Assigned by Ministry of Agriculture, Forestry and Fisheries

Survey on Agricultural and Rural Development based on Population Issues

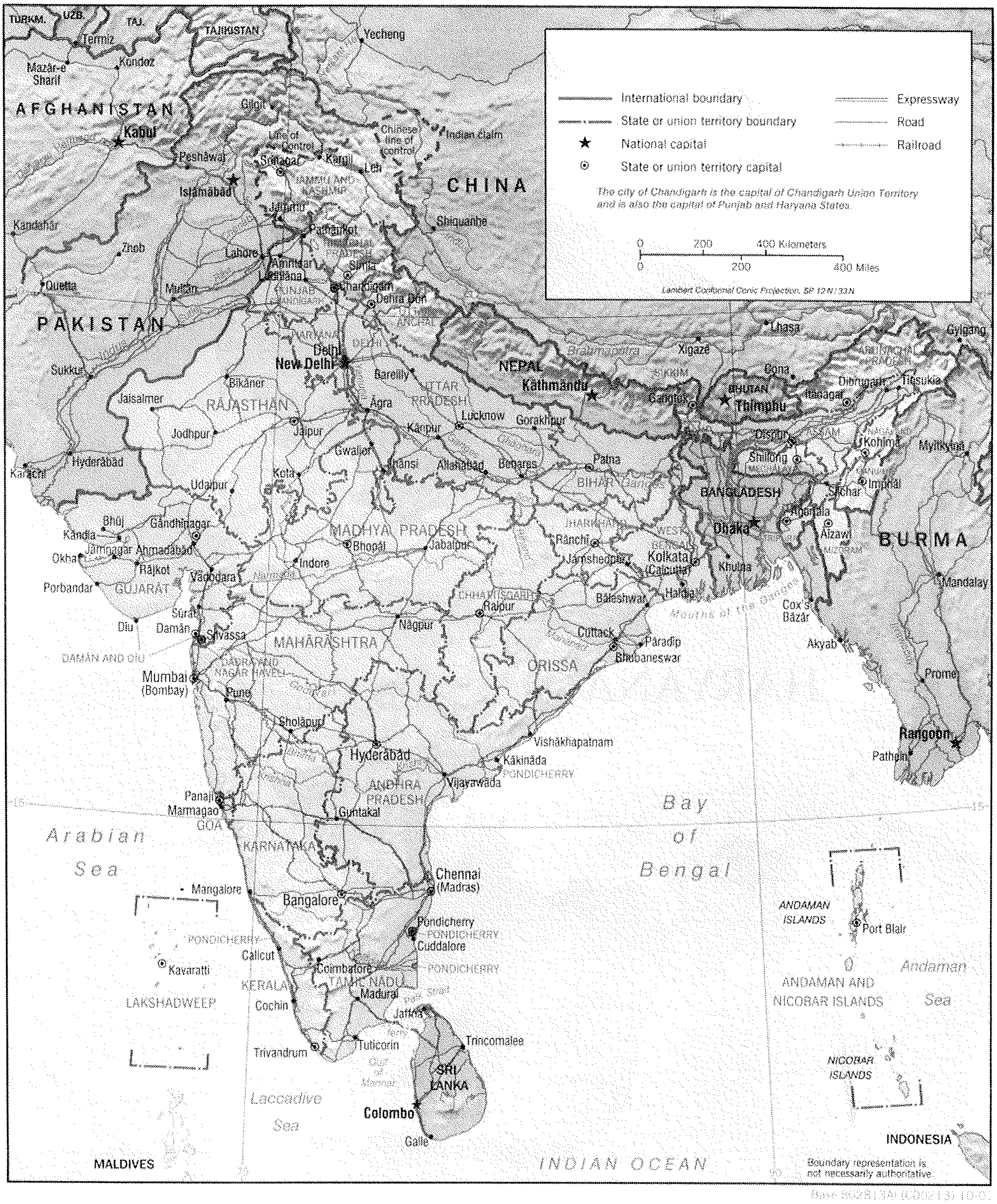
— India —

Focus on
Punjab and Haryana States

March 2005

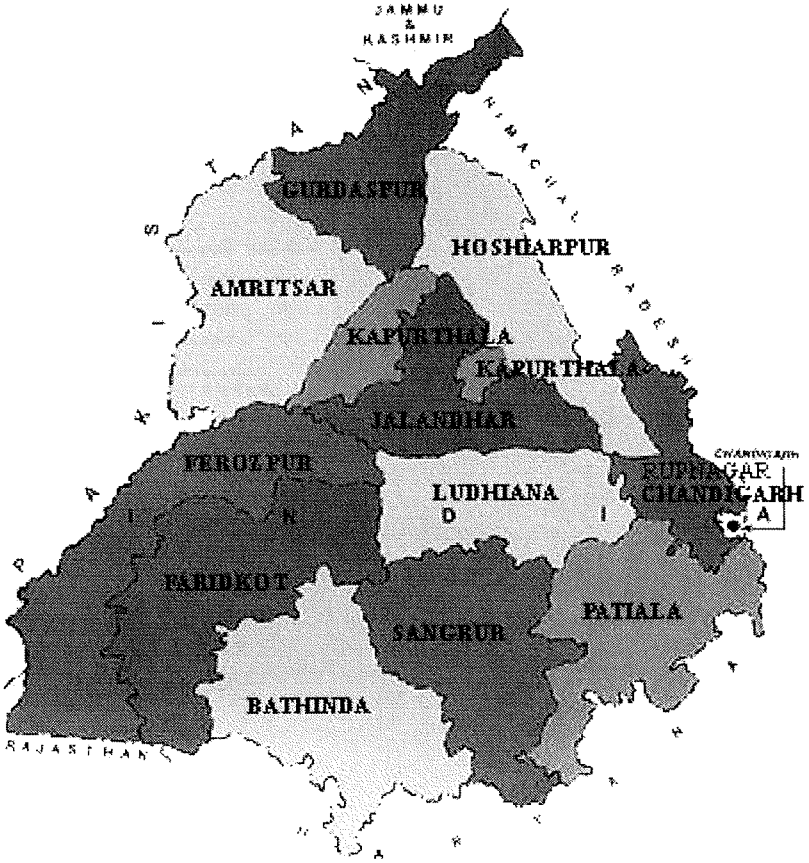
The Asian Population and Development Association
(APDA)

India

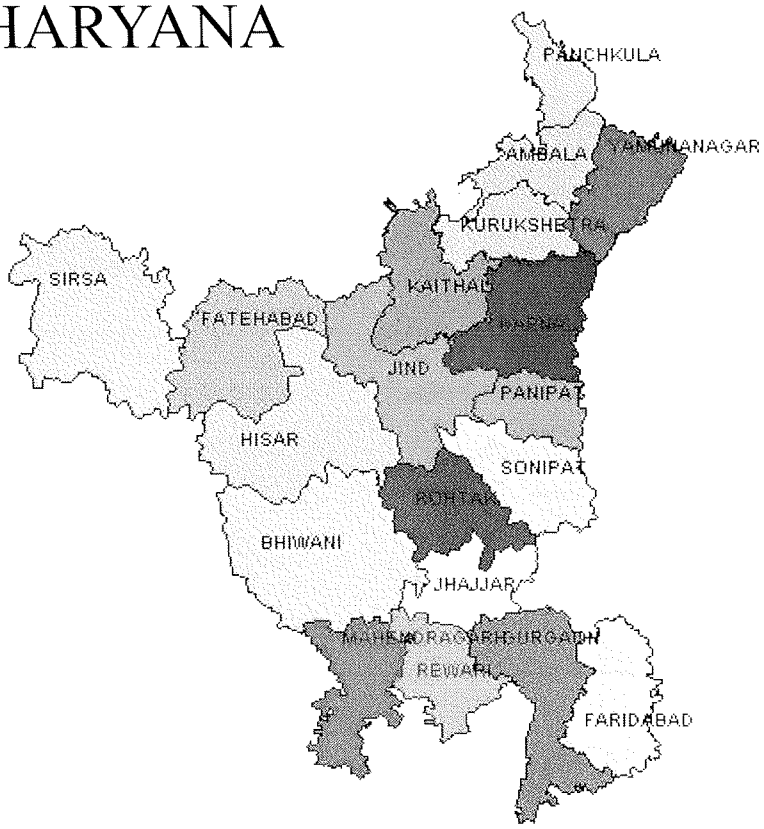


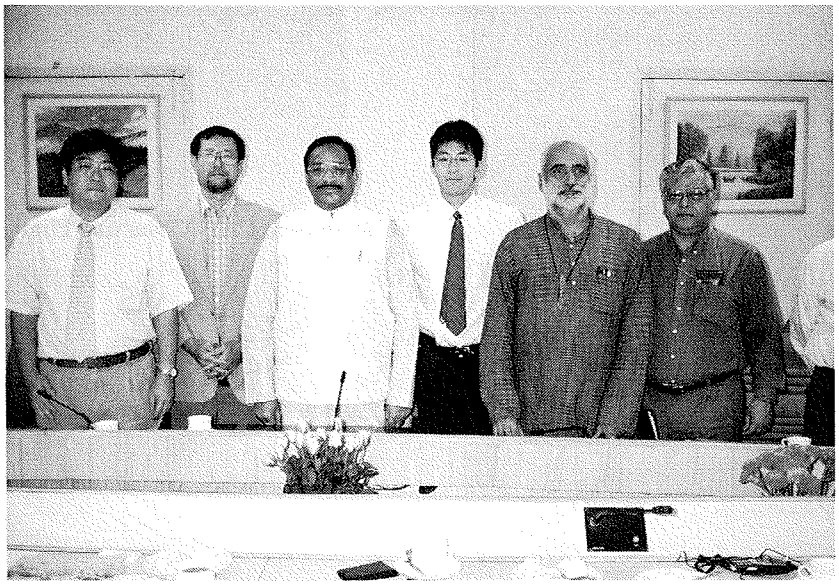
International boundary
State or union territory boundary
National capital
State or union territory capital
Expressway
Road
Railroad
The city of Chandigarh is the capital of Chandigarh Union Territory and is also the capital of Punjab and Haryana States.
0 200 400 Kilometers
0 200 400 Miles
Lambert Conformal Conic Projection, SP 12 N/33 N
AFGHANISTAN
PAKISTAN
CHINA
NEPAL
BHUTAN
BANGLADESH
BURMA
SRI LANKA
MALDIVES
INDONESIA
Arabian Sea
Bay of Bengal
Laccadive Sea
Andaman Sea
INDIAN OCEAN
New Delhi
Kābul
Islāmābād
Kāthmāndu
Thimphu
Dhaka
Rangoon
Colombo
Mumbai (Bombay)
Kolkata (Calcutta)
Chennai (Madras)
Hyderābād
Bangalore
RAJASTHAN
GUJARAT
MAHĀRĀSHTRA
MADHYA PRADESH
UTTAR PRADESH
BIHAR
ORISSA
ANDHRA PRADESH
KARNATAKA
KERALA
TAMIL NADU
LAKSHADWEEP
ANDAMAN AND NICOBAR ISLANDS
Boundary representation is not necessarily authoritative.

PUNJAB



HARYANA





Minstry of Agriculture, India

From Left

Mr. Osamu Kusumoto Team Member

Dr. Akihiko Ohno Team Member

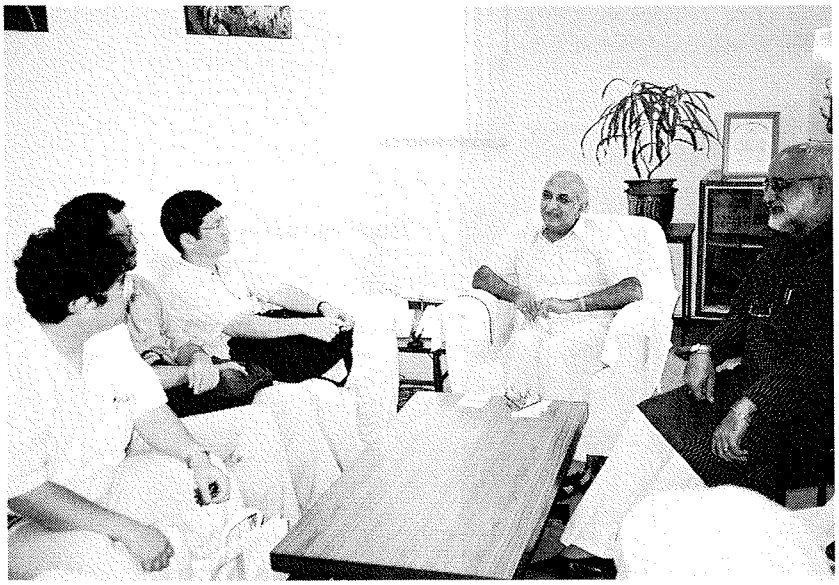
Mr. Kanti Lal Bhuria

Minister of State for Agriculture

Mr. Masanori Takemoto Team Member

Manmohan Sharma

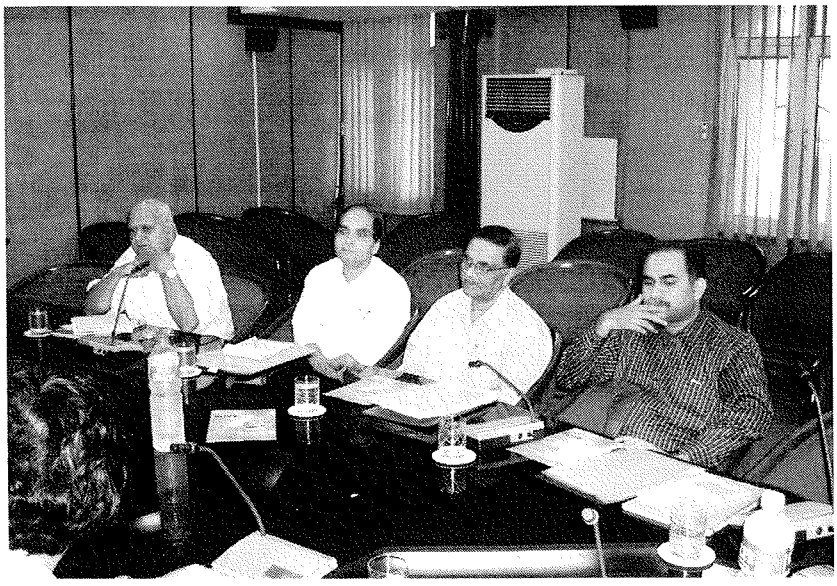
IAPPD Executive Secretary



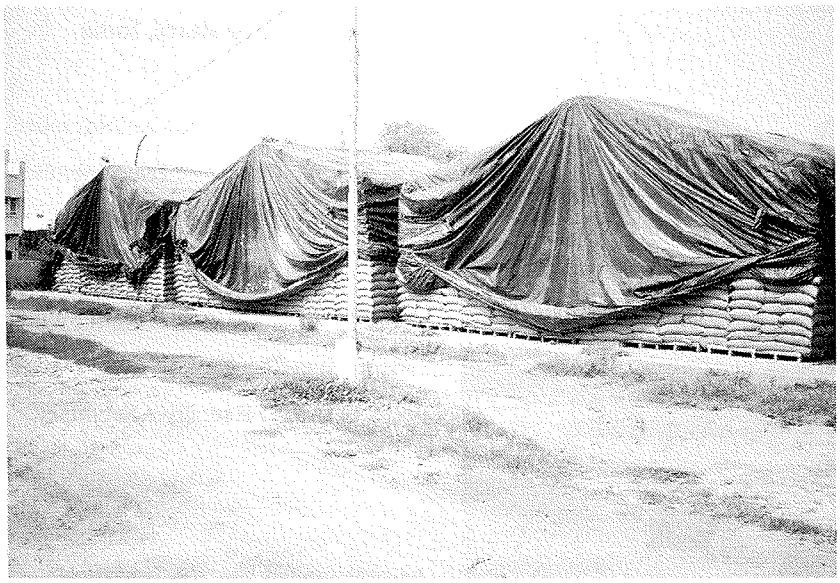
CCS Haryana Agricultural University

Third from Left

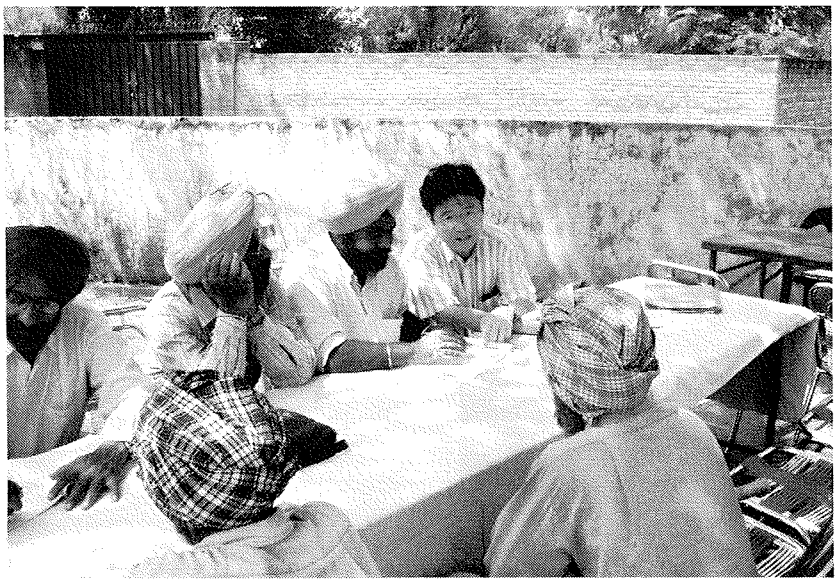
Dr. Seiichi Fukui Team Leader



Food Corporation of India（FCI）



Foodgrains at CAP (Cover and Plinth) Storage



Hearing survey at Punjab State

Questionnaire survey

Hearing survey at Haryana State

Women interviewers join our questionnaire survey

Foreword

This report presents the results of the "Survey on Agricultural and Rural Development based on Population Issues", a project implemented in India by the Asian Population and Development Association (APDA) under the consignment from Ministry of Agriculture, Forestry and Fisheries in 2004. The survey and compilation of the results were mainly carried out by the members of the APDA Survey Committee (Chairperson: Dr. Shigeto Kawano, Professor Emeritus, the University of Tokyo).

This survey was conducted under the concept that "Japan's cooperation in the field of agriculture, forestry and fisheries positions contribution to stability of global food supply and demand as its important measure whose further promotion is expected. Meanwhile, in implementing international cooperation, strong demand for efficient and effective implementation and transparency exists for ODA in view of the country's difficult economic and financial condition in the recent years. For this purpose, a study of subjects such as problems related to assistance in the major target countries of this survey, grasping of assistance needs, agricultural and rural development and the relationship between assistance and agricultural produce trade is indispensable. The study therefore must be performed from the viewpoint of changes in agricultural/rural population and employment structure in the developing countries."

The field survey in India was conducted with the guidance and cooperation of Mr. Kanti Lal Bhuria, Minister of State for Agriculture, Government of Inida and Mr. Tomofumi Inoue, First Secretary, The Embassy of Japan, and other cooperators. Guidance regarding the content of the survey and assistance for the arrangement of field survey were offered by Manmohan Sharma, Executive Secretary, the Indian Association of Parliamentarians on Population and Development (IAPPD) had made all the arrangements for the field survey in India. I would like to take this opportunity to extend my deepest gratitude for their support.

I sincerely hope that this report will contribute to the advancement of the rural community and agricultural development programme in the India and support effective assistance by the Japanese Government in this country.

Lastly, I would like to note that this report has been complied under the sole responsibility of APDA and dose not necessary reflect the view or policies of the Ministry of Agriculture, Forestry and Fisheries, or the Japanese Government.

March 2005

Dr. Taro Nakayama,
Chairman,
The Asian Population and Development Association

Contents

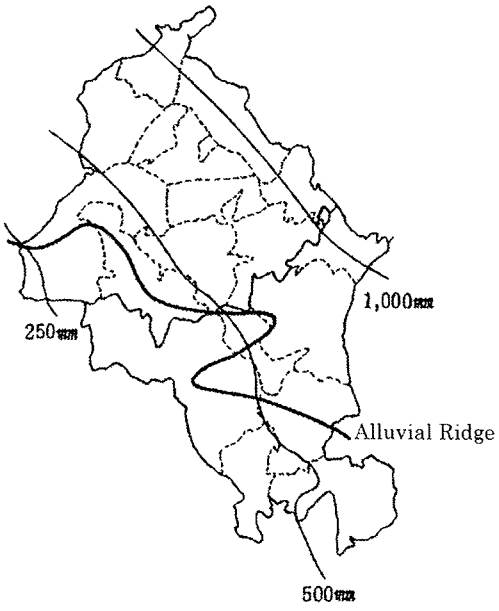
Chapter I Agriculture in Punjab and Haryana

This chapter describes the agricultural situations of north-western India that forms the granary of the country.

