breeding of farmers […] so that location specific varieties can be developed."[100]

---

[98] Swaminathan, (2010), p. 63

[99] See: Swaminathan, (2010), p. 68

[100] Swaminathan, (2010), p. 69

With the help of high complex, naturally occurring, beneficial micro-organisms like photosynthetic bacteria, lactic acid bacteria, yeasts, fermentative fungi, etc. water can be purified, even sewage.

Sanitary and phyto (plant)-sanitary measures and the Codex Alimentarius standards of food quality need to be observed in organic agriculture. It is also important to combine traditional wisdom and contemporary science to achieve healthy food, a healthy environment and also sufficient food to feed everyone.

Ecotechnology means marrying the best of modern science to the best in traditional wisdom and traditional ecological prudence. One can use biotechnology for bioterrorism or bio-happiness, it is in our responsibility to ensure that the ethical aspect of eco-technology: a better life and good health succeeds.

9.1. Swadeshi a Revolutionary but quite Simple Way especially in India to improve Livelihood

Swadeshi was propagated by Gandhi in the freedom struggle and is the contrary of today's globalisation. It is the spirit in us which requires us to serve our immediate neighbours before others and to use things produced in our neighbourhood in preference to those from remote, Gandhi said.[101]

Foreign clothes may be better and cheaper than the home-spun, but the relentless use of the imported fabric would lead to unemployment of thousands of villagers who have traditionally earned a living by spinning and weaving home-made clothes. The same logic extends to other agro-based products as well. Gandhi believed that choosing such imported goods would lead to a degeneration of the entire village economy, which was the backbone of India's economy. Gandhi's postulate of what everyone should dispose of: a balanced diet, a decent house to live in, facilities for the education of one's children and adequate medical relief. The tiller of the soil should have a sufficiency of fresh pure milk and oil, fish, eggs and meat if he is a non-vegetarian,

[101] See: Gandhi, (1925)

adequate but not fine clothing (what would fine clothes for instance avail him if he is ill-nourished and underfed?), facilities for sanitation, comfortable housing, clean drinking water, dirt-free roads and a sense of participation in decisions that affect his daily life.[102]

According to that the living standard should be measured. The acceptable degree of inequality in society should be seen in terms of differences in consumption, life-style and the standard of living not the income.

Gandhi's overriding concern was decentralization of production which was to be achieved through village industries. He opposed to centralised state control of the distribution of food grains or other necessary items, he was also against price control and rationing for those were instruments of food planning in independent India. Since three quarters of the Indian population lived in villages, economic development had to be brought to the villages. He was a determined enemy of the inequality and injustice that are characteristic for societies driven by possessive individualism but he never gave up his commitment to the individual as a valuable part. He was convinced that if the individual ceases to count, what is left from society?

His plea was not so much for using capital less, as for using labour more. Gandhi calls a good machine any machine that does not deprive masses of men of their opportunity to work but adds to his efficiency and moreover does not enslave the worker.

He rejected any plan which exploited natural resources of a country to the full while neglecting the use of man-power, for that would not alleviate inequality. Organisation of machinery for the purpose of concentrating wealth and power in the hands of a few and for the exploitation of many he holds to be altogether wrong – much of the organisation of machinery of the present age is of that type.

For him it is one thing to improve the economic condition by one's own active effort, this is superior to having the same outcome brought about by the state." It is one thing to improve the

[102] See: Dasgupta, (1996)

economic conditions of the masses by state regulation of taxation and wholly another for them to feel that they have improved their condition by their own sole personal effort."[103]

Although criticized by the Left, he constantly refused to condemn the acquisition of wealth, he says: "my advice that moneyed men may earn millions - honestly of course - but so as to dedicate them to the service of all, is perfectly sound". Likewise, while condemning exploitation of workers by capitalists, he refused to condemn all businessmen as individuals. "I don't look at the rich as wicked and at the poor as angels."[104]