1. Agricultural environments in north-western India and Green Revolution

Figure 1 shows annual precipitation and the sub-alluvial ridge in north-western India. There is an impervious ridge called Delhi-Shahpur sub-alluvial ridge that runs across north-western India. Groundwater level is as shallow as 7 to 8 metres in the northern side of this ridge. Meanwhile, groundwater not only becomes deeper in level to 15 to 20 metres but turns saline on the southern side of the ridge. Consequently, tubewells which is essential for introduction of HYV (high yield variety) rice, have mainly introduced in the north for this reason.

Figure 1 Annual Precipitation and the Alluvial Ridge in North-western India



Source: Annual Precipitation: Gurdey Sigh Gosal and B. S. Ojha, *Agricultural Land-use in Punjab - A Special analysis-*, The Indian Institute of Public Administration, New Delhi, 1967.
Alluvial Ridge: see H. L. Uppal, "Rise of Watertable in Arid of Tracks of Punjab and Haryana its Potential - A Key to Desert Reclamation," *The Annual Journal*, Vol. 12, The Institute of Engineers (India), May 1973.

Annual precipitation reaches 1,000mm in northern Punjab near the state border with Himachal Pradesh but decreases as you move in south-western direction. The 500mm line runs almost parallel to the ridge with a semi-arid zone lying behind it. Soil changes to sandy loam and water-retaining capacity is reduced in these areas. Irrigation canals are also better equipped in the northern side of the ridge. Canal network is also built in the south but does not enjoy sufficient water supply in reality. It should be noted that irrigation canals are rarely used directoy for irrigation. More importantly, groundwater level has risen over the past several centuries as water permeated into the ground as a result of development of canal network that was constructed during the era of British India. It facilitated tubewell irrigation and led to development of rice crop for which water management plays an important role. As will be mentioned later, however, lowering of groundwater level caused by excessive water use due to numerous tubewells has caused critical problems as we will see later.

Table 1 Changes in percentage of wheat and rice cultivation

	Wheat	Rice	Maize*	Grams	Cotton	Sugar cane	Others	Total
Punjab								
1960/1961	29.5	4.8	2.7	17.7	9.4	2.8	33.1	100.0
2000/2001	43.2	32.9	0.1	0.7	7.5	1.4	14.2	100.0
Haryana								
1966/1967	16.2	4.2	25.3	23.1	6.2	3.3	21.7	100.0
2000/01	35.2	17.2	11.6	2.0	11.4	2.3	20.3	100.0

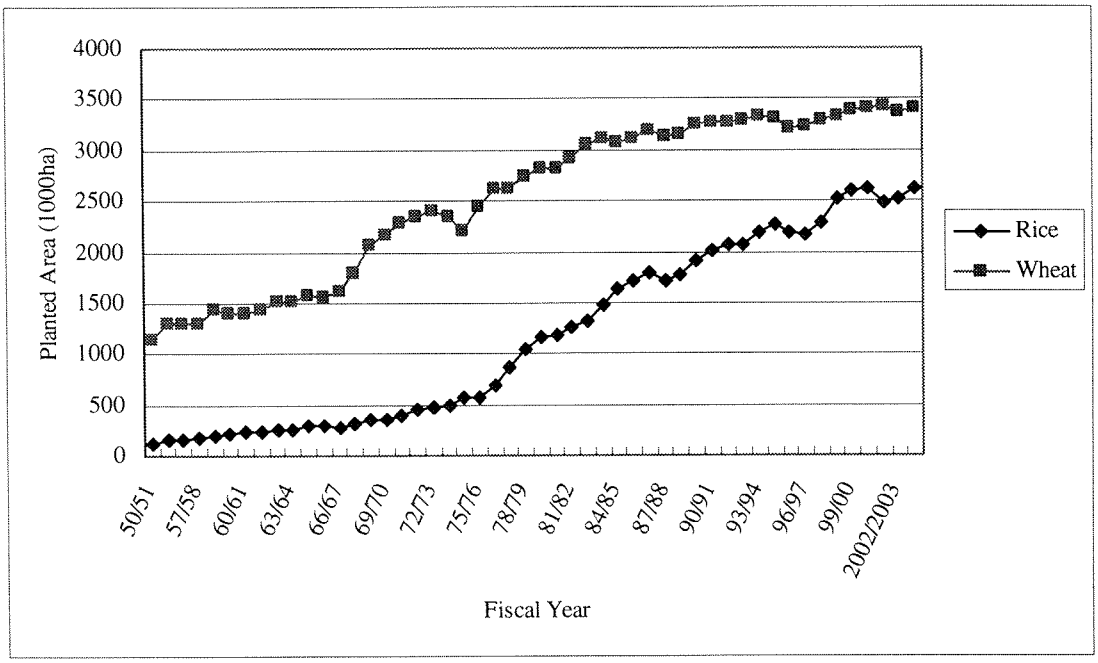
* Includes barja in addition to jowar. Used for human consumption in the past but is not used as feed.
Source: Government of Punjab, *Statistical Abstract of Punjab, 2003/04*, Government of Haryana, Statistical Abstract of Haryana, 2003/04.

The northern side of the ridge provides superior conditions for agriculture in terms of both coverage and quality of irrigation. The region had traditionally relied on wheat which is winter crop (*rabi*). However, rice was introduced as rainy season crop (*kharif*) by the Green Revolution in the 70s and formed a wheat/rice double cropping belt. In contrast, a HYV wheat/millet zone having wheat as main crop and growing mostly millets in the rainy season (growing cotton as cash crop in some areas) was formed in southern region of the ridge where irrigation cannot be fully provided for physical reasons.

Green Revolution, which was realized through a trinity consisting of HYV, irrigation and chemical fertilizers, is also more developed in the northern part of the ridge. The region had nearly completed converting its wheat to HYV in the mid-1970s and converted its rice to HYV that requires more intensive water management in the first half of the 1980s. Cropping ratio of wheat and rice also increased during the process of conversion to HYV. Table 1 takes a look at cropping patterns both states before and after Green Revolution. It shows that monoculture of wheat (winter crop) and rice (rainy season crop) has been formed particularly in Punjab. In Haryana, the degree of

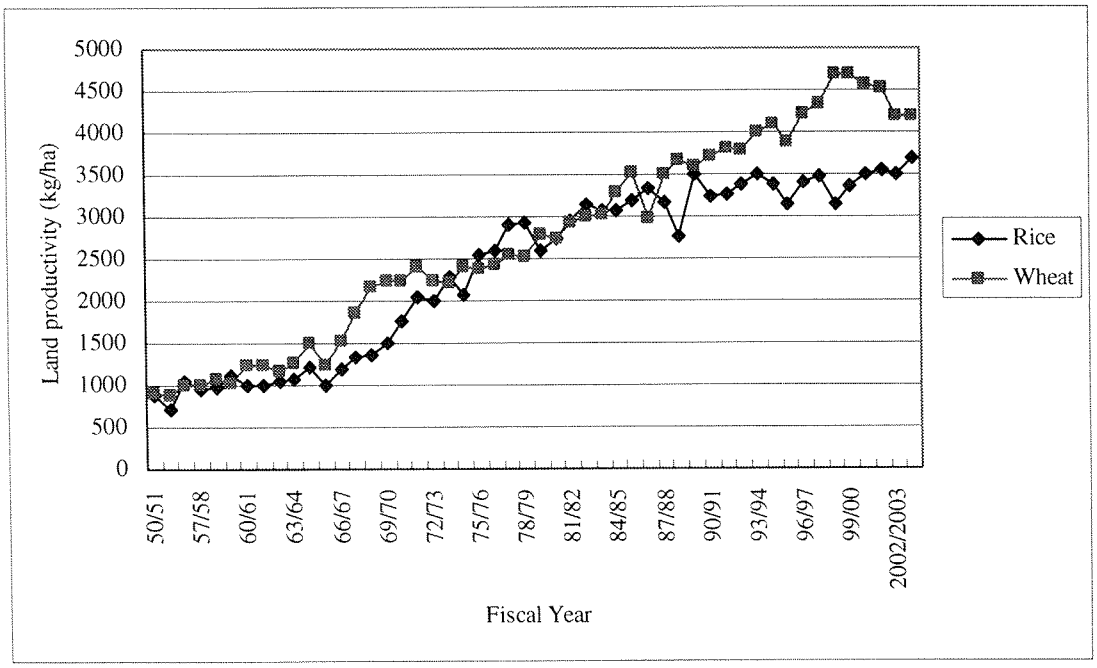
wheat/rice monoculture is smaller, although monoculture similar to Punjab is advancing in the northern part of the ridge. Incidentally, wheat and rice are aggravating the after-mentioned water problem as they tend to use more water compared to other crops and require 6 to 7 and 24 water supplies, respectively.

Figure 2 Changes in planted area of wheat and rice in Punjab State (1000ha)



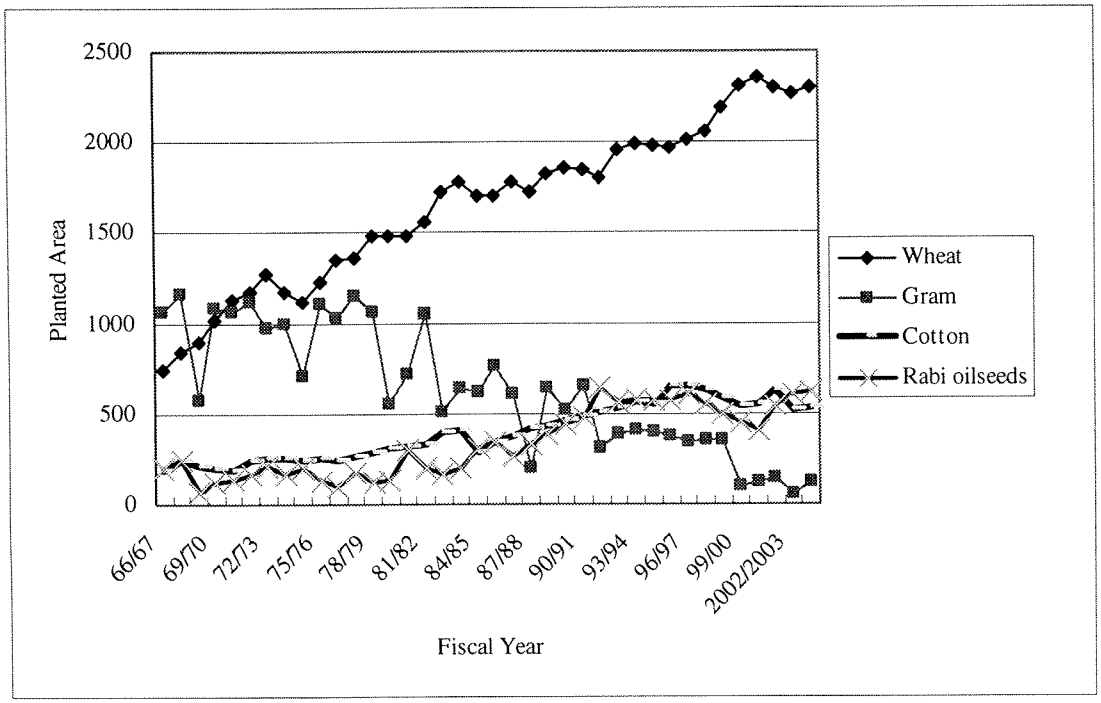
Source: Government of Punjab, *Statistical Abstract of Punjab*, Various Issues.

Figure 3 Changes in land productivity of wheat and rice in Punjab (kg/ha)



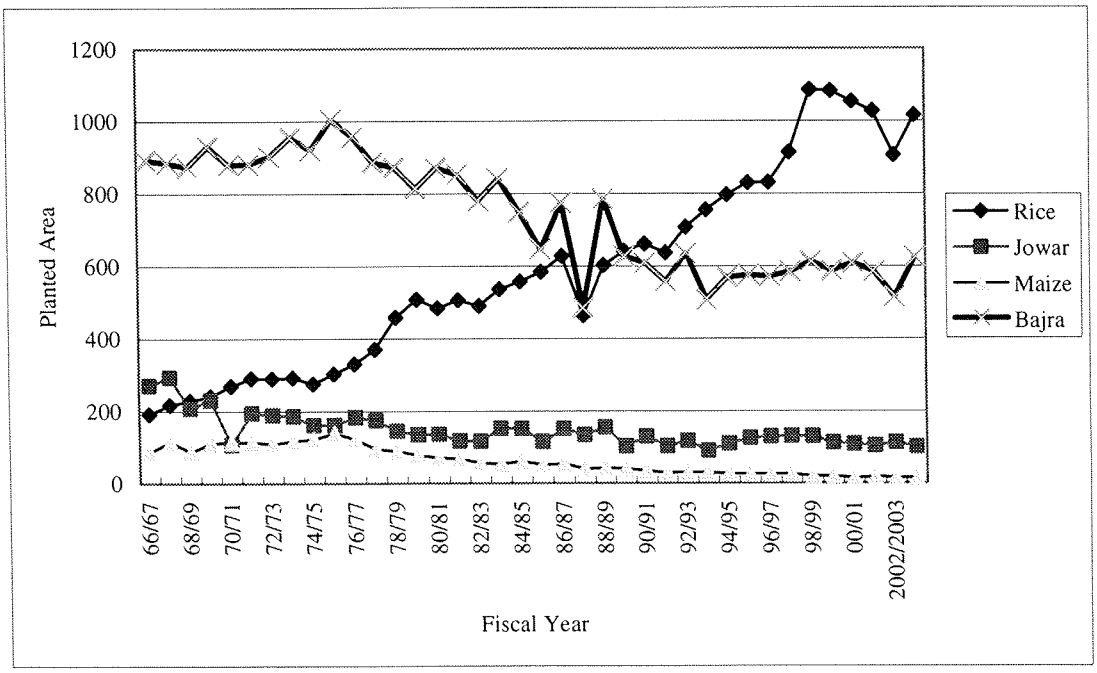
Source: Same as Figure 2.

Figure 4 (A) Changes in sown area in Haryana (winter crop)



Figures 2 through 5 show changes in sown area and land productivity in Punjab and Haryana. One can see that sown area of wheat and rice has rapidly increased after the advent of the Green Revolution, resulting in emergence of wheat/rice monoculture.

Figure 4 (B) Changes in sown area in Haryana State (rainy season crop)



Source: Government of Haryana, *Statistical Abstract of Haryana*, Various Issues.

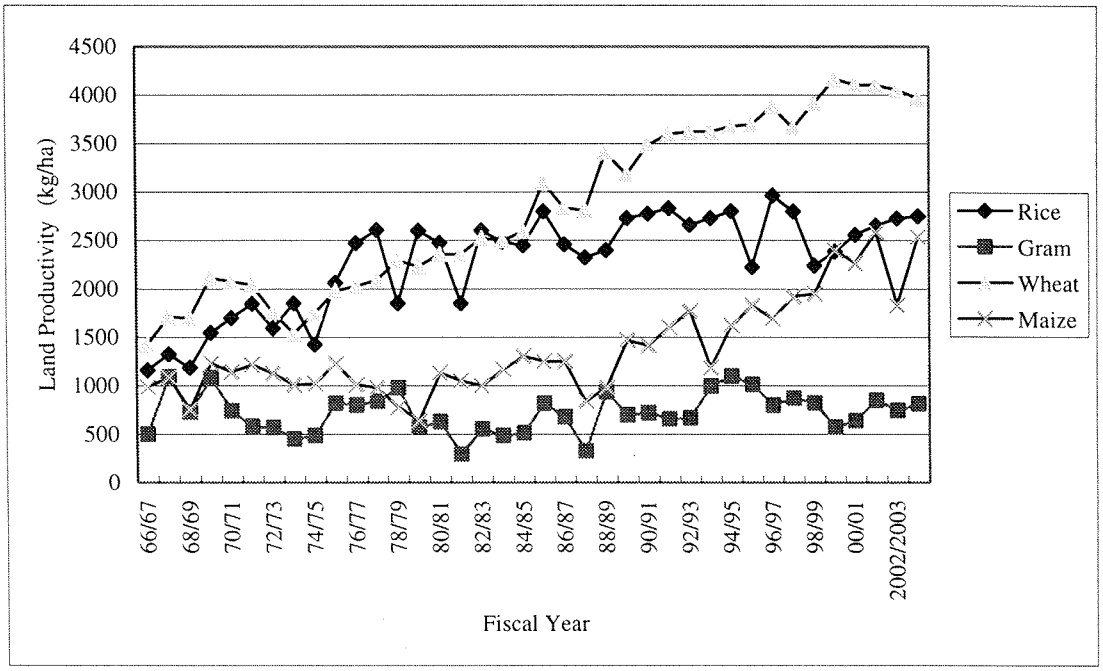
Table 2 Percentage of HYV in Haryana State

	Rice	Wheat
1970/71	11.1	55.8
1975/76	55.7	88.7
1980/81	85.6	92.0
1985/86	84.7	94.8
1990/91	72.4	98.9
1995/96	60.0	94.5
1999/00	57.2	97.6
2001/02	62.3	97.5

Source: Government of Haryana, *Statistical Abstract of Haryana*, Various Issues

Such monoculturalization was promoted by increased land productivity through introduction of HYV and agricultural subsidies including minimum price supporting poliy. Such monoculturalization was attained by replacing the existing millets (such as maize and pearl millet) with wheat and rice. Another element that accelerated this trend was the fact that fodder crops were no longer planted after cattle for cultivation were ousted from the field following the diffusion of tractors. As can be seen from the figure, however, an increase of sown area and land productivity has reached plateau in the last 10 years with the drop being particularly conspicuous in land productivity. One of the reasons for this is the advancement of crop conversion to traditional rice variety (basmati) which has low productivity but sold at high prices in the market following the decline in profitability of HYV rice (Table 2).

Figure 5 Changes in land productivity of main crops in Haryana State



Source: Same as Figure 4.

Table 3 shows the cost and revenue per unit area of main crops in Haryana. Profitability of HYV rice and wheat is still high compared to gram, although profitability of basmati rice is even higher. Considering the fact that basmati rice has an international competitive edge and that any rice with surplus would be HYV rice (price supporting policy applies to HYV and not to basmati), conversion from HYV to basmati in Haryana is a desirable phenomenon. Attention must also be given to the fact that traditional rice uses less water compared to HYV.

A similar effect can be expected from conversion to gram by replacing wheat. There is a need for policy intervention to reverse the profitability as wheat is currently more profitable, although it goes without saying that this is not an easy option.

Table 3 Cost and revenue per hectare of rice (HYV vs. basmati) and wheat

Paddy (HYV)

	Gross revenue	Total cost	Net profit	Land productivity	Producer's price
1990/91	6,204	5,166	1,038	2,176	285
1995/96	7,973	7,732	241	1,827	425
1999/00	10,975	10,791	184	2,190	490
2000/01	11,869	11,183	686	2,360	469
2001/02	13,842	11,337	2,505	2,550	535
2002/03	14,289	12,362	1,927	2,460	570

Paddy (Basmati)

	Gross revenue	Total cost	Net profit	Land productivity	Producer's price
1990/91	9,059	5,176	3,882	794	1,140
1995/96	9,228	7,191	2,037	820	1,125
1999/00	11,029	9,702	1,327	890	1,012
2000/01	11,247	10,582	665	920	1,191
2001/02	9,745	9,421	324	830	1,200
2002/03	16,563	11,254	5,309	1,070	1,529

Wheat

	Gross revenue	Total cost	Net profit	Land productivity	Producer's price
1990/91	4,397	3,853	544	1,488	296
1995/96	7,319	6,678	641	1,620	383
1999/00	11,928	9,418	2,510	1,770	584
2000/01	11,955	10,373	1,582	1,730	610
2001/02	10,531	9,673	858	1,616	620
2002/03	11,704	10,559	1,145	1,518	630

Gram

	Gross revenue	Total cost	Net profit	Land productivity	Producer's price
1990/91	2,542	1,522	1,020	374	679
1995/96	3,313	2,488	825	340	896
1999/00	3,209	5,392	-2,183	246	1,318
2000/01	6,203	5,717	486	350	1,676
2001/02	6,203	5,755	448	350	1,499
2002/03	7,130	5,840	1,290	378	1,728

Note: Producer's price calculated for every 100kg. Land productivity is in the unit of kg/ha.
Source: Khatkar et al. *Profitability of Crops in Haryana*, 2004.