9.2. How can the Gandhian Economy Based Concepts help to ameliorate the Present Situation?

In addition to the bio-village-concept developed by Swaminathan, which is based on Gandhi's philosophy and economic thoughts, there are other considerations which could support the idea of decentralization upon village-level. One reason is the observation that small farms in developing (in this sense of unequal, semi-feudal land distribution) countries have the tendency to be more productive than larger farms. The difference of productivity is substantial as can be shown on the example of Punjab: productivity on the largest farms (as measured by value added per unit of land) is less than 40% of the productivity of the second smallest size group. In the semi-arid region of India profit- to- wealth ratios are at least twice as high on the smallest farms than on the largest.[105]

The industrialisation of agriculture was aimed at producing more food and increasing our bodily comfort, yet millions of people are hungry today and much more suffer from food-related diseases like obesity, hypertension, diabetes, etc. Industrial agriculture named as the Green Revolution in developing countries is a chemical-, capital and fossil-fuel intensive system that pushes poor farmers into debts and deprives them of their land.

---

[103] See: Dasgupta, (1996), paragraph 119

[104] Dasgupta, (1996), paragraph 119

[105] See: Banerjee, (1999), p.1

For Gandhi the highest ideal was self-sufficiency. He understood the very backbone of India was its villages and unless village economy could be reformed, nothing could be achieved.

Gandhi's view on economics was simple and straightforward at the outset but had deep political connotations for he understood economic motives to be the basic principle of imperialism and colonialism. He therefore understood that the only way to weaken the colonial forces would be to attack the basic economic profits that the British gained from its colony India. This coupled with his actual understanding of the Indian condition led to the development of a unique brand of economic reorientation of the Indian society that he propagated throughout his life. His economic model was not only a political tool, clad in spiritual rhetoric but his concern for the predicament of the Indian villagers was sincere as was his concern for the heartless mechanization of the world economy without ethical considerations. Gandhi said: "Our production is production by masses" not a mass-production as was propagated by the industrialized nations.

"What India needs is a job-led growth, not a jobless growth, a human centred kind of development. India needs more farmer's farming and less factory farming", says Dr. Swaminathan.[106]

10. Conclusion and Summary

Ultimately it is evident that the Green Revolution was not an appropriate instrument to achieve food security in the long run because, although it produced far more than expected. It also spoilt the soil through monoculture, polluted and caused the groundwater-level to sink considerably and financially ruined the small peasants because of the cost intensive agricultural technique, they were not aware of. But a technology cannot be made responsible for millions of empty stomachs – it is partly the failure of the government which often changed its policy between governmental regulation and liberalisation as is demonstrated in the example of the land reform, that was only done half heartedly for it was in the end liberalized and left to the market so that some socially important rules and regulations were abrogated regarding the ceilings and other market restrictions and the land reform turned out partially inefficient. Partially it was the failure of the agrarian

[106] Swaminathan, (2001)

policy that forced the poor farmers to adopt the Green Revolution technology instead of the cheap traditional agricultural method – as a consequence they became highly indebted and dependent on moneylenders who asked exorbitant high interest rates, partially it was the fact that the mass of the poorest simply cannot afford to buy the staple food at such prices. It is like a red thread running through history: the high taxes of the British colonist that robbed the peasants of their land, the high interest rates of the landlords' moneylenders and later the high interest rates of the moneylenders cooperating with the big companies that sold chemical fertilizers, pesticides etc. The heritage from the British was that the traditional land utilisation was overthrown by the institution of private property which subverted social equity.

Why the Bengal famine was to be examined, was because a similar scenario, not a famine but a shortage of food affecting the poorest, repeats itself, in spite of the Green Revolution. The remarkably high harvests did not reach the poor masses because of high production costs that reflected in prices the poor could not afford since land-labourers also earn less than others.

The Green Revolution came up with high costs. Hybrid seeds that could not be conserved and had to be bought every 3-5 years an excessive need for artificial fertilizers and consumption of water, pesticides (for the crops were more prone to diseases), fuel for machines - all such requirements meant bankruptcy and the loss of land for many small peasants. In some states the land reform was also quite successful but in others the positive effect was neutralized since the farmers got deluded to plant the hybrid seed instead of keeping to traditional crop-rotation and conservable seed. One can say the Green Revolution is partly responsible for the fruitlessness of the land reform.