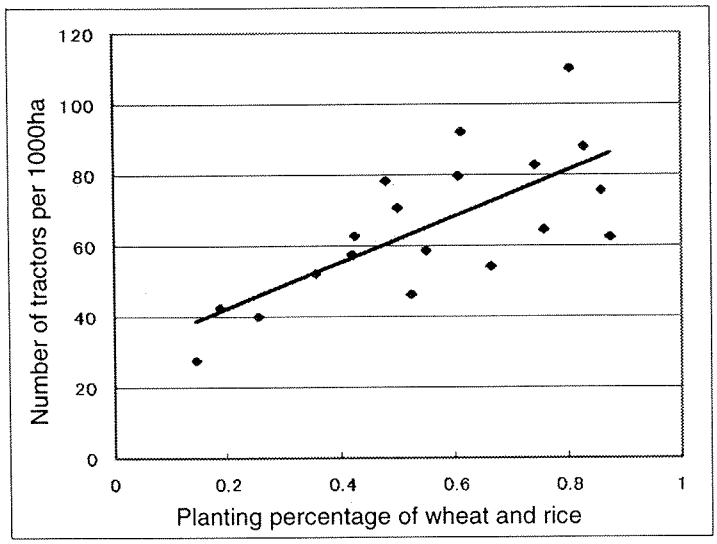
2. Tractorization

North-western India is a region that boasts high productivity as well as the most advanced agricultural mechanization. Typical agricultural machineries include wheat thresher, tubewell (which replaced Persian well) and tractor. This section will focus on the impact of tractors on rural community.

Introduction of tractors gained momentum after the launch of Green Revolution for the following reasons. Prior to the Green Revolution, peak months for draft animal demand were in October and November when ploughing and seeding were performed for wheat planting, and April when wheat was threshed (Figure 4)[1]. After the advent of the Green Revolution in fiscal 1969/70, demand in April was alleviated by spread of threshers while demand increased rapidly in October and November mainly due to popularization of HYV rice. In the past, harvest was completed by early October at the latest because fast-growing crops such as *bajra* and maize were being grown in the rainy season. For this reason, there was enough time left for tillage (normally 5 times) before seeding wheat in November and December. However, the growing season for HYV rice that gained popularity by replacing such cereals was 140 to 150 days. Productivity of wheat declined when seeding was delayed until December or later. In this manner, it became necessary for rice harvesting and wheat planting to be completed over a two-month period from mid-October to mid-December. This is where the demand for tractor aroused.

[1] *In the past, threshing was performed by using cattle to tow a wooden roller over harvested wheat. This work was replaced by tractor thereafter.*

Figure 6 Percentage of double—cropping and diffusion of tractors by district in Haryana State



Number of tractors per unit area = 28.1 + 68.5 Wheat/rice planting percentage R^2=0.54

(3.02) (4.33)

Figures in parentheses: t-value Sig. at 1%.

Source: Government of Haryana, *Statistical Abstract of Haryana*, 2003/04.

Figure 6 shows the proportion of area under wheat/rice and number of tractors per unit area in each district of Haryana. Tractors came into wide use with the introduction of wheat/rice double cropping. Introduction of tractors has exerted enormous impact on rural community. Let us take a look at this from the viewpoint of: 1) the wage labour market; 2) excessive investment of machinery; and 3)the land lease market.

Tractors substitute draft animal labour. Draft animals are usually used by family labour because animals are abused when used by others. A more accurate way to describe tractors is therefore "substitute for family labour." Tractors substitute family labour but represent technology with a character of hired labour. Table 4 shows the number of days family and hired labour were input for every hectare by type of farm labour at farms using draft animals and farms using tractors. Relative to farms using draft animals, family labour is decreasing while hired labour is increasing at farms using tractors. One can conclude that tractors are offering income earning opportunities to needy households considering the fact that hired labour is predominantly offered by such households (many seasonal workers from Bihar and other deprived states come to the northwest to work).

Tractors used in north-western India have at least 30 horsepower and no cultivators are used because of the silt soil of this region. Tractors with certain weight are needed as the silt that has dried after irrigation becomes very compact and cannot be ploughed with cultivators. For this reason, acreage of farms owning tractors tends to be smaller than the optimal acreage of such farms in other regions.

A minimum operation of 500 hours a year is generally required. Table 4 offers an estimation of annual maintenance cost of tractors and a pair of draft animals in Haryana for fiscal 1977/78. Although we will not go into the details, introduction of tractors is predicted to advance as maintenance cost of tractors per management area at farms with 2 hectares or less is lower than maintenance cost of draft animals.[2] However, it takes farms with acreage of 10 hectares or more for annual operating time to exceed 500 hours and even such farms attain this level by leasing their tractors. As tractors become more popular, there is a strong likelihood that tractor maintenance will result in overinvestment as supply of tractors in the lease market becomes excessive.

Table 4 Family and hire labour input by type of work (unit: days/ha)

	Farms using draft animals		Farms owning tractors	
	Family labour	Hired labour	Family labour	Hired labour
Tilling	9.5	2.0	1.4	0.3
Seeding	5.1	1.7	2.1	2.1
Fertiliser application	1.1	0.2	0.7	0.4
Irrigation	4.7	1.6	4.0	2.7
Weeding	--	0.1	0.4	0.3
Reaping	1.9	4.7	1.0	4.5
Threshing	12.1	11.5	9.9	14.5
Transportation	4.5	1.6	2.7	2.8
	4.0	0.5	5.9	0.9
Total	*42.9*	*23.9*	*28.1*	*28.5*

Source: India, National Council of Applied Economic Research, *Implications of Tractorization for Farm Employment, Productivity and Income*, Vol. 2, New Delhi, 1980.

Table 5 shows the annual operating time of tractors in Punjab by farm scale. Annual operating time falls far below 100 hours at small and subsistence farms to suggest the possibility of overinvestment. According to an interview we conducted with the farmers, one of the reasons for purchasing tractors apart from their economic rationale is the fact that tractor ownership is one of their status symbols.

Table 5 Annual operating time of tractors in Punjab by farm scale

	Subsistence	Small	Average	Large	Very Large	Average
Per farm	31	44	135	210	392	261
Per *ha*	38	36	52	42	47	46
Leased	—	—	32	10	40	25

Singh, Tirath (1993) "A Study on the Pattern of Structural Shifts in Punjab Agriculture", *Journal of Research*, Vol.XXX, No1 and 2, Punjab Agricultural University, Ludhiana.

Aside from leasing, economic efficiency of tractors can also be secured by expanding farm acreage. Farm work had been performed by a pair of cattle prior to introduction of tractors. As farms

[2] *Tractors are also used for wheat seeding (with seed driller), driving threshers and transport in addition to tilling and broadly substitute draft animal labour.*

generally own a pair of cattle due to the labour intensive nature of livestock tending, the size of cultivation was determined by the area that can be cultivated by a pair of cattle[3]. This was the main rationale behind the leasing of land from large land owners to small farms. However, tractors would remove this restriction. Table 7 shows the status of land lease before and after the introduction of tractors. Farms that had been leasing out land prior to purchasing tractors have stopped leasing their land and increased their tenancy. This trend is also observed in Haryana (Table 8 and 9).

Table 6 Annual cost of tractors and draft animals per hectare (unit: rupees/ha)

	Tractor retention cost					Cost for retaining a pair of draft anima	
	Farm scale (ha)						
	Below 2	2~4	4~10	Above 10	Average		
(Average)	(1.62)	(3.39)	(7.01)	(16.74)	(9.69)	Farm acreage	5.20
Sown area	3.24	6.31	11.78	26.78	15.99	Planted acreage	8.53
Depreciation	1,215	1,440	2,230	2,252	2,207	Feed	2,551
Interest rate	2,555	2,528	4,606	4,784	4,231	Labour	1,280
Improvement	1,035	2,323	588	1,630	1,402	Depreciation	
Fuel	1,175	2,045	2,083	3,242	2,475	cost	338
Others	135	246	141	432	284	Interest	699
Total	*6,115*	*9,182*	*9,648*	*12,340*	*10,399*	*Total*	*4,818*
Operating time							
┌Owned farm	98	148	246	503	316	Cost per farm	565
└Leased farm	238	261	171	144	185	acreage	
Cost per farm acreage	480	432	462	328	366		

Source: India, National Council of Applied Economic Research, *Implications of Tractorization for Farm Employment, Productivity and Income*, Vol. 2, New Delhi, 1980.

Table 7 Changes in land lease relation before and after tractor purchase

(Ropar District, Punjab State) (unit: ha)

Owned area	Before purchase	After purchase	Leased land	Rented land
	Leased land	Rented land		
Below 4.05ha	—	—	—	—
4.05~7.09	6.07	2.43	—	3.24
7.09~10.12	7.29	6.88	—	14.57
10.12~20.24	27.53	30.36	—	112.15
Above 20.24ha	—	8.10	—	58.70
Total	*40.89*	*47.77*	—	*188.66*

Source: Economic and Statistical Organization, Punjab (India), Study of Impact on Employment in the Command Area of Punjab Tractor Limited, Sahibzada Ajit Singh Nagar (Mohali) Distt. Ropar (Punjab), Chandigarh, 1979.

[3] *There is an expression in northwestern region called "plough acre" which refers to an area that can be cultivated by a pair of cattle.*

Table 8 Percentage of rented land among farms owning tractors and farms using draft animals by farm acreage (%)

(Karnal District, Haryana)

Farm acreage (ha)	6.07~10.12	~14.17	~20.24	Above 20.24
Farms using tractors	5.72	8.86	4.29	12.51
	(7.73)	(12.02)	(16.36)	(27.71)
Farms using draft animals	6.00	2.27	1.06	—
	(8.10)	(11.37)	(16.83)	(—)

Note: Values inside parentheses are average farm acreage (ha).

Source: R.H. Sharma, *Economics of Tractor Cultivation — A Study in Karnal District, Harnaya—*, Agricultural Economics Research Center, University of Delhi, Delhi, 1974.

Table 9 Rented land among farms owning tractors and farms using draft animals

(Karnal District, Haryana) (unit: ha)

Owned area	Farms owning tractors		Farms using draft animals	
	Owned land	Rented land	Owned land	Rented land
Below 2ha	1.62	—	1.03	0.01
2~4	3.11	0.28	2.83	—
4~10	6.84	0.17	5.16	—
Above 10ha	14.87	1.85	11.74	—

Source: India, National Council of Applied Economic Research, *Implications of Tractorization for Farm Employment, Productivity and Income*, Vol. 2, New Delhi, 1980.

It is a phenomenon called "reverse tenancy" in which farms owning tractors (i.e. large farms) become tenants. From a different point of view, it represents collection of tenanted land by large farms that drove small farms out of the land lease market. These developments in the land lease market will aggravate income disparity.

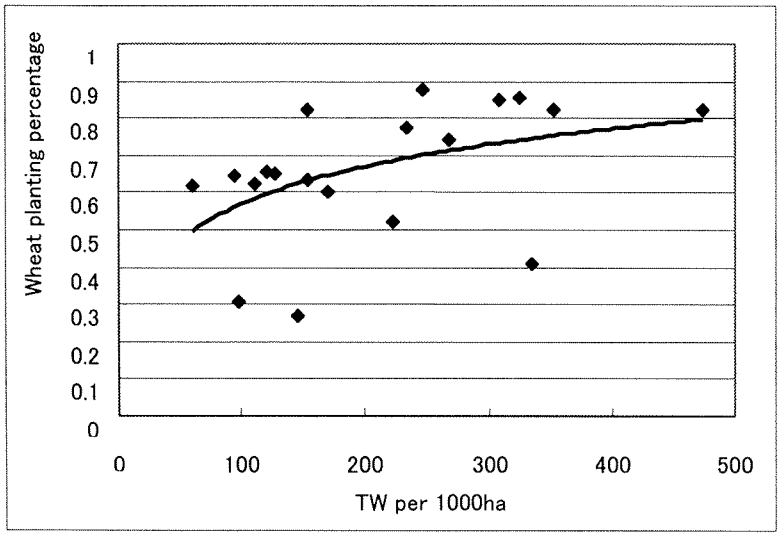
3. Groundwater depletion caused by tubewell

We have pointed out that irrigation is an important element that led to the success of Green Revolution. Number of irrigations required is up to 6 times for wheat and 24 times for rice. In addition, tubewell irrigation is superior to canal irrigation in that is the latter can not assure stable and timely water supply.

Figure 6 shows the number of tubewells per unit area and the proportion of wheat /rice sown area to total cultivated area for each district in Haryana. While no significant relationship exists between the number of tubewells per unit area and percentage of wheat cropping, a positive relationship does exist for rice. In other words, tubewells are indispensable for the introduction of HYV rice which is a water-intensive crop and gives rise to a serious problem of groundwater depletion (Figure 8).

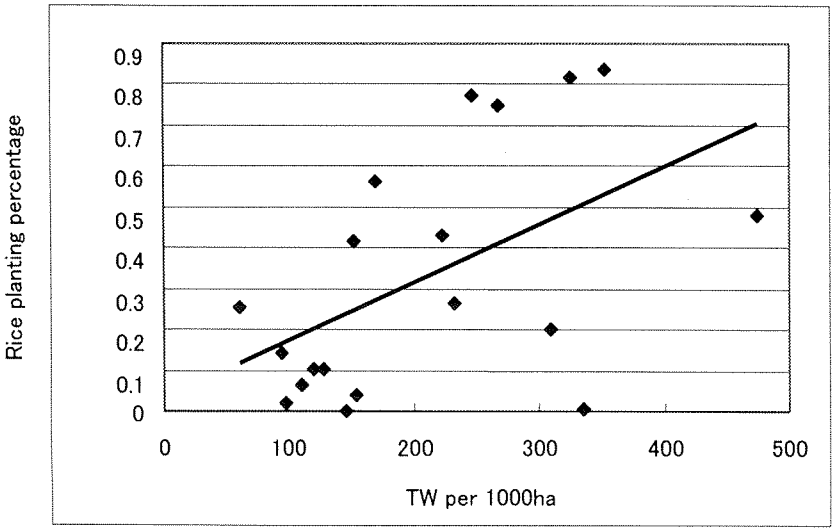
Deep tubewells have become necessary instead of shallow tubewells as a result, putting pressure on farm profit by increasing the cost of irrigation.

Figure 7 Number of tubewells per unit area and wheat sown area in Haryana (by district)



Wheat planting percentage = 0.60 + 0.37TW R^2=0.20
(6.00) (2.07) TW coefficient Sig. at 5.4%

Figure 8 Number of tubewells per unit area and rice sown area in Haryana (by district)



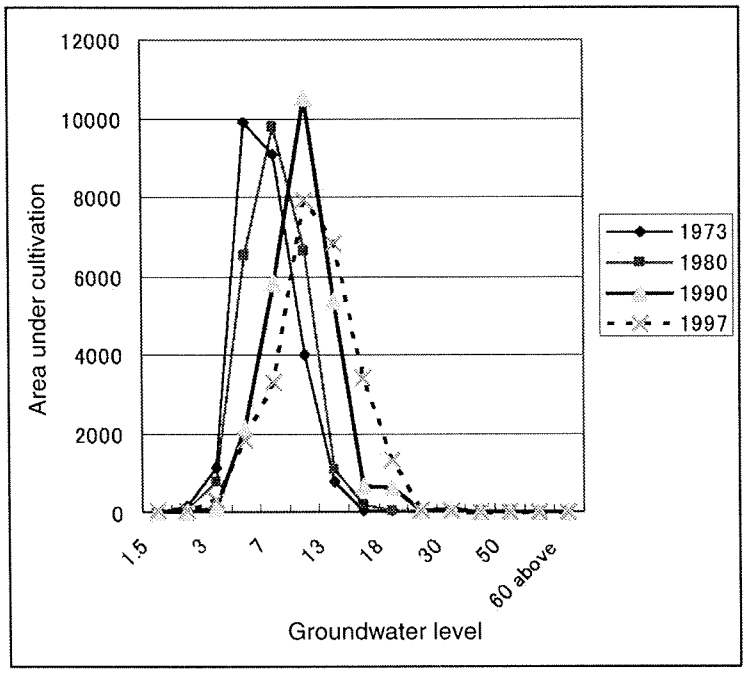
Rice planting percentage = 0.03 + 1.41TW R^2=0.28
(0.23) (2.55) TW coefficient Sig. at 2.2%

Source: Government of Haryana, *Statistical Abstract of Haryana*, 2003/04.

Several measures are being taken against the lowering of groundwater level. Since 70 percent of

groundwater increment is said to be realized through canal irrigation, it is necessary to increase the use of canal irrigation. It is also necessary to seek conversion of crops to those that do not require much water because the cropping pattern consisting of wheat and rice requires large amount of water. However, it is difficult to bring down wheat and rice cultivation in view of resistance from the farmers who benefit from subsidies to those crops. Meanwhile, it is not easy to subsidize crops other than wheat and rice under the present fiscal condition.

Figure 9 Lowering of groundwater level in the central region of Punjab (meters)



Source: Prepared by the author from S.K.Mittal, Status Paper on Ground Water Resources and Agriculture in Punjab, nd.

Punjab and Haryana form the granary of India. It is said that groundwater level is dropping 20 to 40 cm annually in the area due to excessive irrigation water use. This depletion of groundwater will have a serious impact on agriculture in this region and would also have ominous implications for India's food security.

4. Potential for application of Punjab farming method to other regions

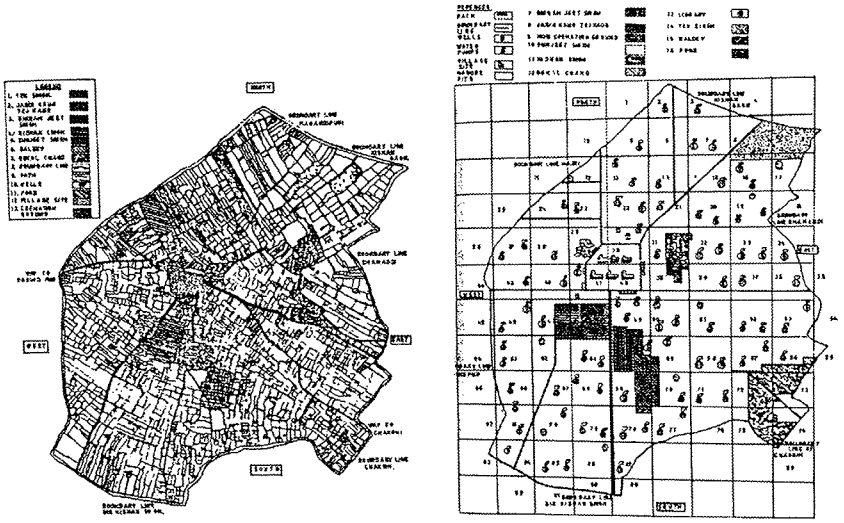
Punjab farming method is a model that led the Green Revolution to success. If it becomes impossible to maintain the Punjab farming method due to falling groundwater level—or when food

shortage arises due to increase in food demand caused by population increase or economic growth in India (although it is unlikely to happen in a short- to medium-term)—it will be necessary to carrying out Green Revolution in regions other than the north-western India.

Land fragmentation resulting from equal inheritance to sons is one of the impediments of Indian agriculture. Ganges river basin is relatively blessed in terms of groundwater use and is suited for introduction of powered pumps which are indispensable for introduction of HYV rice. However, its diffusion is concentrated in north-western India in the upstream Ganges and not seen in any significant degree downstream in central and eastern Uttar Pradesh, Bihar and West Bengal. This contrast also corresponds to the status of Green Revolution's dissemination. One can assert that the largest element determining the introduction of tubewells (which is known to have scale economy, approximately 1 hectare) is to solve the farm fragmentation problem through land consolidation.

The need for land consolidation has been claimed since pre-independence and attempts to this end had been made in north-western India since the era of British India. The movement gained momentum after the independence and the process had more or less completed in the mid-1960s. Land consolidation in this region is characterized by standardization of land parcel to 1 acre through rectangularation of fields and planarization of farmland which is a condition required for efficient irrigation (see Figure 10). Introduction of tubewells was accelerated through these series of efforts and introduction of agricultural machinery such as tractor was facilitated. Infrastructure for accepting Green Revolution was formed in this manner.

Figure 10 Effect on land consolidation



In contrast, land consolidation has hardly advanced in downstream Ganges basin. Rectangularation also has not taken place; the effort has not gone beyond mere exchange of farmland and no rules

have been laid on the shape of fields.

Several reasons exist behind this contrast in the progress of land consolidation between the upstream and the downstream regions of the Ganges basin. First, castes that are directly engaged in agriculture such as the Sikhs and the farming caste of Jat are predominant in the upstream region while the Brahman that avoids direct engagement in agriculture was at the centre of land ownership in the downstream region. From a historical viewpoint, independent farmers lived upstream while complex land ownership was formed downstream owing to the zamindar system that was enforced as a large scale seignory system. Furthermore, massive intermigration occurred in north-western India between Islam and Hindu population during the Indo-Pakistani separation and simplified the farm ownership pattern.

Land consolidation, even though it serves as the infrastructure for carrying out Green Revolution, is predicted to encounter great difficulty. For this reason, one can safely conclude that the extent of productivity improvement realized in north-western India (known as the Punjab farming method) cannot be readily realized in other regions. Thus, a possible crisis of agricultural production in north-western India would lead directly to food crisis for India.

Chapter II Villages Studied

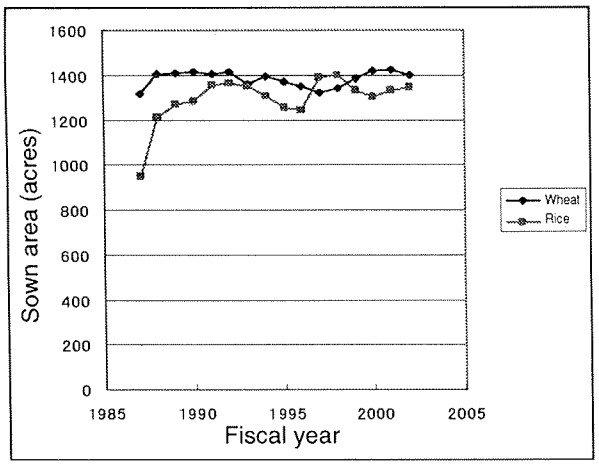
1. About the villages studied

The progress of Green Revolution varied from region to region depending on their respective conditions for irrigation. In this study, we selected one village from a region where Green Revolution had significantly pervaded and another village from a region with limited dissemination owing to the paucity of irrigation facilities. The former is Alamgir village in Ludhiana District of Punjab and the latter is Balsamund village in Hissar District of Haryana. The two villages are only about 200km apart in straight line distance but the conditions of their agriculture contrast starkly as they are located on the other side of alluvial ridge. While the author is aware that it is unreasonable to discuss Indian agriculture through comparison of two villages, this contrast fully strikes up the characteristics of regions where Green Revolution was introduced and regions where it was not introduced.

(1) Alamgir village

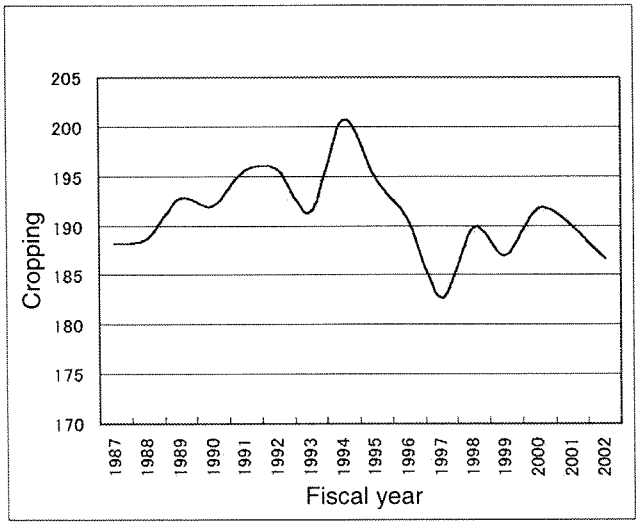
Ludhiana District is known as the most advanced agricultural district in this state where the Green Revolution is advanced. Located about 25km from the main town of the district, Alamgir village is a medium-sized village with total area of 1.835 acres, farm area of 1,616 acres and 174 land-owning farm households.

Figure 11 Changes in sown area of wheat and rice in Alamgir village.



Source: Prepared by author based on land ledger (Lal Kitab) at Alamgir village.

Figure 12 Changes in cropping intensity of Alamgir village



Source: Prepared by author based on land ledger (Lal Kitab) at Alamgir village.

Figure 11 looks at changes in sown area of wheat and rice. A monoculture planting pattern of wheat and rice double cropping has been established. As shown in Figure 12, cropping intensity has reached the 200 mark for this reason. Aside from wheat and rice, most crops are fodder crops. Irrigation rate is 100%, realized primarily by tubewells except for canal irrigation used in about 5% of farmland.

Let us take a look at the farming calendar for wheat and rice in this village.

Rice: Rice seedbed is prepared in May. Rice seedlings are transplanted when monsoon starts in June but this is occasionally delayed until July. Ploughing is performed two to three times by tractor which gets the job done in only 30 minutes per acre. Ploughing by tractor hiring costs 100 rupees per acre. Then levelling is performed twice (15 minutes/acre) and padding is performed once (45 minutes and 200 rupees using hired labour/acre). Rice planting is contracted at 400 to 500 rupees per acre and can be completed in 20 to 30 minutes by 10 farm workers. A half litre of herbicide (costing 300 rupees) is used for weeding each acre. A wage of 80 rupees per day is paid when done by hand, although the amount varies depending on the amount of weed. Insecticides are applied two to three times and cost 30 to 36 rupees per acre (5 to 6 cans costing 6 rupees each are used for every acre). About 900 rupees' worth of chemical fertilizers are applied to each acre. Irrigation is required about 30 times but its cost varies significantly depending on the condition of monsoon. Harvest takes place in September and October. Harvest combine is used for all harvesting in Ludhiana District (at 400 to 500 rupees/acre).

Wheat: Preparations for planting are made between October 15 and November 15. Ploughing

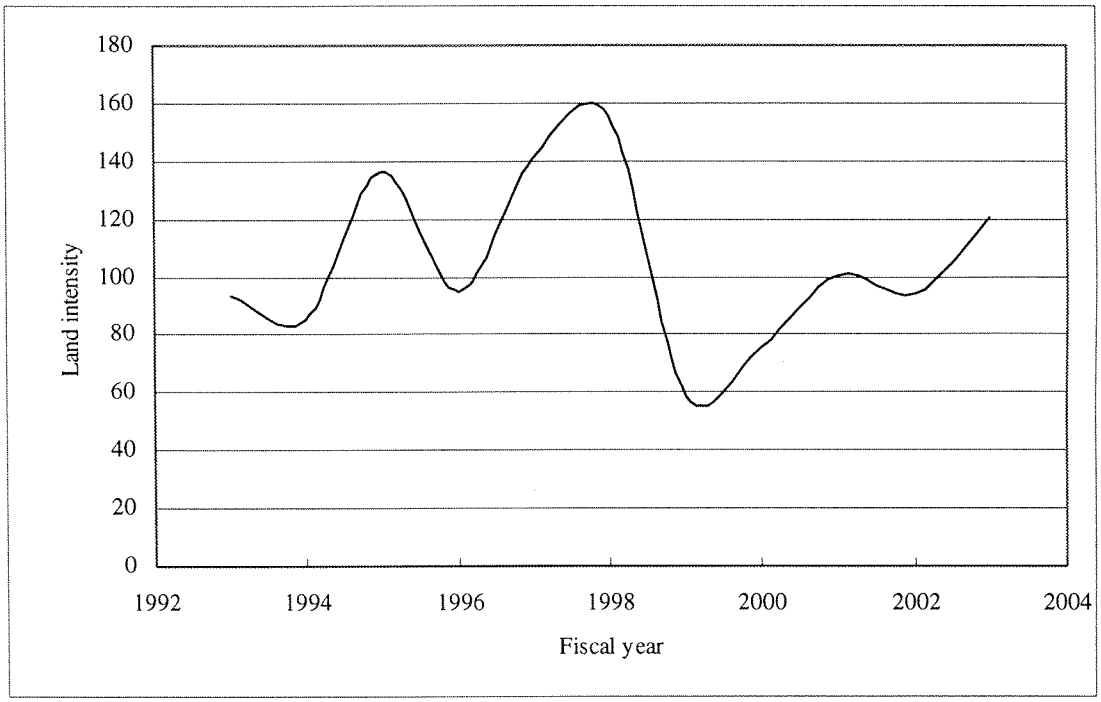
(takes 25 minutes/acre using tractor, costs 100 rupees/acre when done by hired labour) and disc-harrow (takes 25 minutes/acre using tractor, costs 150 rupees/acre when done by hired labour) are performed once each. Levelling (takes 20 minutes/acre using tractor, costs 70 rupees/acre when done by hired labour) is also performed. Seeding, which is performed by attaching a seed drill to a tractor, takes 30 to 40 minutes/acre using tractor and costs 200 rupees when done by hired labour. Herbicides worth 750 to 800 rupees/acre and insecticides worth 270 rupees/acre are also applied. Irrigation is performed for a total of five times.

Harvesting takes place from April 8 to 13 and is performed in the form of reaping by hired labour. This method is used because, in contrast to rice straws which have low nutritional content and cannot be used as feed, wheat straws can be used as feed and therefore cannot be harvested by combine harvester which bends and breaks the straws and makes them unfit for use as feed. The work is contracted at 1,000 to 1,200 rupees per acre and takes 5 workers per day to complete. Thresher is used for threshing and is contracted at 1,000 to 1,200 rupees per acre and takes 5 workers per day to complete. About 1,800kg of straws are harvested per acre and a 100kg of straw is sold for 80 to 90 rupees. If the same work is performed using combine harvester (costing 500 rupees/acre) and reaper (costing 400 to 500 rupees/acre), straw yield will be reduced by 60% in addition to its quality as fodder being inferior.

(2) Balsamund village

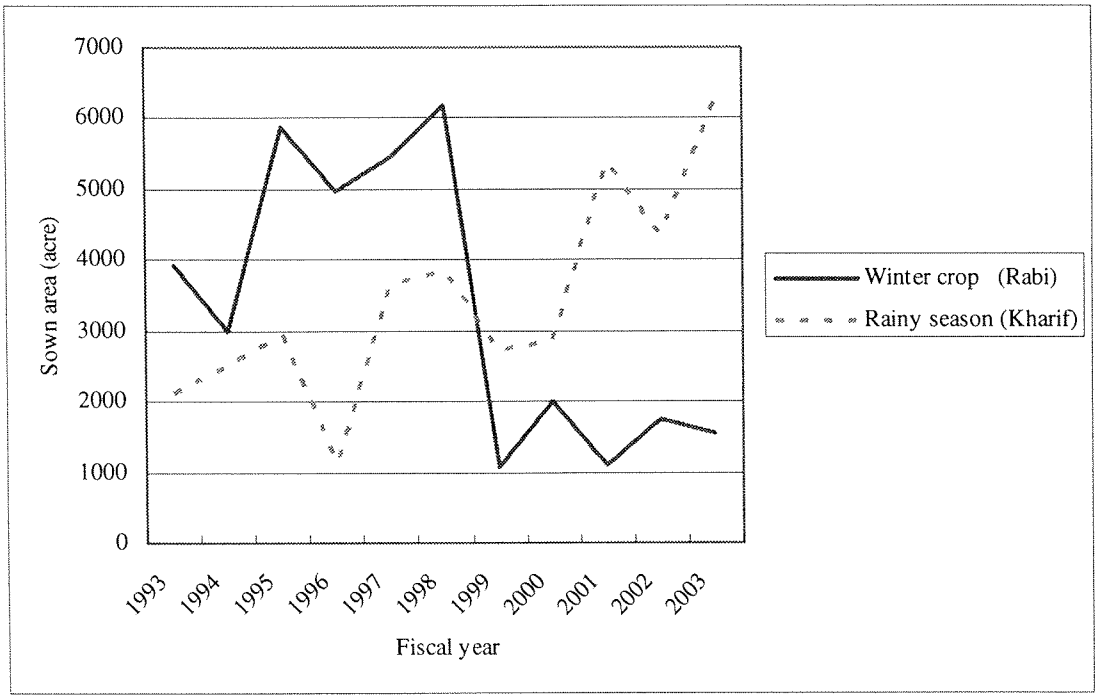
Balsamund village is located 30km west of Hissar, the district capital of Hissar District, on the state border with Rajasthan. It is a large village with total area of 6,838 acres, farm area of 6,468 acres and 2,400 land-owning farm households. As the village is located on the edge of Thar Desert, mounds for preventing sand shifting are built on the state border with Rajasthan. Only 1,344 acres, corresponding to 20.8% of all farmland, are covered by canal irrigation. Moreover, sufficient water usually cannot be secured as it comes from the Indus water system.

Figure 13 Changes in cropping intensity of Balsamund village (acre)



Source: Land ledge of Balsamund village.

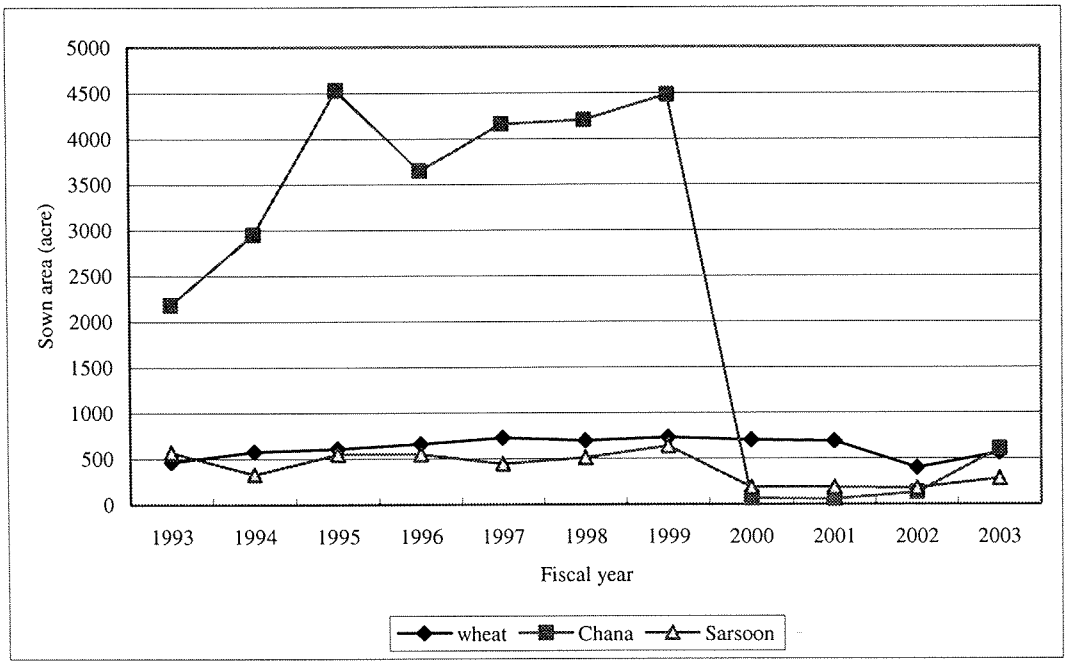
Figure 14 Changes in sown area between winter crop (rabi) and rainy season crop (kharif)



Source: Same as Figure 13.

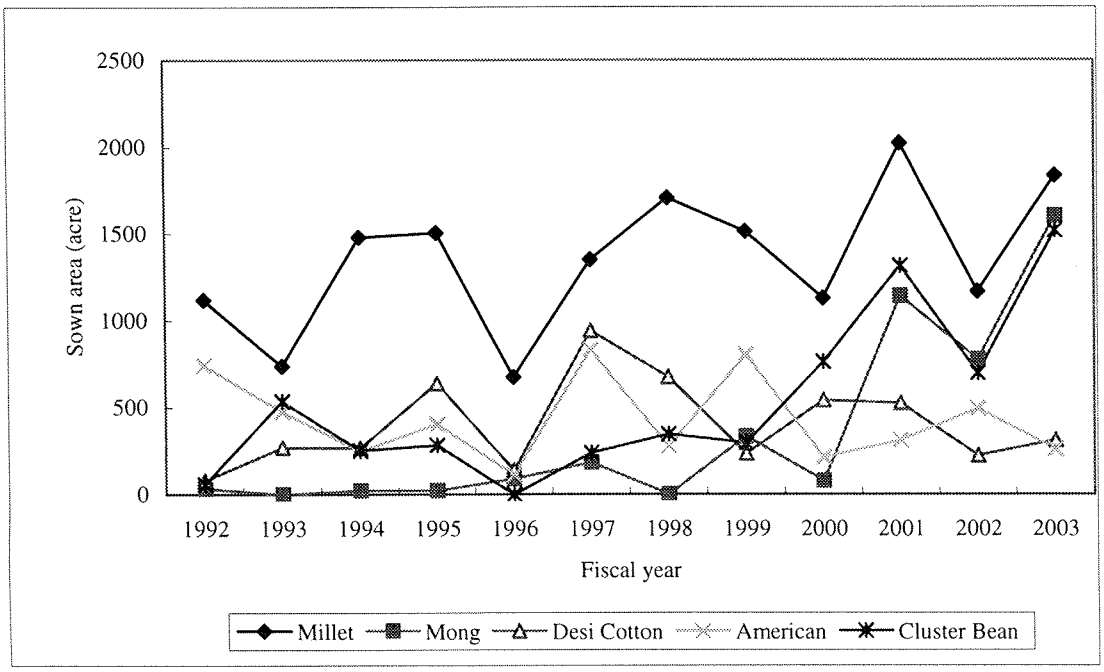
Figure 15 Changes in sown area at Balsamund village

Winter crop (rabi)



Source: Same as Figure 13.

Figure 16 Changes in planted area at Balsamund Village Rainy season crop (acre)



Source: Same as Figure 13.

Unlike Alamgir, cropping intensity of this village (Figure 13) fluctuates largely between 80 and 160 and is low when seen in terms of average. These changes are caused by fluctuations in rainfall.

Average annual rainfall in this semi-arid region is extremely low at 250mm. For instance, there was hardly any rainfall in 1999, causing significant decline in sown area for both winter and rainy season crops. In contrast, 1998 was a year blessed by rain.

There has been a considerable change in the past 10 years with sown area for winter crop and rainy season crop, as the former decreased significantly while the latter increased. The impact of 1998 being a year blessed by rain followed by drought in the subsequent year cannot be negated. More essentially, however, there was a rapid decline in sown area of gram (Figure 14). This trend is not limited to this village and has been observed in north-western India and in other regions throughout India. Introduction of high yield varieties through genetic manipulation had started for gram. However, the productivity of these varieties was largely affected by low temperature, frost, excessive rainfall and early arrival of summer despite their resistance to pest. This has turned gram into a risky crop and its planting is avoided by farmers particularly after the 1999 drought. While this is true not only for gram and is observed in all other pulses, decline in its sown area led to decline in sown area for winter crop because northwestern India was a major production centre for gram. It was not possible to increase the sown area of wheat as a substitute for gram because of the irrigation required to grow wheat.

As have been reviewed so far, Alamgir village and Balsamund village have contrasting agricultural environment with rice/wheat double-cropping turning into monoculture in the former and millets being grown in the latter. Let us take a look at the behavioural patterns of farmers in these villages in the following section.

Chapter III Results of Farm Interview Survey

A questionnaire-based interview survey was conducted on 99 households in Alamgir village (Punjab) and 103 households in Balsamund village (Haryana).

1. Attributes of farm households studied

Main farm attributes of the two villages are compiled in Table 8. Average area of land owned is only 7.84 acres (3.12 hectares) in Alamgir compared to 11.49 acres (4.6 hectares) in Balsamund. About half of the farmers in Alamgir lease in farm land while the percentage in less than a quarter in Balsamund. Average leased-in land (farmers are reluctant to bring out information about leased-out land because of the strict tenancy law) were 4.32 and 3.66 acres, respectively. When the subject was limited to tenant farmers, the figures were 8.41 acres and 10.50 acres, respectively. This indicates that they are renting farms almost equal to the average area they own of 6.66 acres and 11.00 acres, respectively. In addition, average area owned by tenant farmers is almost equal to the average for the village to suggest that the scheme of small farmers becoming tenant farmers no longer exists in these two villages.

Table 10 Landownership and tenancy (Acre)

	Alamgir	Balsamund
Farmland owned (acres)	7.84	11.49
Leased in land	4.32	3.66
Tenant farm households	48	24
Land rented per household	8.41	10.50
Land owned by tenant farms	6.66	11.00

Table 11 Farm machinery ownership (%)

	Alamgir	Balsamund
Thresher	33.3	6.8
Powered pump	90.9	19.4

While 90% of farms own tubewells in Alamgir, the percentage for Balsamund is only 20%. Threshers are driven by tractors but their ownership is limited to one-third of farms even in Alamgir. This is mainly because of the lease market of threshers. The lease market contribute to the reduction in operating time of tractors to suggest that overinvestment in tractors exists in Alamgir.

Table 12 Farms owning tractors

	Alamgir	Balsamund
Percentage of farms owning tractors	71.7% (71)	17.5% (18)
Average horsepower of tractors	39.40	42.78
Land ownership of farms owning tractors	7.65 (6.84)	21.85 (20.80)
Land ownership of farms not owning tractors	3.27 (2.31)	10.22(8.28)
Test of difference in land ownership between farms owning tractors and farms not owning tractors	t=3.91 sig. at 0.1%	t=3.93 sig. at 0.1%

Significant difference also exists in percentage of farms owning tractors (Table 12). Size of farms owned by farms owning tractors is almost twice as large as that of farms that do not own tractors and significant difference is also observed in mean value (Table 13). When tenanted land area and tractor ownership are compared, tenanted land area is far larger among farms owning tractors to indicate advancement of reverse tenancy. In contrast, farms owning tractors do have larger tenanted land area but no significant difference with farms not owning tractors can be observed in Balsamund. Tractors were introduced in Alamgir in response to the peak of demand for draft animal labour around November that intensified with the advancement of wheat/rice monoculture while percentage of wheat planting is low and rice is not planted in Balsamund as we have seen earlier. In other words, land lease in this village works under different logic compared to Punjab as such peak in draft animal demand does not exist there in and around November.