The Green Revolution used high yield seed from Mendelian breeding financed by the World Bank and other IFI's but on the condition that multinational companies could settle down in India. The other condition was to introduce a more liberal policy like the liberalization of the land-market and abolishment of price-limitation for basic food. The Green Revolution was a quantum leap with regard to productivity at the beginning but it also caused severe degradation of the soil and groundwater-shortage causing productivity to fall. Yet India is still leading in the World Statistics in many crops while endemic hunger prevails among the poor masses. Famine gets significantly more media attention than hunger. The overproduction is exported and does not reach the hungry people in the country.

The negatives of the Green Revolution revealed itself after a decade or so yet this could have been avoided with organic agriculture, crop rotation, animal manure, composting. Still there are two sides: the transgenic, genetically modified seed monopoly of the multinational companies like Monsanto, DuPont and the ecological approach of Prof. Swaminathan and the environmental activist Dr. Vandana Shiva. Industrially produced food is less nutritious and contains chemicals and toxins. Artificial fertilizers lead to depletion of vital micronutrients and trace elements like magnesium, zinc, calcium, iron. Monoculture does not produce more food und nutrients but instead takes up more chemicals and therefore is only profitable for agrochemical companies.

Part of the suspicion against genetic manipulation technique in agriculture is that the technology is controlled by corporations that profit from it, regardless of its adverse effects it can have. Moreover, the gene revolution by the multinational companies is based on intellectual property rights and social exclusion in access to the technology.

Swaminathan's idea of combining traditional knowledge with biotechnology using certain qualities of plants like salt tolerance and cross-breed it with certain crops should improve the quality in the sense of being good for the health and not causing cancer or other diseases as a future goal.. Swaminathan also adopted Gandhi's idea of village-economy and called it the bio-village concept which is based on the principle of "pro-nature, pro poor and pro woman", orientation to technology development and dissemination. Its major components are the conservation and improvement of natural resources, particularly soil, health, water and biodiversity and amongst other aspects to improve the income of farmers, increase productivity on farms and add value to primary produces. But he also offers community banks specialised on credits for small farmers with low transaction costs and interest rates.

The bio-village concept introduces a new way of thinking. Even the IMF (International Monetary Fund) and the World Bank which have been pushing for globalization and free market have started talking about developing a human face of liberalisation. At the recently concluded UNCTAD (United Nations Conference on Trade and Development) meeting in Bangkok 2011 the need for putting a social pillar to globalisation was discussed.[107]

---

[107] See: Krishna, Kumar, (2000)

According to V. Shiva the industrialisation of agriculture was aimed at producing more and increasing our bodily comfort, yet a billion people on this globe are hungry today and more suffer from food related diseases. Hunger has become the biggest market force. Money is first being made through the creation of hunger and it is being made again through false solutions to hunger. Ironically it is those technologies and economic systems that are offered as solutions to hunger that actually create hunger in the form of the industrial agriculture sold as the Green Revolution.[108]

Bertrand Russell and Albert Einstein and colleagues stated the following in their Manifesto 1955: "We appeal, as human beings, to human beings: remember your humanity and forget the rest. If you can do so, the way is open to a new paradise, if you cannot, there lies before you the risk of universal death."[109]

[108] See: Shiva, (2011)

[109] Russell; Einstein, (1955)

11. Appendix

11.1 Zusammenfassung

Wie sich herausgestellt hat, war die Grüne Revolution langfristig betrachtet keine geeignete Methode Indien's Landwirtschaft nachhaltig zu verbessern und den Hunger der Bevölkerung zu bekämpfen. Denn die Grüne Revolution erwies sich als zu teuer, da sie viel Kunstdünger, Pestizide, viel Wasser und Treibstoff für die Maschinen verbraucht und zudem die Samen nicht reproduzierbar sind, sondern alle drei bis fünf Jahre erneuert werden müssen, was vielen Bauern besonders den Kleinbauern nicht klar war. Trotz Düngung und künstlicher Bewässerung wurden die Böden ausgelaugt, das Grundwasser verschmutzt bis vergiftet und der Grundwasserspiegel gesenkt. Dies hat auch wiederum Auswirkungen auf die Produktivität. Das Auslaugen der Böden hätte mit der alten landwirtschaftlichen Methode des Fruchtwechsels und der Düngung mit Mist und Kompostierung vermieden werden können und wäre außerdem fast kostenlos.

Die Grüne Revolution und die Landreform wären bei richtiger Anwendung geeignete Methoden die landwirtschaftliche Produktivität zu steigern, wobei letztere auch dem Aspekt der gerechten Verteilung gerecht werden sollte. Doch da die Landreform den einzelnen Staaten überlassen war, gestaltete sich das Ergebnis unterschiedlich, nur in wenigen Staaten wie Bengal profitierten die Landlosen bzw. die Kleinbauern und Pächter. Überwiegend wurden durch die Liberalisierung des Landmarktes Gesetze/Regelungen zugunsten des Landerwerbs von Besitzlosen wieder rückgängig gemacht. Die Anforderungen der Kommerzialisierung der Landwirtschaft stehen jenen der gerechten Landverteilung entgegen, da kleinere Landeinheiten zwar produktiver bewirtschaftet werden, aber für die kapitalintensive Grüne Revolution wahrscheinlich nicht genug Profit erbringen.

Es zieht sich wie ein roter Faden durch die Geschichte, seit der Herrschaft der Briten, dass die Bauern, Farmpächter anfangs durch zu hohe Steuern, dann durch zu hohe Zinsen der Geld-verleiher, später durch für die Kleinbauern beinahe unleistbare Technik der Grünen Revolution: die Kleinen werden in die Schuldenfalle gedrängt, um anschließend ihr Land, das ihren Lebensunterhalt darstellt, wieder zu verlieren. Heute wie zur Zeit der Kolonialisierung sind 40% der Landbevölkerung Landlose. Trotz der hohen landwirtschaftlichen Produktivität leiden noch Millionen Inder Hunger. Grund dafür ist das Auseinanderklaffen von Löhnen und Kaufkraft wie

die Untersuchung der Hungersnot in Bengal 1942/43 beweist.
Als einen Ausweg aus der Armutsfalle nennt Prof. Swaminathan das Konzept des Bio-village, das der Dorfgemeinschaft größere Bedeutung einräumt: Banken auf Dorfebene, die günstige Darlehen einräumen inklusive Beratung bei Projekten (wie das Züchten von Champignons), Vermarktung von Nebenprodukten aus der Landwirtschaft wie z.B. Papier aus Reisstroh und vor allem die Konservierung des genetisch wertvollen, pflanzlichen Erbes. Dieses Konzept beruht auf den Ideen Mahatma Gandhis: Dezentralisierung auf Dorfebene, weniger Kapital mehr Arbeit, die Reichen sorgen in Selbstverantwortung für die Armen; Genügsamkeit. In Zukunft sollte das Ziel der Landwirtschaft gemäß Swaminathan sein, gesunde, nahrhafte Lebensmittel zu erzeugen nach dem Motto: ein gesunder Boden bringt gesunde Nahrungsmittel hervor, die allen Menschen zugänglich sind und der Hunger der Vergangenheit angehört.

11.2 Lebenslauf

Persönliche Daten:

Name:	Dejust
Vorname:	Nira
Geburtsdatum:	10.02.1988
Wohnort:	1220 Wien, Wehrbrücklstraße 37/3/6
Telefon:	0650-8911230, 01-9535393
Email:	sarasd10@hotmail.com
Staatsbürgerschaft:	Österreich

Ausbildung:

2002-13.6.2006	Bilinguales Oberstufenrealgymnasium (VBS), 1230 Wien, Draschestraße mit gutem Erfolg und Matura abgeschlossen
seit WS 2006	Magisterstudium der Internationale Entwicklung an der Universität Wien, derzeit im 8 Semester und auch
seit WS 2007	Studium der Betriebswirtschaftslehre derzeit im 6 Semester
28.09.2008	Erfolgereicher Abschluss des 1. Studienabschnittes für Internationale Entwicklung
2009	Auslandssemester in Frankreich / Bordeaux an der Universität von Science Politique
2011-08-02	Diplomarbeit für Internationale Entwicklung mit dem Thema: „Sustaining India's agriculture under ther perspective of the „Green-Revolution" and its effects of it today". Betreuender Professor P.h.D Alejandro Cunat