Table 13 Tenanted land area

	Farms owning tractors	Farms not owning tractors	
Alamgir	5.51 (7.23)	1.27 (2.51)	t=3.0 sig. at 0.3%
Balsamund	5.44 (14.61)	3.28 (5.50)	T=1.1 not sig.

Table 14 Tenancy contract format

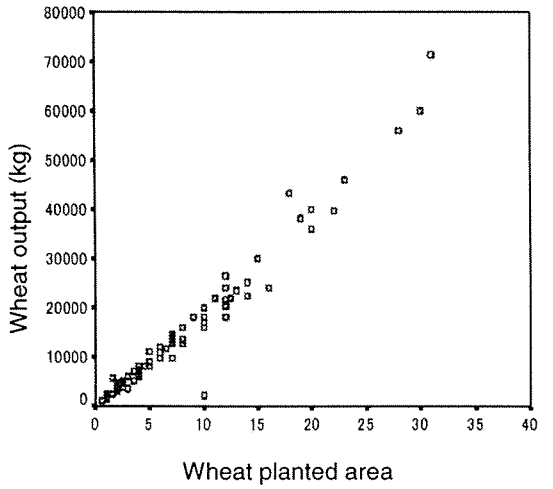
	Fixed cash tenancy	Fixed produce tenancy	Sharecropping	Total
Alamgir	93.8 (45)	4.2(2)	2.1 (1)	48 (100.0)
Balsamund	25.0 (6)	0 (0.0)	75.0 (18)	24 (100.0)

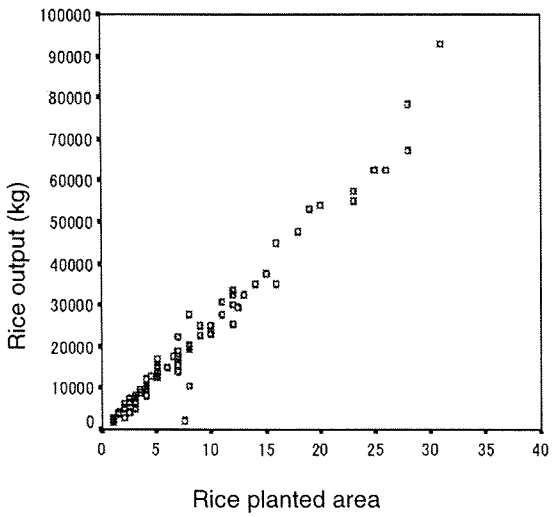
A large difference also exists between the two villages with regard to the form of tenancy contract, with fixed cash tenancy being dominant in Alamgir and sharecropping (50:50) being the mainstream in Balsamund. The backdrop of this difference is the stable yield realized through irrigation in Alamgir and uncertainties of yield caused by limited irrigated land area and unstable water availability at such land in Balsamund.

2. Agricultural productivity

As clear from Figure 17, which shows the sown area of wheat and rice and their output in Alamgir, there is linear relation between sown area and output, i.e. uncertainties hardly exist between the two. Moreover, converse relation between farm acreage and land productivity, which had been pointed out as a characteristic of agriculture in India, nor the merit of scale, no longer exist.

Figure 17 Sown area (acre) and output (kg) of rice and wheat in Alamgir Village





Meanwhile, linear relation is not observed and dispersion is prevalent in Balsamund (Figure 18). This is attributed to the fact that, unlike in Alamgir, irrigation is not sufficient in Balsamund. As can be seen in the fluctuations of cropping intensity, Balsamund faces uncertainties originating from natural conditions due to lack of irrigation.

Figure 18 Sown area (acre) and output (kg) of rice and wheat in Balsamund Village

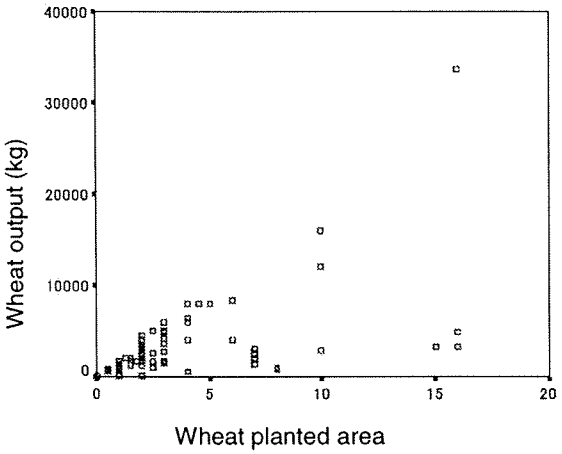


Figure 19 Wheat sown area (acre) and wheat marketing rate (%) in Alamgir Village

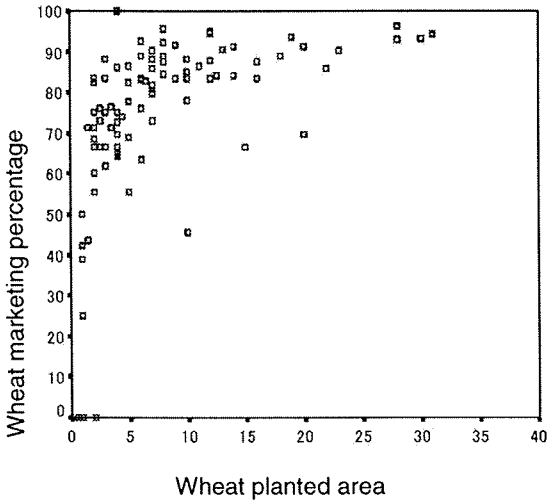
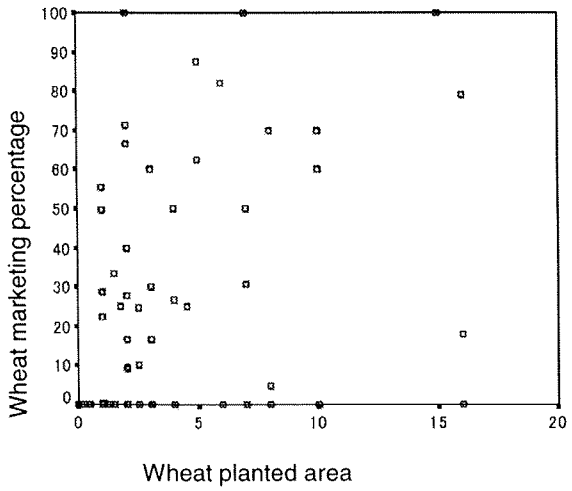


Figure 20 Wheat sown area (acre) and wheat marketing rate (%) in Balsamund Village



Let us now take a look at the marketing rate (sales rate). Marketing rate in Alamgir is 76.1% with marketing rate exceeding 80% for households with average farm acreage. In contrast, marketing rate in Balsamund is only 19.4% with no marked relation with sown area. In other words, wheat is basically used for household consumption in Balsamund. This fact signifies that agricultural policy is affecting these two villages in a different manner. For instance, price supporting policy, subsidies for irrigation and chemical fertilisers (the so-called three major subsidies in agriculture) directly affect the income of farmers in Alamgir but are not a major concern for farmers in Balsamund. On the contrary, price supporting policy will negatively affect the welfare of some poor farmers that have to purchase wheat by raising the market price above the equilibrium price.

The varying impact of agricultural policy on different regions and different income classes is what makes the steering of Indian agricultural administration so difficult. It is one of the reasons behind the division of the Indian National Congress Party which used to boast monolithic unity and their defeat in the general election.

While rice is only grown in Alamgir (Figure 19), majority of rice is sold in the market because rice is not part of the diet of this region.

Thus the difference in crops lead to income disparity discussed later. Let us now take a look at sales of milk which is another important source of income for farm households. Milk consumption is increasing in India and its production is benefiting the farmers. It is a phenomenon called "White Revolution" as opposed to Green Revolution. Buffaloes are superior to cows in terms of both quality and quantity of milk yielding. For this reason, each household is raising an average of 6.05 heads of female buffaloes in Alamgir and earning 177,000 rupees a year by selling their milk. On the other hand, few buffaloes are raised in Balsamund because of its dry climate which is unsuited for raising buffaloes. A sale of milk is also limited but increases after crop failure as a result of pressured selling.

Figure 21 Rice sown area and rice marketing rate in Alamgir Village

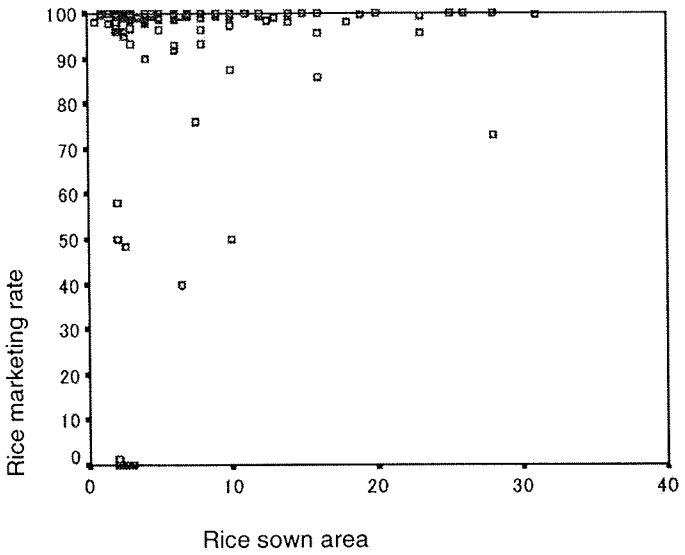


Table15 White Revolution

	Dairy cow	Female buffalo	Annual milk sales
Alamgir	0.68 (1.06)	6.05 (3.96)	Rs. 17369
Balsamund	0.42 (0.56)	1.37 (1.09)	Rs. 203
Average difference test	2.18 sig. at 3.0%	11.57 sig. at 0.1%	4.70 sig.at 0.1%

3. Income structure

Percentage of monetary income is shown in Table 16. Monetary income per farm household in Alamgir is 2.5 times larger compared to that of Balsamund. While it is natural for Alamgir to have high agricultural income, agricultural wages are also higher in this village. This fact requires attention as the lease charge for tractors used in cultivation is included as agricultural wages. Therefore, agricultural wage income is higher for tractor-owning households than those that do not (Table 17). Needless to say, agricultural wages of farms not owning tractors come from wage labour Since cultivation leasing in tractors is not common in Balsamund, farms owning tractors have no agricultural wage income. Non-agricultural income is more than 7 times higher at Alamgir mostly owing to income from milk sales.

Table 16 Details of income (Rs.)

	Alamgir	Balsamund
Agricultural income	136,388	64,022
Agricultural wages	6,077	1,310
Non-agricultural income	39,052	5,429
Salary	10,441	4,011
Remittance	1,666	0
Others	6,193	640
Total	199,820	75,415

Non-agricultural income includes milk sales.

Table 17 Agricultural wages (Rs.)

	Alamgir	Balsamund
Farms owning tractors	6,447.06	0.0
Farms not owning tractors	5,178.57	1,588.24

Difference in income between the two villages is clearly manifested in percentage of consumer durables ownership (Table 18). The fact that 60% of households in Alamgir own their private car is particularly amazing.

Table 18 Percentage of consumer durables ownership

	Alamgir	Balsamund
Private car	58.6	9.7
Motorcycle	80.8	60.2
Bicycle	89.9	81.6
TV	89.7	63.1
Refrigerator	83.8	66.0
Telephone	73.7	61.2

4. Financial market

Let us examine the lives of farmers from the viewpoint of their use of the financial market. Farmers experience numerous difficulties such as drought and disease. Let us take a look at these difficulties that they faced in the past three years in the form of unexpected expenditure. Unexpected expenditure has been experienced by 36.7% and 48.5% of farmers in Alamgir and Balsamund, respectively. However, they were mostly spent on illness treatment and marriages, and incidents of poor crop were fewer than expected.

Table 19 Unexpected expenditure

	None	Illness	Marriage	Funeral	Ritual	Poor crop	Others	Total
Alamgir	62	10	13	1	4	5	3	98
	63.3%	10.2%	13.3%	1.0%	4.1%	5.1%	3.1%	100.0%
Balsamund	53	20	22	0	1	4	3	103
	51.5%	19.4%	21.4%	0%	1.0%	3.9%	2.9%	100.0%

We asked the farmers that experienced unexpected expenditure about the amount required and how they dealt with the situation (Table 20). The amounts were considerably high compared to monetary income with its amount exceeding average annual monetary income in Balsamund. About 40% of expenditure is being covered by savings but amount comparable to this is being paid through sales of personal assets. Such cases mostly consist of sales of livestock, indicating the fact that livestock comprise capital goods through their contribution to farm work and milk production and at the same time playing the role of savings that are used for covering the expenditure in the event of contingency. The percentage of using loan for payment is low and accounted for only several percent at Balsamund in particular.

Table 20 Amount of unexpected expenditure and method of payment

	Amount required	Method of payment				
		Savings	Sales of personal assets	Loan	Others	Balance
Alamgir	124,500	46,861	55,694	16,666	2,500	20,416
	36	36	36	36	36	36
Balsamund	81,946	33,104	29,666	1,367	40	3,806
	49	49	49	49	49	49

Regarding the status of loan, 67.3% of farms are taking loans in Alamgir while the percentage is only 42.7% in Balsamund. As can be seen from the fact that majority of loans in Alamgir are taken from agricultural cooperative, loans are mainly taken for agricultural purposes (particularly for chemical fertilizers). At the backdrop is the increase in current expenses accompanied by monetary expenditure for chemical fertilizer purchase, irrigation cost, tractor rental and farm labour wages in Alamgir as a result of advancing the Green Revolution. In contrast, expenditure on chemical fertilizer in Balsamund is small because of limited availability of irrigation and current expenses are not large because rice is not planted. Loans from agricultural cooperatives are also small for this reason.

Table 21 Status of loans

	No loan	Coopera-tive	Commer-cial bank	Other banks	Relatives	Friends	Money-lender	Others	Total
Alamgir	32	44	5	0	2	1	14	1	99
	32.3%	44.4%	5.1%	0%	2.0%	1.0%	14.1%	1.0%	100.0%
Balsamund	59	14	10	1	6	5	8	0	103
	57.3%	13.6%	9.7%	1.0%	5.8%	4.9%	7.8%	0%	100.0%

	Amount of loan	Interest	Period (months)	Outstand-ing balance
Alamgir	54335.82	15.19	8.00	23985.07
	67	67	66	67
Balsamund	53818.18	20.13	11.47	11834.09
	44	43	40	44

Annual interest is low at 15% in Alamgir where loans from agricultural cooperative are large. This is due to government subsidies to cooperatives and suggests the fact that Green Revolution is being financed by subsidies.

Looking at personal loans (Table 22), one sees that personal lending and borrowing among villagers hardly exist. As can be seen from the large amount of loans taken from village moneylender (Table 21, the function of village community from the viewpoint of financial point of view is quite feeble.

Table 22 Lending

	None	Relative	Family	Friend	Others	Total
Alamgir	93	1	1	1	3	99
	93.9%	1.0%	1.0%	1.0%	3.0%	100.0%
Balsamund	99	2	0	2	0	103
	96.1%	1.9%	0%	1.9%	0%	100.0%

5. Population, Social Structure and Public Health

(1) Overview of the survey

We conducted a field survey in Ludhiana District of Punjab State and Hissar District of Haryana State in August 2004. The village we selected for the survey in Ludhiana District of Punjab was a Village which played a leading part in the Punjab riot and inhabited primarily by Sikhs. It is an affluent village with complete irrigation coverage. The survey in Hissar District of Haryana was conducted in a village belonging to a semi-arid region adjoining Rajasthan and inhabited mostly by Hindus. It is not a less prosperous village relying on production of pulses and irrigation is almost nonexistent.

The basic attributes of the respondents are as follows. The number of survey questionnaire sheets collected was 100 copies in Punjab and 113 copies in Haryana. The survey in Punjab was conducted by explaining the purpose of survey to the graduate students of Punjab Agricultural University in Ludhiana and the employees of Punjab State Department of Agriculture Ludhiana Branch and was conducted in the form of hearing survey. In Haryana, the survey was conducted by explaining the purpose of this survey to the graduate students and faculty of Haryana Agricultural University in Hissar and to the staff of Department of Agriculture, Government of Haryana and was conducted in the form of hearing survey.

Table 23 Basic Information of respondents

	State	N	Average	Standard deviation
Age	Punjab	100	49.66	12.33
	Haryana	102	42.03	14.72
Number of meals	Punjab	100	2.97	0.17
	Haryana	102	2.31	0.47
Land area (acres)	Punjab	100	7.80	12.00
	Haryana	101	11.49	12.46
Age of spouse	Punjab	99	45.42	12.43
	Haryana	92	38.29	13.95
Number of spouse's meals	Punjab	99	2.97	0.17
	Haryana	90	2.29	0.46

Source: Prepared from questionnaire survey unless stated otherwise.

Significant difference exists between the two villages in all of the basic attributes of the respondents mentioned here. As for the difference in land area, the area that can be cultivated and harvested fluctuates largely from year to year in the semi-arid region of Haryana. Land area is therefore greater in Haryana by reflecting the need for relatively large amount of land.

The difference in age of respondents in the basic attributes does not have any meaning as they were not selected by using statistical techniques such as random sampling-based stratified two-stage sampling. However, a clear difference in number of meals exist with the majority of respondents in Punjab eating 3 meals while those in Haryana mostly eating only 2 meals.

This result suggests that the village in Haryana was generally poorer. In particular, extremely large fluctuation of annual rainfall in unirrigated semi-arid region adjoining Rajasthan results in large fluctuation of yield. Likelihood of experiencing certain degree of starvation must have been high under these circumstances. Such difference in background is believed to have caused the difference in number of meals.

(2) Religion of respondents

As is clear from the survey results, Hindu population accounts for vast majority in Haryana while Sikh population is the vast majority in Punjab. While, Hindu, Islam and Sikh comprise the three major religions of the Indian subcontinent, information about the Sikh population is extremely limited. Since the two villages selected for this survey offered clear contrast between Hindu and Sikh, we will analyze the difference of awareness between these two religions with emphasis on demographic transition.

Table 24 Respondents to the survey

State	Haryana		Punjab		Total	
	Number	Rate(%)	Number	Rate(%)	Number	Rate(%)
Hindu	98	95.15	4	4.00	102	50.25
Sikh	3	2.91	96	96.00	99	48.77
Islam	2	1.94	0	0.00	2	0.99
Total	*103*	*100.00*	*100*	*100.00*	*203*	*100.00*

(3) Social structure

The results for Punjab and Haryana were same in that equal inheritance to sons was most common, followed by equal inheritance to sons and daughters. There were two Muslims among the respondents in Haryana and one of them selected equal inheritance based on the rules of Islam. The other respondent did not select such inheritance method because he only had a daughter and this method therefore was not an option. The percentage of equal inheritance to sons was higher in Haryana and that of equal inheritance to sons and daughters was higher in Punjab. Inheritance by sons was most common in any case.

Table 25 Inheritance survey results

State	Haryana		Punjab		Total	
	Number	Rate(%)	Number	Rate(%)	Number	Rate(%)
Equal inheritance to sons	71	68.93	54	54.00	125	61.58
Equal inheritance	18	17.48	33	33.00	51	25.12
First son	5	4.85	10	10.00	15	7.39
Equal inheritance to daughters	4	3.88	1	1.00	5	2.46
First daughter	3	2.91	0	0.00	3	1.48
Islamic equal inheritance	1	0.97	0	0.00	1	0.49
Last child	0	0.00	2	2.00	2	0.99
NA	1	0.97	0	0.00	1	0.49
Total	*103*	*100.00*	*100*	*100.00*	*203*	*100.00*

Most couples live with the husband's parents after marriage, as is also the case in Pakistan. Hardly any difference exists between Punjab and Haryana in this respect.

Table 26 Residence selected upon marriage

State	Haryana		Punjab		Total	
	Number	Rate(%)	Number	Rate(%)	Number	Rate(%)
Live with husband's parents	94	98.95	96	96.67	190	97.94
Near husband's parents	1	1.05	2	2.02	3	1.55
Others	0	0.00	1	1.01	1	0.52
Total	*95*	*100.00*	*99*	*100.00*	*194*	*100.00*

As for the relationship with spouse, the most common response in both Punjab and Haryana was that they had no personal acquaintance with their present spouse prior to marriage and were married after meeting for the first time at an arranged introduction. The result of x^2 test on "relationship with spouse" in Punjab and Haryana was 0.0015, indicating that it is significant at 0.5% level and that difference does exist. This difference is attributed to the fact that cross-cousin marriage accounts for 37% of all marriages in Haryana. The percentage of cross-cousin marriage in Punjab is about 20%. Islamic tradition has been rejected in the history of struggle with Islam in Punjab while such tradition may still remain in Haryana where Islam was once the dominant religion.