---

EDV Kenntnisse:

MS Office (Word, Excel, Powerpoint), die Basis von HTML, JavaScript und SQL, sowie Macintosh Apple

---

Sprachkenntnisse:

Deutsch, Englisch und Französisch in Wort und Schrift

Cambridge certificate in advanced english

Spanisch (Basiskenntnisse)

Berufserfahrung:

01.06.2005 Bei der Firma Marionaund Parfumeries Autriche GmbH. Lamezanstraße 9, A-1230 Wien.

Tätigkeiten: Filialservice, Administration, Telefonmanagement

Praktikum bei der Volksbank International im Controling Bereich, im Sommer 01.08.2008 und 01.07.2009.

Meine Aufgaben bei der Volksbank waren:

Mitarbeit an Working Papers über die Finanzmarktentwicklung sowie makroökonomische Umgebung.

Analyse der Mitbewerber.

Mitarbeit an Strategiepapieren und Bankvergleichen.

Die Vorbereitung von Investmentsummaries von unterschiedlichen Banken.

Assistenz bei Behördenansuchen (Visumsanträge, Beglaubigungen, etc.)

Allgemeine Assistenz: (Flüge buchen, Hotels reservieren, usw.)

Erstellung von Protokollen.

Übersetzungen Deutsch/Englisch.

Allgemeine Unterstützung in allen Tätigkeiten.

Praktikum bei Coca-Cola Hellenic in der Finanzabteilung, im Sommer den 01.07.2010

Meine Aufgaben bei Coca-Cola Hellenic waren:

Die Bearbeitung von Reisespesenabrechnungen

Die Unterstützung bei der Abstimmung von unterschiedlichen Bilanzkonten.

Verschiedenste administrative Tätigkeiten

Sonstiges:

2005	Die Teilnahme an der „Model United Nations“ in Budapest (CARMUN)
2003-2009	Diverse Sprachkurse im Ausland, sowie Sprachreisen in Frankreich, USA, England.
09.02.2007	Führerschein B

11.3 Illustrations

Table 4 INDICATORS OF GROUNDWATER IRRIGATION DEVELOPMENT SINCE 1951

	Dugwells		Private Tubewells		Public Tubewells		Electric Pumpsets		Diesel Pumpsets	
	Thousands of Units (Cumulative)	Average Annual % change	Thousands of Units (Cumulative)	Average Annual % change	Thousands of Units (Cumulative)	Average Annual % change	Thousands of Units (Cumulative)	Average Annual % change	Thousands of Units (Cumulative)	Average Annual % change
1950/51	3,860	-	3	-	2	-	21	-	66	-
1960/61	4,540	(1.6)	22	(22.1)	9	(16.2)	200	(25.3)	230	(13.3)
1968/69	6,100	(3.8)	360	(41.8)	15	(6.6)	1,090	(23.6)	720	(15.3)
1973/74	6,700	(1.9)	1,140	(25.9)	22	(8.0)	2,430	(17.4)	1,750	(19.4)
1977/78	7,425	(2.6)	1,700	(10.5)	30	(8.1)	3,300	(8.0)	2,350	(7.7)
1979/80	7,780	(2.4)	2,110	(11.4)	36	(9.5)	3,950	(9.4)	2,650	(6.2)
1984/85 (target)	8,980	(2.8)	3,310	(9.4)	51	(7.2)	6,460	(10.3)	3,550	(6.0)

Note: The electric and diesel pumpsets are used on various types of wells, so that the total number of wells is the sum of dugwells and tubewells both public and private. The total number of power pumped wells is the sum of diesel and electric pumpsets. Pumpsets are also used for surface lifts (i.e. where no wells exist).

Source: Report of the Working Group on Minor Irrigation for the Sixth Five Year Plan 1980-85; Sixth Five Year Plan 1980-85.