Table 27 Relationship with spouse

State	Haryana		Punjab		Total	
	Number	Rate(%)	Number	Rate(%)	Number	Rate(%)
No relationship (arranged introduction)	51	49.51	58	58.00	109	53.69
Friend	3	2.91	14	14.00	17	8.37
Maternal cousin	16	15.53	12	12.00	28	13.79
Paternal cousin	22	21.36	8	8.00	30	14.78
Sister's friend	2	1.94	4	4.00	6	2.96
Brother's friend	3	2.91	4	4.00	7	3.45
No response	6	5.83	0	0.00	6	2.96
Total	*103*	*100.00*	*100*	*100.00*	*203*	*100.00*

(4) Education and academic background

The results concerning academic background which serves as an important indicator of modern rational inclinations, demographic transition, information gathering and use of technology are as follows. Since most respondents were male, spouse's academic background can be regarded as academic background of women. No significant difference existed between Punjab and Haryana in male academic background. However, significant difference of 0.0015% existed for spouse's academic background, the greatest cause of which being the fact that 71% of spouses in Haryana had not gone to school. There are two possible reasons for this. One is that the generation of people that were surveyed in Haryana lived under strong social constraints from the code of conduct prevalent in traditional Hindu society and did not feel the need to educate women. This can be seen as a social gender disparity. The other possibility is the fact that the village surveyed in Haryana had been traditionally poorer and could not afford to send girls to school. The reality may be a combination of the two.

Table 28 Final schooling

State	Haryana		Punjab		Total	
	Number	Rate(%)	Number	Rate(%)	Number	Rate(%)
None	24	23.30	32	32.00	56	27.59
Less than 4 years	4	3.88	8	8.00	12	5.91
4～5 years	7	6.80	6	6.00	13	6.40
6～7 years	8	7.77	1	1.00	9	4.43
8～9 years	10	9.71	13	13.00	23	11.33
10 years or more	36	34.95	30	30.00	66	32.51
Diploma	4	3.88	1	1.00	5	2.46
University and above	8	7.77	6	6.00	14	6.90
Traditional education	2	1.94	3	3.00	5	2.46
Total	*103*	*100.00*	*100*	*100.00*	*203*	*100.00*

Table 29 Academic background of spouse

State	Haryana		Punjab		Total	
	Number	Rate(%)	Number	Rate(%)	Number	Rate(%)
None	70	71.43	41	41.00	111	56.06
Less than 4 years	3	3.06	9	9.00	12	6.06
4～5 years	6	6.12	13	13.00	19	9.60
6～7 years	0	0.00	4	4.00	4	2.02
8～9 years	10	10.20	9	9.00	19	9.60
10 years or more	3	3.06	20	20.00	23	11.62
Diploma	3	3.06	1	1.00	4	2.02
University and above	2	2.04	2	2.00	4	2.02
Traditional education	1	1.02	1	1.00	2	1.01
Total	*98*	*100.00*	*100*	*100.00*	*198*	*100.00*

Turning our eyes to the academic background of children, little difference exists between Punjab and Haryana for both boys and girls, and difference between boys and girls is greater than regional differences. Average academic background is between "Diploma" and "University and above" for boys and between "10 years or more" and "Diploma" for girls. The percentage of those who think that girls do not need to be educated, as they do in Pakistan, is small and is less than 5%.

Table 30 Ideal academic background for children: gender disparity

	Haryana		Punjab	
	Boy	Girl	Boy	Girl
Average	7.274	6.632	6.894	6.388
Variance	1.095	2.746	2.477	3.717
Number of observations	95	95	85	85
Degree of freedom	94		84	
t	4.427		3.76	
P(T<=t) both sides	0.000026		0.000313	
t boundary value both sides	1.9855		1.98861	

Values were calculated through the following quantification: (None = 1), (Less than 4 years = 2), (4～5 years = 3), (6～7 years = 4), (8～9 years = 5), (10 years or more = 6), (Diploma = 7) and (University and above = 8).

Table 31 Ideal academic background for boys

State	Haryana		Punjab		Total	
	Number	Rate(%)	Number	Rate(%)	Number	Rate(%)
None	0	0.00	3	3.03	3	1.49
Less than 4 years	1	0.97	1	1.01	2	0.99
4～5 years	0	0.00	2	2.02	2	0.99
6～7 years	4	3.88	4	4.04	8	3.96
8～9 years	20	19.42	17	17.17	37	18.32
10 years or more	12	11.65	26	26.26	38	18.81
Diploma	61	59.22	41	41.41	102	50.50
University and above	3	2.91	5	5.05	8	3.96
Traditional education	2	1.94	0	0.00	2	0.99
Total	*103*	*100.00*	*99*	*100.00*	*202*	*100.00*

Table 32 Ideal academic background for girls

State	Haryana		Punjab		Total	
	Number	Rate(%)	Number	Rate(%)	Number	Rate(%)
None	5	4.90	4	4.17	9	4.55
Less than 4 years	0	0.00	1	1.04	1	0.51
4～5 years	2	1.96	5	5.21	7	3.54
6～7 years	2	1.96	3	3.13	5	2.53
8～9 years	6	5.88	4	4.17	10	5.05
10 years or more	28	27.45	23	23.96	51	25.76
Diploma	17	16.67	13	13.54	30	15.15
University and above	38	37.25	35	36.46	73	36.87
Traditional education	3	2.94	4	4.17	7	3.54
No response	1	0.98	4	4.17	5	2.53
Total	*102*	*100.00*	*96*	*100.00*	*198*	*100.00*

(5) Social norms

1) Social values

Social values were studied by quantifying the response to the questions as: (Completely agree = 1), (Somewhat agree = 2), (Somewhat disagree = 3) and (Completely disagree = 4) in an effort to measure the degree of consent to the indices raised. In other words, complete agreement was quantified as "1" and complete disagreement was quantified as "4." The survey results shed light on the difference between the two. Needless to say, all respondents were included for comprehensive coverage.

In the comparison of social values, respondents in both states mentioned "Social status" as the most important value in their lives, although the percentage in Haryana was higher at 57.14% compared to 35.35% in Punjab. The next common response in Haryana was "Family bond," followed by "Honour," while the response that followed in Punjab was "Honour," "Family bond" and "Money."

Farmers in Haryana have strong affinity to their community and are very conscious about how they are viewed by their community. In contrast, people appear to be more interested in their own values and gain than their community's view of them. Another interpretation of this might be that Haryanan farmers have stronger tendency to side with changes in society while Punjabi farmers are more self-reliant.

This can be seen as religious differences. For Hindus whose religion has been institutionalized and has become almost undistinguishable from social structure, social constraints have great significance and lead to stabilization of order. Meanwhile, Sikhs are still strongly aware of their religion and their values come out more in the open because of less social constraints.

Table 33 Comparison of social values

Social values	Haryana State		Punjab State	
	Number	(%)	Number	(%)
Money	9	9.18	14	14.14
Social status	56	57.14	35	35.35
Family bond	18	18.37	15	15.15
Honour	11	11.22	23	23.23
Children	3	3.06	11	11.11
Friend	1	1.02	0	0.00
Enjoy one's life	0	0.00	1	1.01
Total	*98*	*100.00*	*99*	*100.00*

2) Social norm

An interest fact resurfaces with regard to social norm. The table below lists the values in Punjab and Haryana in order of deviance. While clear difference exists between Punjab and Haryana in all items, one observation is that Punjabis are more pessimistic compared to Haryanans. It is a clear difference as the average value for Haryana is 1.43 compared to 1.86 for Punjab.[4]

In addition, discrepancy is large with regard to future outlook and social fairness but is small, although in relative terms, for personal matters. There are three ways to interpret this. One is that it is the difference between Sikhs who are critical about the society and Hindus who are more conforming. This represents a reflection of relatively weak social constraints in Punjab and stronger constraints in Haryana. Another interpretation is that it reflects the relative deterioration of environment surrounding Punjab. In Punjab, it is becoming difficult to maintain the present productivity owing to rapid falling of groundwater level and changes in government's subsidy policy. Meanwhile, the village we studied in Haryana did not have irrigation to begin with and will not be affected by such policy change. The crops that qualify for government subsidy are also not grown

[4] Significant when average for Haryana and Punjab was 1.43 and 1.86, respectively, degree of freedom = 12, t = -6.155, P(T<=t) both sides and 0%.

in this village. These differences in environment may have some impact. The third interpretation is that both of these factors are affecting the situation.

Table 34 Social norm

Item	Haryana	Punjab	χ^2Test
Investment in education will pay off in the long-term.	1.17	1.72	1.757E-12
Your society is fair to all.	1.62	2.32	7.206E-11
You can expect help from your friends when it is needed.	1.29	1.92	1.776E-10
Tomorrow will be a better day than today.	1.34	2.09	1.163E-08
Diligence leads to success.	1.16	1.59	4.225E-08
You feel that there is value in the society.	1.44	1.96	6.677E-08
Honest person will be rewarded in the end.	1.26	1.85	1.257E-07
Honest person will be rewarded in heaven.	1.64	2.31	2.428E-05
A person should strive to the limit of his/her ability.	1.35	1.64	1.186E-04
Dedication to one's work is a virtue.	1.39	1.60	2.733E-03
Diligence is a social responsibility.	1.39	1.62	4.489E-03
Any more leisure is not good for the society.	1.80	1.69	4.579E-02
Idleness is vice.	1.71	1.90	1.803E-01

In addition, the criteria for measuring cultural values vary from one culture to another and the response also changes according to cultural bias and background. What becomes important in connection to this is the relative physical relationship. In the case of Haryana, for instance, the concept that was most accepted by the respondents was "Diligence leads to success," indicating an average of 1.16. This is followed by 1.17 of "Investment in education will pay off in the long-term," indicating that concepts based on the premise of self-effort being rewarded by society are winning public acceptance. In contrast, the same concept "Diligence leads to success" also won the highest consent in Punjab but with a lower average compared to Haryana of 1.60, followed by 1.60 of "Dedication to one's work is a virtue," meaning that people are feeling more affinity to their ability and effort than to their society.

In comparison, people in Haryana did not respond very positively to "Any more leisure is not good for the society" and "Idleness is vice" by showing average of 1.80 and 1.71, respectively. In Punjab, "Your society is fair to all" and "Tomorrow will be a better day than today" scored low average of 2.32 and 2.09, respectively, to show low acceptance of these ideas. These figures show that there is a strong desire to relax among people in Haryana while people in Punjab are unable to have positive attitude about social fairness and future.

3) Eviance of social values (deviance of respect and trust)

A survey on deviance of "respect" and "trust" for various subjects was conducted to support these averages of social norm. Similar to the survey on social values, this survey was conducted by asking the respondents' degree of "respect" and "trust" on the subject matter in scale of 1 to 4.

While "respect" simply means "respect," "trust" is a concept that anticipates practical measures in an event of contingency. The two tables below illustrate "respect" and "trust" in terms of average.

Needless to say, these two concepts are closely related to each other and do not represent ideas that are completely different. The trend that could not be seen from this table is that there is hardly any deviance in Haryana with the only significant deviance being that towards the government. Meanwhile, considerable deviance exists against social justice in Punjab, followed by that towards the government and the country. While respect and trust for religion and parents exist at about the same level in Haryana, trust for religion is greater than that towards parents in Punjab. It may be possible to interpret this priority on religious bond over family bond as an inclination towards individualism that has been passed on through religion in the same manner Protestantism formed individualism in Europe through confrontation with God.

Table 35 Social awareness of the village surveyed in Haryana

	Average		t	Significance	P(T<=t) Both sides
	Respect	Trust			
Government	1.74	1.61	1.71		0.08977
Community	1.62	1.55	1.35	*	0.17925
Parliamentarians	1.39	1.47	-0.89	*	0.37380
Political system	2.27	2.18	0.86	*	0.39107
Religion	1.04	1.05	-0.58	*	0.56637
Country	1.06	1.05	0.58	*	0.56637
Friend	1.18	1.17	0.20	*	0.84267
Social justice	1.81	1.80	0.13	*	0.89355
Parents	1.04	1.04	0.00	*	1.00000

* Over 10% and therefore not significant.

Table 36 Social awareness of the village surveyed in Punjab

	Average		t	Significance	P(T<=t) Both sides
	Respect	Trust			
Social justice	1.96	2.17	-2.453		0.01593
Government	1.98	2.16	-2.421		0.01733
Country	1.48	1.63	-1.931		0.05634
Friend	1.54	1.45	1.522	*	0.13126
Community	1.23	1.30	-1.407	*	0.16262
Parliamentarian	2.20	2.31	-1.274	*	0.20562
Politics	2.72	2.82	-1.067	*	0.28871
Religion	1.01	1.00	1.000	*	0.31977
Parents	1.11	1.13	-0.533	*	0.59553

* Over 10% and therefore not significant.

(6) Family planning

Most respondents knew about family planning with 94% and 88% of respondents in Haryana and Punjab, respectively, responding that they knew about the program. The lower percentage in Punjab may be a reflection of large number of elderly persons among the respondents. As for the source of information about family planning, the most common source was Ministry of Health in Haryana and TV program in Punjab. A program combining income generation program and family planning for women of farm households similar to the New-Life Movement introduced post-war Japan had been introduced to the surveyed village in Haryana, and the government may be taking measures with interest in this village. We asked about the family planning practice and expectations they have towards family planning to find out how family reform is actually taking place.

Table 37 Source of information about family planning

	Haryana		Punjab		Total	
	Number	(%)	Number	(%)	Number	(%)
Ministry of Health	25	24.27	5	5.00	30	14.78
TV program	24	23.30	22	22.00	46	22.66
Public hospital	23	22.33	15	15.00	38	18.72
Friend	13	12.62	19	19.00	32	15.76
No response	9	8.74	13	13.00	22	10.84
Radio program	7	6.80	11	11.00	18	8.87
Health unit	1	0.97	7	7.00	8	3.94
Women's federation	1	0.97	0	0.00	1	0.49
Ministry of Population and Welfare	0	0.00	1	1.00	1	0.49
Public hospital	0	0.00	0	0.00	0	0.00
NGO	0	0.00	7	7.00	7	3.45
Total	*103*	*100.00*	*100*	*100.00*	*203*	*100.00*

Different trends in family planning methods can be observed between Punjab and Haryana. Sterilization is most common in Haryana at 30.49%, followed by condom (21.95%) and pill (20.73%). Trend differs considerably in Punjab with condom being the most common method at 53.85%, followed by sterilization (24.36%) and IUD (11.54%). While decisive difference exists between the two villages in the percentages of sterilization and condom, the more "women-friendly" choices made in Punjab are worthy of note.

Table 38 Family planning methods used

	Haryana		Punjab		Total	
	Number	(%)	Number	(%)	Number	(%)
Sterilization	25	30.49	19	24.36	44	27.50
Condom	18	21.95	42	53.85	60	37.50
Pill	17	20.73	2	2.56	19	11.88
IUD	16	19.51	9	11.54	25	15.63
Rhythm method	3	3.66	1	1.28	4	2.50
Others	2	2.44	0	0.00	2	1.25
Hormone injection	1	1.22	0	0.00	1	0.63
Interruption method	0	0.00	5	6.41	5	3.13
Total	*82*	*100.00*	*78*	*100.00*	*160*	*100.00*

It is difficult to ask the reason for not practicing family planning because it is being practiced at very high rates in both of these regions. However, we were able to collect the following results through an effort to gather maximum response. A distinctive fact is that as many as 22% of respondents in Punjab gave "Family planning equipment is too expensive" as the reason, indicating that family planning methods they have selected is "women-friendly" but at the same time requires continuing expenditure.

Table 39 Reasons for not practicing family planning

	Haryana		Punjab		Total	
	Number	(%)	Number	(%)	Number	(%)
Having more children leads to increased opportunities and stronger society	5	4.85	2	2.00	7	3.45
Family planning equipment is too expensive	4	3.88	22	22.00	26	12.81
No longer necessary	4	3.88	3	3.00	7	3.45
Number of children should be decided by God, not people	3	2.91	1	1.00	4	1.97
Having more children leads to stronger society through improvement of economic opportunities	1	0.97	0	0.00	1	0.49
Family planning is not good for health	1	0.97	0	0.00	1	0.49
Not interested	1	0.97	1	1.00	2	0.99
Family planning is a sin	0	0.00	2	2.00	2	0.99
Others	0	0.00	1	1.00	1	0.49
Practicing family planning	84	81.55	68	68.00	152	74.88
Total	*103*	*100.00*	*100*	*100.00*	*203*	*100.00*

(7) Public health

(1) Drinking water

As mentioned in connection with Pakistan, infant mortality must be controlled to attain demographic

transition. In the case of the villages selected in this survey, there were not many health issues as water supply system is fairly well developed. In addition, the fact that tap water does not have to be boiled meets one of the conditions for demographic transition. As majority of people do not boil their water, we can imagine that widespread water supply system has dramatically improved the public health requirements.

Table 40 Source of drinking water

State	Haryana		Punjab		Total	
	Number	Rate(%)	Number	Rate(%)	Number	Rate(%)
River	12	11.65	0	0	12	5.91
Well	8	7.77	11	11	19	9.36
Tap water	82	79.61	88	88	170	83.74
Purchased water	1	0.97	0	0	1	0.49
Others	0	0	1	1	1	0.49
Total	*103*	*100*	*100*	*100*	*203*	*100*

Table41 Whether water is boiled

State	Haryana		Punjab		Total	
	Number	Rate(%)	Number	Rate(%)	Number	Rate(%)
Boiled	3	2.91	5	5	8	3.94
Not Boiled	100	97.09	95	95	195	96.06
Total	*103*	*100.00*	*100*	*100.00*	*203*	*100.00*

(2) Arrangements for illness and childbirth

We asked general questions such as "Where would you go when you become ill?" and "Where would you go when your wife delivers a child?" Replies to these questions are listed in Tables 42 and 43. Hospital s and clinics accounted for majority in both cases to show that people have access to proper medical attention.

Table 42 Measures taken in the event of illness

State	Haryana		Punjab		Total	
	Number	Rate(%)	Number	Rate(%)	Number	Rate(%)
Hospital	75	72.82	40	40.00	115	56.65
Clinic	8	7.77	23	23.00	31	15.27
Health centre	14	13.59	26	26.00	40	19.70
Buy non-prescription drugs at pharmacy	1	0.97	10	10.00	11	5.42
Use medicinal herbs	4	3.88	0	0.00	4	1.97
Others	0	0.00	1	1.00	1	0.49
No response	1	0.97	0	0.00	1	0.49
Total	*103*	*100.00*	*100*	*100.00*	*203*	*100.00*

Table 43 Main places for child delivery

State	Haryana		Punjab		Total	
	Number	Rate(%)	Number	Rate(%)	Number	Rate(%)
Hospital	68	66.02	72	72.00	140	68.97
Clinic	16	15.53	3	3.00	19	9.36
Health centre	8	7.77	12	12.00	20	9.85
Buy non-prescription drugs at pharmacy	1	0.97	0	0.00	1	0.49
Use medicinal herbs	3	2.91	8	8.00	11	5.42
Rest at home	4	3.88	0	0.00	4	1.97
Religious doctors	1	0.97	2	2.00	3	1.48
No response	2	1.94	3	3.00	5	2.46
Total	*103*	*100.0*	*100*	*100.00*	*203*	*100.0*

(3) Existence of children raised by breastfeeding

We also asked about breastfeeding which is important in realizing certain child-bearing intervals and raising healthy infants. The percentage of children that were not breastfed were a mere 2% in Haryana and 12% in Punjab. Although we do not know the reason for this difference, majority of children were breast-fed. Average months breastfeeding was practiced were 12.15 months for Punjab and 13.51 months in Haryana, showing a striking contrast with Pakistan where babies were breastfed for 24 months without exception.

Table 44 Status of breastfeeding

State	Haryana		Punjab		Total	
	Number	Rate(%)	Number	Rate(%)	Number	Rate(%)
Raised children on mother's milk	95	97.94	85	87.63	180	92.78
Did not raise children on mother's milk	2	2.06	12	12.37	14	7.22
Total	*97*	*100.00*	*97*	*100.00*	*194*	*100.00*

Table 45 Number of months breastfeeding was practiced

Staus	Punjab	Haryana
N	85	88
Average (months)	12.15	13.51
Standard deviation (months)	5.220	6.693

(4) Number of child births/deaths and ideal number of children

We also studied the number of children that were actually born. Average number of children of the married child-rearing respondents in the survey villages was not so high at 2.8 in Punjab and 3.0 in Haryana (Table 46). To a question about the so-called sexual selection ("Would you want a boy or a girl if you could only have one child?"), about 80% of the respondents replied "boy" in both villages (Table 47) to reflect an existence of boy preference. In other words, it clearly indicates a prevalence of paternal society throughout this region including Pakistan. Boy preference represents

an obstacle to demographic transition as there are cases where women are forced by peer pressure to continue giving birth until a boy is born. To look at sex ratio at birth, 701.22 and 904.46 girls were born for every 1,000 boys in the surveyed village in Punjab and Haryana, respectively. Although there is a possibility of statistical error because of the small number of samples in this survey, these figures are indeed abnormal. However, an unbalanced sex ratio of 932.9 in the national statistics is seen as an important issue for India's population.