Table 9: ANTICIPATED AND ACTUAL RATES OF RETURN TO PRIVATE GROUNDWATER INVESTMENT

Shallow Tubewell with Pumpset	Anticipated Returns to the Economy	Anticipated Returns to the Farmer	Actual Returns to the Economy	Actual Returns to the Farmer
Bihar	50+	48	n.a.	43
Gujarat	23	30	20	30
Haryana	22-27	39-66	50+	16-129
Uttar Pradesh	16-41	17-44	50+	22-33
Dugwell with Pumpset				
Andhra Pradesh	27-30	18-26	37-50+	16-50+
Gujarat	23	26	15	12
Karnataka	12	19	26	21
Madhya Pradesh	17	35	41	37
Maharashtra	23-50	23-40	18-50+	11-50
Tamil Nadu	19-20	28-29	26	16

Source: World Bank.

Table 11: WATER USE EFFICIENCY AND SIZE OF OUTLETS

	Overall Project Efficiency /a			Average Cost per Irrigated hectare
	Bhima %	Krishna %	Kukodi %	Rs/Ha
Outlets Serving 40 ha Main & Branch Canals Lined	37	35	35	15,000
Outlets Serving 40 ha Lined to Outlets	44	43	44	13,100
Outlets Serving 8 ha Lined to Outlets	52	50	51	12,000

/a Percentage of water diverted from source reaching plants.

Source: World Bank estimates.

Table 12: OPERATING ACCOUNT OF THE GOVERNMENT IRRIGATION SYSTEM 1976/77-1978/79
(Current Rs million)

	Operating Costs of the Irrigation System	Irrigation Charges	Operating Deficit	Revenues as a % of Expenses
1976/77	2,946.5	1,329.6	1,616.9	45.1
1977/78	3,521.0	1,304.9	2,216.1	37.1
1978/79	4,015.0	1,373.7	2,641.3	34.2

Source: CSO, National Accounts Statistics, 1970/71-1978/79, February 1981

Table 13: GROUNDWATER DEVELOPMENT AND RURAL ELECTRIFICATION, 1979/80

States	Level of Groundwater Development (% of potential)	Villages Electrified (%)	Pumpset Connections (Thousands of Units)
North-west			
Punjab	82	100	262
Haryana	80	100	203
North-east			
Bihar	35	31	152
Orissa	19	38	13
West Bengal	19	36	24

Sources: 1. Report of the Working Group on Minor Irrigation for the Sixth Five Year Plan, 1980-85.
2. Rural Electrification Corporation.

12. Bibliography

Abbie, Leslie; Harrison, Q., James; Wall, W., John (1985) *Economic Return to Investment in Irrigation in India*. World Bank Staff Working Papers No. 536

Badhuri, (1973) *A Study in Agricultural Backwardedness Under Semi-feudalism*. published in: Economic Journal, March 1973.

Banerjee, Abhijit (1999) *Land Reforms: Prospects and Strategies*. Massachusetts Institute of Technology – Department of Economics; Working Paper 99-24 Oct.1999; Room E52-251; 50 Memorial Drive - Cambridge, MA 02142

Barsamian, David (2002) *Monocultures of the Mind. An interview with Vandana Shiva*. In: Z magazine http://www.thirdworldtraveler.com/Vandana_Shiva/Monocultures_Mind.html [Accessed: 05.04.2011]

Bedekar,V.V. (2009) *Agriculture in Ancient Bharat*. http://www.Krishidesh.wordpress.com/2009/11/21/history-of-agriculture-in-bharat/ [Accessed: 15.04.2011]

Besley, Timothy; Burgess, Robin (1998) *Land Reform, Poverty Reduction and Growth: Evidence from India*. London School of Economics; Houghton Street: London WC2A 2AE.

Binswanger, H, Deininger, K. and Feder, G. (1995) *Power, Distortions, Revolt and Reform in Agricultural Land Relations.* In: "Handbook of Development Economics" Vol.III, Elsevier: New York

Bombay museum: http://www.bombaymuseum.org/ahimsa/sec5/swadeshi.html [Accessed: 28.09.2010]

Chatterjee, Patralekha (2002) *D+C Development and Cooperation*. Deutsche Stiftung für Internationale Entwicklung http://www.inwent.org/E+Z/zeitschr/de202-8.htm [Accessed: 15.04.2011]

Chaturvedi, Sachin (2005/6) *Dynamics of Biotechnology Research and Industry in India; Statistics, perspectives and Key Policy Issues*. Science Technology and Industry WORKING PAPER Statistical Analysis of Science Technology and Industry DSTI/DOC.