We conducted a comparison assay of male and female births in the surveyed village in Haryana and could not assert any significance. However, we did get a 0.1% significance on the village we surveyed in Punjab (Table 48).[5] It may be that abortion is being used as de facto family planning in the form of prenatal sexual selection. Although they both inhabit the Indian subcontinent and have low ratio of girls, the results for Hindus and Sikhs were completely different from the Muslim population in Pakistan.

Table46 Number of child deliveries

Number	Haryana		Punjab		Total	
	Number	Rate(%)	Number	Rate(%)	Number	Rate(%)
0	2	2.08	3	3.06	5	2.58
1	46	47.92	47	47.96	93	47.94
2	38	39.58	31	31.63	69	35.57
3	5	5.21	14	14.29	19	9.79
4	5	5.21	2	2.04	7	3.61
5	0	0.00	1	1.02	1	0.52
Total	*96*	*100.00*	*98*	*100.00*	*194*	*100.00*

Source: Hearing survey.

Table47 Sexual preference

State	Haryana		Punjab		Total	
	Number	Rate(%)	Number	Rate(%)	Number	Rate(%)
Boy	82	79.61	82	82.00	164	80.79
Girl	20	19.42	12	12.00	32	15.76
No preference	1	0.97	6	6.00	6	3.45
Total	*103*	*100.00*	*100*	*100.00*	*203*	*100.00*

Source: Hearing survey.

[5] *Significant when average number of live births for boys 1.16, average number of live births for girls 1.16, degree of freedom = 98, t = 3.44, P(T<=t) both sides at 0.000854.*

Table48 Difference in male and female births

	Haryana State		Punjab State	
	Boy	Girl	Boy	Girl
Average	1.60	1.45	1.66	1.16
Variance	0.74	1.45	0.84	0.95
Number of observations	98	98	99	99
Degree of freedom	97		98	
t	1.1772		3.441	
P(T<=t) both sides	0.2420		0.001	

Source: Hearing survey.

(8) Conclusion of the field survey

Although the number of questionnaire sheets collected was small, we may have been able to take a glimpse of the little-known social awareness of Hindu and Sikh population through the survey we conducted on social awareness and population/family planning. Both are known as advanced regions in India with well-developed infrastructure such as roads. Punjab has been playing an important role in India's food security as the country's breadbasket and has received support from the government in the form of agricultural subsidies among others. The state also has been maintaining high productivity by taking advantage of the irrigation network built during British India period and tubewell irrigation using the once very abundant groundwater. The seriousness of falling groundwater level, once pointed out by environmental NGOs including Worldwatch Institute, is now understood by the Indian government.

In the past, one had to dig only 5 metres from the ground to find groundwater. Now, it is now not rare for someone to have to dig as low as 100 metres to find water. As it is extremely difficult to replenish a groundwater zone once it is depleted, one cannot readily find an optimistic outlook for the future as long as the high productivity that has supported the abundance of Punjab continues to rely on irrigation centred around tubewells. Such change in the environment may be te cause of cynical outlook prevalent in the Punjab community. One cannot also overlook the fact that Sikhs are more independent and rational compared to Hindus.

Although Hindus and Sikhs share the basic infrastructure, there is a difference between the two in that Hindus are more integrated into the society while Sikhs maintain a more confrontational stance. Considerable difference also exists with the Muslim population in Pakistan in terms of social awareness, turning the relationship between these three religions into a very interesting subject of study. Both of the surveyed villages were more or less equipped with the conditions for supporting demographic transition and are expected to experience further decline in TFR. Number of births was lower than the ideal number of children in the survey results to suggest that family planning is pervasive. Deterioration of conditions in Punjab is a cause of concern as loss of income caused by falling groundwater level and subsequent decline in agricultural productivity may lead to social

unrest. Advancements in the area of population may also lose momentum, giving rise to a need to introduce alternative economic activities to replace rice and wheat.

6. Summary of demographic transition in India

India has an area almost equal to Europe (excluding Scandinavian and Russian Europe) and by far exceeds Europe in terms of diversity of languages and ethnic groups. In addition, the population of India accounts for one-sixth of world population. A closed-in space has been formed in the Indian subcontinent as a result of being blocked by the massive mountains of Himalayas, Hindu Kush and Karakorum to the north and facing the ocean to the south. Its history is filled with invasions and racial migrations to the extent it become the crossroads of civilization and created a world of its own. One does not have to quote Heidegger to realize that we, as existence within the world, live inside our view of the world, sharing that view and reinforcing it through interaction in our lives.

India has incorporated its diversity and complexity into its Hinduistic world view. It justified mundane irrationality and resolved it in retinal manner by dividing society into classes and bringing in the concept of reincarnation. The way of the world is reduced to an order called Dharma within the context of reincarnation and gave no room for establishment of theodicy. The Indian society that has been hierarchized into multiple classes in this world view appears to be going through transformation.

The highest caste in the social caste system of India is the priest class known as Brahman. Intellectual labour is respected and physical labour is slighted under this value. Improvement of literacy rate, which has large impact on demographic transition (particularly on fertility transition), is rapidly advancing in India today. Emphasis on knowledge as a traditional Hindu value may be contributing to this improvement of literacy. Such expansion of education signifies that people of India will have access to information from around the world and be inevitably exposed to modern values of the West. This is the context in which acceptance of modern values is rapidly advancing. One may be able to rephrase this as Hinduistic world view going through transformation as a result of preference that evolved out of Hinduistic world view being supported by the government in the area of social development. World view loses its intrinsic meaning when it is discussed in relative terms. It may be that what was once India's world view is changing into a subsystem of modern world view, i.e. this may be regarded as a process in which people abandon their traditional notion of India being the only world there is and the country becomes not any different from other countries of the world.

No matter how much effort is made, the population of India will certainly increase by large margin because of its huge population and high population increase rate that continued until recent years. If demographic transition is part of process for adapting to various conditions of the modern era, India is rapidly advancing in this process. However, India's population density has already reached the same level as that of Japan and its future increase will inevitably become a large burden for the country. In this sense, further efforts will be needed to reduce such burden as much as possible.

Chapter IV Tasks of cooperation result of field survey

1. Tasks

Let us point out the tasks of cooperation based on our field study. It is necessary to be fully aware of the recklessness of an attempt to discuss the economic assistance to India as a whole based on the case study of two villages. However, the villages included in this study consisted of a village that is most advanced in terms of agriculture and a village that is considerably backward in this respect. I would like to indicate several points from this comparison.

(1) India has attained food self sufficiency from a macro point of view, However, considerable contrast in agricultural condition exists among regions owing to large differences in level of advancement of Green Revolution. In other words, it is always necessary to keep in mind the contrast between northwestern India that sells the majority of grains it produces in the market and regions where even farms with average farm size must purchase grains (typical example of which is Bihar). The reality of economic assistance would therefore differ significantly depending on which of these regions it would target.

(2) The following economic assistance can be offered to agriculturally-advanced regions. The problem these regions would face in the future is depletion of groundwater resources. Groundwater management and conversion to water-saving crops are top-priority tasks.

(3) Economic assistance to agriculturally-backward regions will take various forms. Use of genetically-engineered seeds is starting in India. However, as can be typically seen from the example of gram in Balsamund, it is not necessarily succeeding. Pulses are important source of protein in India which has a large population of vegetarians and increasing their production would offer an effective measure in alleviation of poverty. For this reason, introduction of low-risk pulse varieties is needed in response to changes in production environment. Introduction of dairy farming technology and its guidance, establishment of cold storage and cold chain needed for marketing are needed. Selling milk contributes to stabilizing the income of farm households by bringing income throughout the year. Milk is also an important source of protein and making inexpensive milk available in the market is also effective in improving the nutrition of impoverished people.

2. Challenges of Cooperation Based on the Results of Field Study

(1) Issues related to postharvest loss

Losses after harvest was one of the subjects of this study. It has been commonly believed that about 10% of food is lost after harvest in India. Postharvest losses can be divided by their nature into two categories. One is a problem related to transporting perishable goods such as vegetables and fruits to the market. It is a complex problem that involves improvement of distribution network and cold chain. It is a difficult task to solve as it also requires considerable effort including implementation of market and distribution infrastructure building as well as introduction of the concept of TQC (total quality control). In this sense, a detailed study is needed to adopt concrete assistance measures. In addition, offering support in this area requires significantly large-scaled support that is likely to exceed the scope of assistance that can be offered.

As for the other issue of grain stock, considerable difference of perception existed between the popular theory and the official view with the former arguing that grain stock in India is being significantly lost by flood, insect damage and rat damage. However, according to an interview with Food Corporation of India (FCI), the authority responsible for food stock in India, the loss is only 1% in average although the percentage differs slightly from one grain type to another. Generally speaking, however, it is difficult to readily believe that the rate of loss is so low after observing grain being stored outdoors covered with plastic tarp due to shortage of storage in many occasions. Nevertheless, it is impossible to show the grounds for negating the figures announced by an official body of the Indian Government through our limited study that was conducted over a limited period of time. It is also clear that the Indian Government is not feeling the need for support or improvement in this area. The need for assistance does not exist in this sense, although improvements are likely to be made by simply attaching rat stopper to storage pillars and by placing the items that are placed directly on the floor on a duckboard for air permeability. Moreover, support for storage itself may be effective in view of the fact that food is being stored outdoors due to shortage of storage space.

(2) From the viewpoint of demographic and social structure

The Indian Government is basically taking the required measures to cope with the population problem and there appears to be no need to consider a new direction. As mentioned in this report, the Indian Government is rapidly increasing its expenditure in the areas of social development and health; clear results corresponding to such increased spending are being observed including higher literacy rate, decline in infant mortality and decline in population growth rate. Further promotion

of the present policy is believed to be the most effective measure from the viewpoint of population policy. Population density of India is comparable to that of Japan because of its large population. It is astonishing to think that a country with such high population density has attained self-sufficiency and even has sufficient stock. In this sense, one can argue that problem of food and population does not exist in India, although the situation by no means permits optimism in the long-term.

There are several obvious reasons for this. First, there is the increase in food demand that is predicted to occur from population growth. Time and its impact must be taken into consideration when studying population. Implementation of consistent population policy is very difficult because the time span in this case is longer than the duration of an economic policy or an administration. Once born, population reproduces itself after 20 some years. For this reason, considerable amount of time is needed for population to stabilize after it has swelled. The length of time needed for population to stabilize is referred to as "population momentum". This momentum effect is clearly prevalent in India's population owing to its large scale and history of rapid increase in the past. As a result, population of India will continue to increase by additional 500 million before it stabilizes. Coping with such massive population growth and the increase in food demand resulting from it are at issue.

Second is the constraint originating from water resource that has been revealed by this study. The two states we studied, Punjab and Haryana, have been playing the central role in food production of India as the country's bread basket. The importance of these regions can be seen from the fact that India was able to attain food self-sufficiency as a result of food surplus from these regions being shipped to other regions. However, World Watch Institute and others have been warning since more than 10 years ago from the environmental viewpoint that the groundwater resource that is supporting food production in these provinces are rapidly being depleted. When we conducted our study in 1994, India's Ministry of Agriculture held an optimistic view that such problem does not exist or can be solved. In this recent study, however, their opinion had changed and admitted that groundwater level has dropped significantly in Punjab and Haryana. This means that the Indian Government officially admitted food production in these regions where high productivity has been attained through irrigation agriculture will probably have to decline in the near future.

In Theory of Population, Malthus stated that "population grows exponentially whereas the increase in food production grows in an arithmetic fashion, causing food shortage and famine as a result." The premise for this argument was that "farmland can only be expanded in an arithmetic fashion" and that "there is no room for expansion." It is said that there are hardly any cultivable land left in the world and that the only option available would be to increase the productivity of the farmland that already exists. In the case of India, however, this signifies a predicament in which food

production in Punjab and Haryana that have been meeting the growing food demand through high productivity can not only be increased but may decline in the future.

In other words, we see that, in the case of India, there is a serious problem that further improvement in productivity of these two provinces, which had been meeting the growing demand from increasing population through high productivity, cannot be expected because of substantial increase in population that is expected to occur in the future despite the success in population policy.

Conversion of crops from those requiring large water input such as rice and wheat to vegetables and other cash crops are under way in Punjab and Haryana to cope with depletion of groundwater resource and accompanying decline in groundwater level. As analysed in this report, however, whether these crops can guarantee sufficient income for farmers remains questionable. At the same time, it is clear that such strategy of agricultural diversification would not lead to increased production of staple grains.

The Indian Government is trying to cope with this anticipated increase in grain demand by carrying out agricultural development in regions that have demonstrated relatively low productivity such as Bihar, Maharashtra and Madya Pradesh in an effort to increase productivity in these regions.

From the viewpoint of population, demographic transition in India is most backward in the Ganges river basin in the north and most advanced in lower latitude regions. Female literacy is higher and demographic transition is more advanced in these poorer regions as social development occurred more smoothly in the south where there were less social constraints compared to the Ganges valley where complex social structure was formed because of the longstanding affluence brought about by the rich soil of the flood plains and social development is hindered by the deeply-rooted caste system.

If productivity has historically been low in a country like India where civilization flourished and sufficient human resources existed since ancient times, it is necessary to fully examine its cause. Considering the characteristics of the natural environment such as soil fertility, groundwater reserve and climate, these regions must have demonstrated productivity comparable to Punjab and Haryana. For this reason, it is not sufficient to say that development has not advanced; it would be more reasonable to assume the existence of numerous obstacles from the viewpoint of social structure and rural economy. In this sense, the regions that are earmarked by the Ministry of Agriculture for development and production increase are likely to be regions with rigorous social constraints where such efforts to increase productivity have consistently failed in the past.

While vice minister and officers at the Ministry of Agriculture asked us for technical support, India

has turned out world-class scholars in this area and has sufficient accumulation of technology. It is natural to think that there is not much need for technical assistance.

Then it becomes necessary to determine the nature of assistance that is needed. Social structure and values that seek demographic transition exert maximum influence when it is unconditionally accepted, i.e. when people are not aware of their belief in it or its special value. For this reason, it is extremely difficult for local researchers to uncover the assumptions and problems caused by them when a problem exists in social structure.

To quote a term used in sociology of knowledge, people cannot deviate from the limitations of their own knowledge known as seinsverbundenheit (existential connectedness). In this sense, analysis of social structure from global viewpoint as well as research and study on the realities of rural community and rural economy from a social science perspective will prove to be extremely important in order for India to attain increased food production. In other words, studies for identifying the issues to enable measures that are indispensable in carrying out agricultural development and the findings of such studies will serve as important assistance.

Appendix:

Survey Member, Cooperator, Itinerary and Collected Material

1. Survey Committee

(1) National Committee

Dr. Kawano Shigeto	Emeritus Professor, The University of Tokyo
Dr. Hara Yonosuke	Professor, Institute of Oriental Culture, The University of Tokyo
Dr. Fukui Seiichi	Professor, Graduate School, Kobe University
Dr. Akihiko Ohno	Professor, Aoyama Gakuin University
Mr. Michio Ozaki	Executive Director/ Secretary General, APDA (Asian Population and Development Association)
Mr. Kusumoto Osamu	Assistant Secretary General/ Senior Researcher, APDA
Mr. Takemoto Masanori,	Researcher, APDA
Ms. Ryoko Kimura	Staff, International Affairs, APDA
Ms. Hitomi Tsunekawa	Staff, APDA

(2) Survey Member (August 2, 2004-August 14, 2004)

Dr. Seiichi Fukui	Survey Team Leader
Dr. Akihiko Ohno	Survey Team Member
Mr. Kusumoto Osamu	Survey Team Member
Mr. Takemoto Masanori	Survey Team Member

2. Cooperators

(1) Embassy of Japan in India

Tomofumi Inoue	First Secretary

(2) Counterpart in India

Indian Associtation of Parliamentarians for Population and Development (IAPPD)

Manmohan Sharma	Executive Secretary

(3) Government and Agencies in India

1) Ministry of Agriculture, Government of India

Kanti Lal Bhuria	Minister of State for Agriculture
Gautam Basu	Additional Secretary & Financial Adviser
Anjali Prasad	Joint Secretary
O. P. Hisaria	Deputy Secretary

2) Department of Agriculture, Government of Punjab

Dr. Ajmer Singh	Director
Gurdial Singh	Joint Director Agriculture (Hydrology)
Rarjet Ly	Manager marketing
Swinder Singh	Agriculture Information Officer
Dr. Bhupinder Singh Shahpuri	Cane Commissioner
Dr. Gurde Singh Gibb	Joint Director Agriculture
Dr. Mangan Singh Sandhu	Joint Director Agriculture
Jogi Jagdip Singh	Joint Director Agriculture
Fatehjang Singh	Joint Director Agriculture (Statistics)
Dr. Harwinder Singh Bhatti	Joint Director Agriculture
Dr. Raj Kataria	Agriculture Engineer (Tubewells)
Rajesh Vashisht	Assistant Geologist Ground Watercell
Dr. Kirpal Singh	Agricultural Development Officer
Dr. B.S. Gill	Agricultural Development Officer
Gurmukh Singh	Agricultural Development Officer
Gurcharan Singh	Agricultural Development Officer
K.S. Grewal	Agricultural Officer
Tajindar Kumar	Agricultural Development Officer

Dr. Baldev Singh	Agricultural Development Officer
Dr. Balwant Singh	Agricultural Development Officer
Kaur Singh	Agricultural Development Officer
Atma Singh	Village Development Officer

3) Punjab Agricultural University

Dr. K. S. Aulakh	Vice-Chancellor
Dr. Ajit Singh Dhatt	Director, Punjab Horticultural Postharvest, Technology Centre
Dr. B. S. Ghuman	Senior Research Engineer-Cum-Head, Department of Processing & Food Engineering, College of Agricultural Engineering
Dr. Joginder Singh	Professor of Agricultural Economics, Department of Economics
Dr. Ashok Kumar	Research Engineer
Dr. Amaryit Singh	Extension Engineer, Department of Processing & Food Engineering
Gurpreet Singh Gill	Research Associate, Department of Economics
Ravinder Singh	Research Associate, Department of Economics
Anil Chopra	Research Associate, Department of Economics
Satwinder Singh	Research Associate, Department of Economics
Sukhjinder Singh	Research Associate, Department of Economics

4) Economic & Statistic Department, Punjab

Mrs. Urmiljit Kaur Khosa	Joint Director

5) Commercial Agriculture Finance Branch, Ludhiana

Harbhajan Singh Gill	Senior Branch Manager

6) Department of Agriculture, Government of Haryana

Rajeev Arora	Director
Sh. H. S. Lohan	Project Director (Kandi), Integrated Watershed Development Project
Kehar Singh	Joint Director (Statistics)

J. S. Vashishtha	Additonal Director Agriculture
R.S. Mehla	Additonal Director Agriculture
Dr. Baldev Singh	Chief Agricultural Officer
Dr. Rajinder Singh Pandher	Chief Agricultural Officer
Dr. Suhlarh Chasido	Sub-Director Agricultural Officer
Dr. Subhash Chander	Sub-Divisional Agricultural Officer
Dr. Parveen Kumar Gulia	Subject Matter Specialist
Dr. Surindar Lal Yadav	Agricultural Development Officer
Dr. Braham Singh	Agricultural Development Officer

7) Economic & Statistical Organization, Haryana

Ranvir Gupta	Economic & Statistical Adviser
V. K. Gupta	Deputy Economic & Statistical Adviser

8) Ludhiana - City

Sh. S.K. Sharma	Commissioner

9) CCS Haryana Agricultural University

M. K. Miglani	Vice-Chancellor
Dr. Styaveer	Dean, College of Agriculture
Dr. Prithri Ray	Deputy Director of Agriculture
Dr. R.S. Kadiam	SES, Professor, Department of Extension, Education
Dr. R.S. Dhukia	Professor, Senior Extension, Department of Extension, Education
Dr. H.K. Verma	Professor, Department of Extension, Education
E.Rajinder. Singh	Representative, Department of Soil & Watershell
Dr. M.S. Joon	Hod, Department of Watercultivate
Dr. Parveen Kumar	Subject Matter Specialist (Agronomy), Department of Agriculture
Dr. R. K. Punia	Professor, Sociology, Directorate of Extension
Dr. R. K. Malik	HOD Agriculture, HOD, Dean PGs
Dr. S. S. Damiya	HOD Soil, HOD, Soil Science
Dr. Sutyavir	Director of Extension & Dean
Dr. H. D. Yadav	Associate Director (Farm Advisory Service), Department of Extension, Education

Dr. R. S. Dhukia	Professor, Directorate of Extension Education
Dr. R.S. Kadian	Professor, Agricultural Economics
Mr. Jayender Yadav	College of Agriculture
Mr. Mahesh Kumar Bhatia	College of Agriculture
Ms. Shalini Mehta	College of Agriculture
Ms. Mamta Kajla	College of Agriculture
Dr. Urmila Devi(Mrs.)	College of Agriculture
Mr. Sunil Kumar	College of Agriculture
Mr. Dharminder	College of Agriculture

10) National Cooperative Union of India

Dr. S.S. Sisodia	President

11) Food Corporation of India (FCI)

Javed Yusufzai	Executive Director (Commercial)
S. S. Singh Gautam	Manager (Quality Control)
R. C. Chonlhary	Manager
R. P. Vaishnaw	Additional Financial Adviser
K. B. Sobti	Joint Manager
K. L. Sharma	Manager (Stocks)
V. P. Sharma	Junior Manager (Stocks)

3. Survey Schedule

Aug 1 (Sun)	・Depart from Kansai (Fukui). Arrive at Narita.
	・12:00 Depart from Narita (AI301) (Fukui, Ohno, Kusumoto, Takemoto).
	・16:55 Arrive at Delhi .
Aug 2 (Mon)	・Visit to the Embassy of Japan. Briefing on Indian agricultural situation.
	・Discuss the survey with Mr. Monmohan Sharma, Executive Secretary, the Indian Association of Parliamentarians on Population and Development (IAPPD).
	・Material Collection
Aug 3 (Tue)	・Move from Delhi to Chandigarh.
	・Meeting with Director Agriculture and other senior officers.
	・Visit to the Statistical Office of Punjab State Government.