Census of India: http://www.indiaonlinepages.com/population/census-2011/ [Accessed: 15.03.2011]

CIA-World Fact Book: https://www.cia.gov./library/publcations/the-world-factbook/geos/in.html [Accessed: 15.04.2011]

Cleaver, M., Harry (1972) The Contradictions of the Green Revolution. In: The American Economic Review, Vol. 62, No. ½, P. 177-186

Clingingsmith, David; Williamson, Jeffery, G. (2004) *India's De-Industrialisation Under British Rule: New Ideas, New Evidence*. Harvard Institute of Economic Research - Discussion Paper No. 2039. Harvard

Dasgupta, Ajit K. (1996) *Gandhi's Economic Thought*. Routledge: New York ISBN 0-415-11430-6

Devereux, Stephen (2004) *Sen's Entitlement approach: critiques and countercritiques.* Oxford Development Studies, Vol. 29, Nr.3.

Duden (2003) *Schülerlexikon*; Bibliographisches Institut & F.A. Brockhaus AG: Mannheim

Encylopedia Britannica: www.britannica.com [Access: 15.04.2011]

European Commission (2007) *India's Role in World Agriculture*. In: Monitoring Agri-trade Policy. Diretorate General for Agriculture and Rural Development. No. 03-07

Gadgil, Madhav; Guha, Ramachandra (1992) This *Fissured Land: An Ecological History of India.* Oxford University Press: Oxford. pp113-140.

Gandhi, Mohandas (12.03.1925): *The Young India* - Magazine

Gandhi, M.K. (without a year) *Selection from Gandhi: Complete book online*; paragraph 555f http://www.mkgandhi.org/sfgbook/fifteenth.htm [Accessed: 15.04.2011]

Ganguly, Saby (without a year) *From the Bengal famine to the Green Revolution* http://www.indiaonestop.com/Greenrevolution.htm [Accessed: 14.02.2011]

Ghatak, Maitreesh; Roy, S. (2007) *Land reform and agricultural productivity in India: a review of the evidence*. Oxford Review of Economic Policy: Oxford, Vol. 23, pp.251-269

Indiaonline (with out a year), *Five Year Plans in India.* In:

http://indiaonline.in/Profile/Economy/PlanningCommission/Five-Year-Plans.aspx[Accessed: 19.06.2011]

International Rice Research Institute: http://irri.org/ [Accessed: 25.02.2011]

Janaiah, Aldas; Achoth, Lalith; Bantilan, Cynthia (2005): *Has the Green Revolution Bypassed Coarse Cereals? The Indian Experience*. Electronic Journal of Agricultural and Development Economics: Mumbai, Vol. 2, No 1

Kavanagh, Patrick (without a year) *From Green to Evergreen: Updating the Food Revolution.* http://publicwebsite.idrc.ca/EN/Resources/Publications/Pages/ArticleDetails.aspx?PublicationID=661 [Accessed: 25.02.2011]

Kohle, Singhal, Deepali; Singh, Nirvikar (1997) *The Green Revolution in Punjab*, India: The Economics of Technological Change.

Krishna, Kumar, Asha (2000) *India's National Magazine.* Vol. 17, Issue 5 http://www.hinduonnet.com/fline/fl1705/17051170.htm [Accessed: 25.05.2011]

Mearns, Robin (1999) Access *to Land in Rural India: Policy Issues and Options*. World Bank Policy Research Working Paper 2123

Nagarajan, S. (2004/3) *Sustaining The Green Revolution in India: A Success Story of Wheat.* Indian Agriculture Research Institute Pusa Campus: New Delhi.

Narain, Pratap; Rao, A.S.; Abrole, I.P.(without a year) *Managing Droughts and Desertification in India-Lessons from the Past and Future Strategy.*

National Portal of India (2010) *Climate- Profile- Know India* http://india.gov.in/knowindia/climate.php [Access: 13.03.2011]

Navdanya International (2011) *Navdanya International Spearheads Monsanto Lawsuit by admin* www.vandanashiva.org/?p=630 [Accessed: 13.04.2011]

Olsen W.K., Murthy. R. (2000) *Contract Labour and Bondage*. In: Journal of Social and Political Thought.

Polaski, Sandra; Panda, Manjo; Ganse-Kumar, A.; McDonald, Scott; Robinson, Sherman (2008) *Policy Dilemmas in India: The Impact of Changes in Agricultural Prices on Rural and Urban Poverty*. Draft 4-15-08

Rosenzweig, M.R.; Binswanger, H.P (1993) *Wealth, Weather Risk and the Composition and Profitability of Agricultural Investments.* In: Economic Journal 103:56-78

Russell, Bertrand; Einstein, Albert (09.07.1955) *The Russell-Einstein Manifesto* http://www.pugwash.org/about/manifesto.htm [Accessed: 03.08.2011]

Sayeed, A.; Treasure House of India's Culture and Heritage: in Encyclopedia: www.culturopedia.com/culture_intro.html [Accessed: 19.04.2011]

Sen, Amartya; Drèze, Jean (1999) *Omnibus: Poverty and Famines, Hunger and Public Action, India: Economic Development and Social Opportunity.* Oxford University Press: Third impression.

Sen, Amartya (1962) *An Aspect of Indian Agriculture*; In: Economic Weekly Vol.14

Sen, Amartya (1982a) *Poverty and famines: An Essay on Entitlements and Deprivation*. Clarendon Press: Oxford.

Sethi, Manpreet (2003) *Land Reform in India: Issues and Challenges.* www.foodfirst.org/files/bookstore/pdf/promised**land**/4.pdf [Accessed: 17.03.2011]

Shiva, Vandana (2000) *The Violence of the Green Revolution. Third World Agriculture, Ecology and Politics.* 4 print. Zed Books Ltd. Third World Network: London and New York

Shiva, Vandana (2001) *World Bank, WTO, and corporate control over water*. In: International Socialist Review. http://www.thirdworldtraveler.com/Water/Corp_Control_Water_VShiva.html [Accessed: 05.04.2011]

Shutterstock www.shutterstock.de [Accessed: 30.06.2011]

Swaminathan, Monkumbu Sambasivan (2010) *Evergreen Revolution and Sustainable Food Security* http://www.nabc.cals.cornell.edu/pubs/nabc_16/talks/Swaminathan.pdf [Accessed: 12.06.2011]

Swaminathan, Monkumbu Sambasivan (2009) *An Evergreen Revolution*. SGI Quarterly

http://www.sgiquarterly.org/feature2009Jly-6-html [Accessed: 12.06.2011]

Swaminathan, Monkumbu, Sambasivan (2001): *Now for the evergreen revolution: Prof. M.S. Swaminathan, a pioneer of India's green revolution, calls for a new approach to world farming* http://findarticles.com/p/articles/mi_mOKZH/is_4_14/ai_30123599/ [Accessed: 12.06.2011]

Swaminathan, Monkombu Sambasivan: M.S. Swaminathan's Research Foundation (July 2007): *Video, audio clips of M.S. Swaminathan's presentation at IDRC: M.S. explains the Evergreen Revolution and Bio-villages concept.*

Shiva, Vandana (2011) *Swaraj: A Deeper Freedom* http://www.vandanashiva.org/?p=611 [Accessed: 25.05.2011]

The National Seeds Corporation of India: http://www.indiaseeds.com/ [Accessed: 25.02.2011]

Thomas, Susan (2003) *Agricultural commodity markets in India: Policy issues for growth.* Indira Gandhi Institute for Development Research (IGIDR), Bombay: India.

Vepa, S., Swarna (project coordinator); Varma, Deepa; Mathew, Minnie (to name a few), (2004), *Atlas of the Sustainability of Food Security in India*. M.S. Swaminathan Research Foundation and World Food Programme, Nagaraj and Company Private Ltd.: Chennai

WordIQ: http://www.wordiq.com/definition/Green_revolution [Accessed: 14.02.2011]