Aug 4 (Wed)	・Meeting with Director of Agriculture Haryana and Visit to the Statistics Department of Haryana. ・Depart from Chandigarh to Ludhiana. ・Meeting with Officials of Department Agriculture on Field Survey in Ludhiana.
Aug 5 (Thu)	・Conducting the field survey in Ludhiana.(Alamgir) ・Meeting with Patwari of Alamgir village.
Aug 6 (Fri)	・Conducting the field survey in Ludhiana (Ohno, Takemoto). ・Visit to Department of Economics, Punjab Agriculture University (Fukui, Kusumoto) ・Meeting with Vice Chancellor, Punjarb Agriculture University ・Visit to School of Engineering and Department of Power ・Visit to Post harvesting facility
Aug 7 (Sat)	・Conducting the field survey in Ludhiana ・Visit Nehru Trustm and Mittal Institute on the way to village ・Visit to Agriculture Bank, Punjarb and discussion on agriculture loan system with staff.
Aug 8 (Sun)	・Depart from Hotel to Hisar. ・Meeting with Professors and Staff of Hisar Agricultural University on Filed Survey in Hisar.
Aug 9 (Mon)	・Conducting the field survey in Hisar/Visit to the post-harvest facilities.
Aug 10 (Tue)	・Conducting the field survey in Hisar/Visit to the post-harvest facilities. ・Meeting with Dean of Hisar Agricultural University. ・Depart from Hisar. Arrive at Delhi.
Aug 11 (Wed)	・Depart from Delhi (TG316) (Fukui). ・Visit to the Department of Statistics. Material collection. (Ohno, Kusumoto, Takemoto)
Aug 12 (Thu)	・Visit to the Department of Statistics. Briefing on statistics of India. ・Meeting with Staff of Food Corporation of India (FCI). ・Visit to the Department of Statistics. Material collection.
Aug 13 (Fri)	・Visit to the Ministry of Agriculture. Briefing on agricultural economy of India and post-harvest problems. ・Courtesy call on Minister of Agriculture, Government of India. ・17:40 Depart from Delhi (AI306).
Aug 14 (Sat)	・8:00 Arrive at Narita.

4. Collected Material

1. Department of Agriculture and Co-operation Ministry of Agriculture, Government of India, *Reports of the Commission for Agricultural Costs and Prices for the Crops Sown During 2002-2003 SEASON*, 2003, New Delhi.
2. Government of India, *Economic Survey 2003-2004*, New Delhi.
3. Prakash Tandon, *Punjabi Saga 1857-2000 The Monumental Story of Five Generations of a Remarkable Punjabi Family*, 2000, New Delhi.
4. Pashaura Singh and N. Gerald Barrier (eds.), *Sikhism and History*, Oxford University Press, 2004, New Delhi.
5. W. H. McLeod, *Exploring Sikhism Aspects of Sikh Identity, Culture, and Thought*, Oxford University Press, 2000, New Delhi.
6. Basanta Kumar Pradhan and P. K. Roy, *The Well Being of Indian Households,* MIMAP - India Survey Report, Tata McGraw-Hill, 2003, New Delhi.
7. Bibek Debroy, *India's Agricultural Exports in the Post Uruguay Round Set Up: Implication, Prospects and Policies,* Report No.3, NCAER (National Council of Applied Economic Research), 2000, New Delhi.
8. G. Chakrabarty and P. K. Ghosh, *Human Development Profile of Scheduled Castes and Tribes in Rural India: A Bench Mark Survey*, Report No.4, NCAER, 2000, New Delhi.
9. Rakesh Mohan, *Small Scale Industry Policy in India: A Critical Evaluation*, NCAER, 2001, New Delhi.
10. V. Selvaraju, *Health-Care Expenditure in Rural India,* NCAER Working Paper Series no.90, NCAER, 2003, New Delhi.
11. Anil Gumber, *Determinants of Unemployment in Rural India: An Exploration of NCAER Household Survey Data of 1994,* NCAER Working Paper Series no.89, NCAER, 2002, New Delhi.
12. Jandhyala B. G. Tilak, *Determinants of Household Expenditure on Education in Rural India,* NCAER Working Paper Series no.88, NCAER, 2002, New Delhi.
13. P. N. Mari Bhat, *Levels and Differentials in Maternal Mortality in Rural India: New Evidence from Sisterhood Data,* NCAER Working Paper Series no.87, NCAER, 2002, New Delhi.
14. P. N. Mari Bhat, *Demographic Transition, Family Size and Child Schooling,* NCAER Working Paper Series No.86, NCAER, 2002, New Delhi.
15. Abusaleh Shariff and Geeta Singh, *Determinants of Maternal Health Care Utilisation in India: Evidence from a Recent Household Survey,* NCAER Working Paper Series No.85, NCAER, 2002, New Delhi.
16. Malathy Duraisamy, *Child Schooling and Child Work in Rural India,* NCAER Working Paper Series no.84, NCAER, 2002, New Delhi.

17. Amitabh Kundu, Abusaleh Shariff and P. K. Ghosh, *Indexing Human Development in India: Indicators, Scaling and Composition,* NCAER Working Paper Series no.83, NCAER, 2002, New Delhi.

18. Indrani Gupta and Purnamita Dasgupta, *Demand for Curative Health Care in Rural India: Choosing Between Private, Public and No Care,* NCAER Working Paper Series no.82, NCAER, 2002, New Delhi.

19. Peter Lanjouw and Abusaleh Shariff, *Rural Non-Farm Employment in India: Access, Income and Poverty Impact,* NCAER Working Paper Series no.81, NCAER, 2002, New Delhi.

20. P. M. Kulkarni, *Inter-State Variations in Human Development Differentials Among Social Groups in India,* NCAER Working Paper Series no.80, NCAER, 2002, New Delhi.

21. Jeemol Unni, *Earnings and Education Among Ethnic Groups in Rural India,* NCAER Working Paper Series no.79, NCAER, 2001, New Delhi.

22. P. Duraisamy, *Health Status and Curative Health Care in Rural India,* NCAER Working Paper Series no.78, NCAER, 2001, New Delhi.

23. Vani K. Borooah, *Do Children in India Benefit from Having Mothers Who Are Literate?,* NCAER Working Paper Series no.77, NCAER, 2001, New Delhi.

24. Jandhyala B. G. Tilak and Ratna M. Sudarshan, *Private Schooling in Rural India,* NCAER Working Paper Series no.76, NCAER, 2001, New Delhi.

25. Devendra Kumar Pant, *Human Development, Demographic Transition and Economic Growth Linkage: An Econometric Analysis with Indian Data,* NCAER Working Paper Series no.67, NCAER, 1997, New Delhi.

26. K. N. Rai and J. C. Karwasra, *Economic Implications of Drought Under Different Farming Situations in Haryana,* NATP Study Series no.1, Department of Agricultural Economics, CCS, Haryana Agricultural University, 2004, Hisar.

27. R. K. Khatkar, K. N. Rai and V. K. Singh, "Profitability of Crops in Haryana", *Reseach Bulletin* no.51, Department of Agricultural Economics, CCS, Haryana Agricultural University, 2004, Hisar.

28. National Sample Survey Organization, Ministry of Statistics and Programme Implementation, Government of India, *Household Consumer Expenditure and Employment - Unemployment Situation in India* NSS 58th Round July-December 2002, Report no.484, 2003.

29. National Sample Survey Organization, Ministry of Statistics and Programme Implementation, Government of India, *Household Consumer Expenditure and Employment - Unemployment Situation in India, 2001-2002* NSS 57th Round July 2001-June 2002, Report no.481, 2003.

30. National Sample Survey Organization, Department of Statistics, Government of India, *Energy Used by Indian Households 1999-2000* NSS 55th Round (July 1999- June 2000), Report no.464, 2001.

31. National Sample Survey Organization, Department of Statistics, Government of India, *Household Consumer Expenditure in India: Key Results*, Report no.453, 2000.

32. National Sample Survey Organization, Department of Statistics, Government of India, *Household Consumer Expenditure and Employment Situation in India 1997* NSS 53rd round, January - December 1997, Report no.442, 1998.

33. National Sample Survey Organization, Department of Statistics, Government of India, *Household Consumer Expenditure and Employment Situation in India 1995-96* NSS 52nd Round, July 1995- June 1996, Report no.440, 1998.

34. National Sample Survey Organization, Department of Statistics, Government of India, *Household Consumer Expenditure and Employment Situation in India 1994-95* NSS 51st Round, July 1994- June 1995, Report no.436, 1998.

35. National Sample Survey Organization, Department of Statistics, Government of India, *Unorganised Manufacturing Sector in India; Salient Features* NSS Fifty-first round, July 1994- June 1995, Report no.434, 1998.

36. National Sample Survey Organization, Department of Statistics, Government of India, *Unorganised Manufacturing Sector in India; Its Size, Employment and Some Key Estimates* NSS Fifty-first round, July 1994- June 1995, Report no.433, 1998.

37. National Sample Survey Organization, Department of Statistics, Government of India, *Migration in India January - June 1993* NSS 49th Round, Report no.430, 1998.

38. National Sample Survey Organization, Department of Statistics, Government of India, *Sources of Household Income in India, 1993-94: Fifth Quinquennial survey of consumer expenditure* NSS 50th Round 1993-94, Report no.413, 1997.

39. National Sample Survey Organization, Department of Statistics, Government of India, *Economic Activities and School Attendance by Children of India: Fifth Quinquennial Survey*, NSS 50th Round 1993-94, Report no.412, 1997.

40. National Sample Survey Organization, Department of Statistics, Government of India, *Nutritional Intake in India* NSS 50th Round July 1993-June 1994, Fifth Quinquennial Survey on Consumer Expenditure, Report no.405, 1996.

41. National Sample Survey Organization, Department of Statistics, Government of India, *Key Results on Household Consumer Expenditure, 1993-94* NSS 50th Round July 1993- June 1994, Report no.401, 1996.

42. National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Government of India, *Differences in Level of Consumption among Socio-Economic Groups 1999-2000* NSS 55th Round (July 1999- June 2000), Report no.472 (55/1.0/10), 2001.

43. National Sample Survey Organisation, Ministry of Statistics & Programme Implementation, Government of India, *Nutrition Intake In India* NSS 55th Round (July 1999- June 2000), Report no.471 (55/1.0/9), 2001.

44. National Sample Survey Organisation, Ministry of Statistics & Programme Implementation, Government of India, *Migration in India 1999-2000* NSS 55th Round (July 1999- June 2000), Report no.470 (55/10/8), 2001.

45. National Sample Survey Organisation, Department of Statistics, Government of India, *Maternal and Child Health Care in India* NSS Fifty-second Round July 1995- June 1996, Report no.445 (52/25.0/2), 1998.

46. National Sample Survey Organisation, Department of Statistics, Government of India, *Household Consumer Expenditure and Employment Situation in India* NSS Fifty-fourth Round January - June 1998, Report no.448 (54/1.0/1), 1999.

47. National Sample Survey Organisation, Department of Statistics and Programme Implementation, Government of India, *Cultivation Practices in India* NSS 54th Round January 1998 - June 1998, Report no.451 (54/31/3), 1999.

48. National Sample Survey Organisation, Ministry of Statistics & Programme Implementation, Government of India, *Household Consumer Expenditure and Employment - Unemployment Situation in India, 2000 - 2001* NSS 56th Round (July 2000 - June 2001), Report no.476 (56/1.0/1), 2002.

49. National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Government of India, *Literacy and Levels of Education in India 1999-2000* NSS 55th Round (July 1999- June 2000), Report no.473 (55/1.0/11), 2001, New Delhi.

50. National Sample Survey Organisation, Ministry of Statistics & Programme Implementation, Government of India, *SARVEKSHANA Journal of National Sample Survey Organisation*, 86th Issue April 2001 - September 2001 Vol. XXIV No.4 & Vol.XXV No.1, Printed by Veerendra Printers, New Delhi.

51. Government of India, Ministry of Labour, Labour Bureau, Shimla/Chandigarh, *Indian Labour Year Book 2002 And 2003*, 2003, Printed by the Printing Unit Labour Bureau Shimla.

53. Government of India, Ministry of Agriculture, Department of Animal Husbandry & Dairying, Krishi Bhavan, New Delhi, *Basic Animal Husbandry Statistics 2002*, AHS SERIES-8, 2002, Printed by the Manager, Government of India Press, New Delhi/Published by the Controller of Publications, Delhi.

54. Central Bureau of Health Intelligence, Directorate General of Health Services, Ministry of Health & Family Welfare, Government of India, *Health Information of India 2000 & 2001*, 2003, Published by Controller of Publication, Civil Lines, Delhi.

55. Central Statistical Organisation, Ministry of Statistics & Programme Implementation, Government of India, *Statistical Abstract India 2002*, 2003, Printed by the Manager, Government of India Press, New Delhi/Published by the Controller of Publications, Civil Lines, Delhi.

56. Department of Agriculture And Cooperation, Ministry of Agriculture, Government of India, *Annual Report 2003-2004*, Printed by Caxton Press, New Delhi.

57. Dr. P.D. Joshi/National Sample Survey Organisation Department of Statistics Ministry of Planning and Programm Implementation, Government of India, *Changing Pattern of Consumption Expenditure In India And Some Selected States* Sarvekshana Analytical Report

Number 2, 1998, Printed by Manager, Government of India Press, New Delhi.

58. Sunil Gulati Ias, Director of Census Operatons, Haryana, *Census of India 2001 Provisional Population Totals*, Paper - 2 of 2001 Series - 7, Printed at Roxana Printers, Chandigarh/Published by the Controller of Publications, Civil lines, Delhi.

59. Sunil Gulati, Director of Census Operations, Haryana, *Census of India 2001: Tables on Houses, Household Amenities and Assets*, Series - 7, 2004, Printed by Public Printing (Delhi) Service, New Delhi/Published by the Controller of Publications, Civil Lines, Delhi.

60. Jayant Kumar Banthia of the Indian Administrative Service, Registrar General & Census Commissioner, India, *Census of India 2001 Tables on Houses, Household Amenities and Assets*, Series -1, 2003, Printed by Chandra Prabhu offset Printing Works, New Delhi/Published by Controller of Publication, Civil Lines, Delhi.

61. Sunil Gulati Ias, Director of Census Operations, Haryana, *Census of India 2001 Provisional Population Totals*, Paper - 3 of 2001 Series - 7, Printed at Roxana Printers, Chandigarh/Published by the Controller of Publications, Civil lines, Delhi.

62. Publication Division, Directorate of Economics & Statistics, (Department of Agriculture & Co-Operation), Ministry of Agriculture, Government of India, *Area And Production of Principal Crops In India 1997 -98*, Seventy-Nine Issue, 2000, Printed by the General Manager, Govt. of India Press, Nashik/Published by the Controller of Publications, Delhi.

63. Directorate of Economics & Statistics, Department of Agriculture & Cooperation, Ministry of Agriculture, Government of India, *Agricultural Prices In India 1999 & 2000*, TWENTYTHIRD EDITION, 2003, Published by Controller of Publication, Civil Lines, Delhi.

64. Department of Agriculture & Co-Operation, Ministry of Agriculture, Government of India, *Reports of The Commission For Agricultural Costs And Prices* for the crops sown during 2002-2003 season, 2003, Printed by the Manager, Government of India Press, New Delhi/Published by the Controller of Publications, Delhi.

65. Government of India, Ministry of Agriculture, Department of Agriculture & Cooperation, Directorate of Economics & Statistics, *Cost of Cultivation of Principal Crops in India* FEBRUARY - 2000.

66. Agro-Economic Research Division, Directorate of Economics And Statistics, Department of Agriculture And Co-Operation, Ministry of Agriculture, Publication Division, Government of India, *Year Book of Agro-Economic Research Studies 1997 To 1999*, 2001, Printed by the Manager, Government of India Press, New Delhi.

67. Directorate of Economics & Statistics, Department of Agriculture & Cooperation, Ministry of Agriculture, Government of India, *Land Use Statistics At A Glance 1996-97 & 1997-98*, 2001, Published by Controller of Publication, Civil Lines, Delhi.

68. Agriculture Statistics Division, Directorate of Economics & Statistics, Department of Agriculture & Cooperation, Ministry of Agriculture, Government of India, *Indian Agriculture*

In Brief 27th Edition (JAN. 2000), 2000, Printed by Directorate of Economic & Statistics, Department of Agriculture & Cooperation, Ministry of Agriculture, New Delhi.

69. Jayant Kumar Banthia of the Indian Administrative Service, Registrar General & Census Commissioner, India, *Census of India 2001 Final Population Totals*, Series1: India, Published by Controller of Publication, Civil Lines, Delhi.
70. Jayant Kumar Banthia of the Indian Administrative Service, Registrar General & Census Commissioner, India, *Census of India 2001 Primary Census Abstract Total Population: Table A-5*, Series - 1, 2004, Printed by Public Printing (Delhi) Service, New Delhi/Published by the Controller of Publications, Civil Lines, Delhi.
71. Government of Haryana, *Statistical Abstract of Haryana 2002-03*, 2004.
72. Government of Haryana, *Statistical Abstract of Haryana 1995-96*, 1997.
73. Government of Haryana, *Statistical Abstract of Haryana 1998-99*, 2000.
74. Government of Punjab, *Statistical Abstract of Punjab 1994.*
75. Government of Punjab, *Statistical Abstract of Punjab 2003.*
76. Government of Punjab, *Statistical Abstract of Punjab 1997.*
77. Government of Haryana, *Family Budgets of Cultivators In Haryana 1990-91.*
78. Government of Haryana, *Family Budgets of Cultivators In Haryana 1991-92.*
79. Government of Haryana, *Family Budgets of Cultivators In Haryana 1992-93.*
80. Government of Haryana, *Family Budgets of Cultivators In Haryana 1993-94.*
81. Government of Haryana, *Family Budgets of Cultivators In Haryana 1994-95.*
82. Government of Haryana, *Family Budgets of Cultivators In Haryana 1995-96.*
83. Government of Haryana, *Family Budgets of Cultivators In Haryana 1996-97.*
84. Government of Haryana, *Family Budgets of Cultivators In Haryana 1997-98.*
85. Government of Haryana, *Family Budgets of Cultivators In Haryana 1998-99.*
86. Government of Haryana, *Family Budgets of Cultivators In Haryana 1999-2000.*
87. Government of Haryana, *Family Budgets of Cultivators In Haryana 2000-2001.*
88. Government of Punjab, *Family Budgets of Cultivators In Punjab 1990-91.*
89. Government of Punjab, *Family Budgets of Cultivators In Punjab 1991-92.*
90. Government of Punjab, *Family Budgets of Cultivators In Punjab 1992-93.*
91. Government of Punjab, *Family Budgets of Cultivators In Punjab 1993-94.*
92. Government of Punjab, *Family Budgets of Cultivators In Punjab 1994-95.*
93. Government of Punjab, *Family Budgets of Cultivators In Punjab 1995-96.*
94. Government of Punjab, *Family Budgets of Cultivators In Punjab 1996-97.*
95. Government of Punjab, *Family Budgets of Cultivators In Punjab 1997-98.*
96. Government of Punjab, *Family Budgets of Cultivators In Punjab 1998-99.*
97. Government of Punjab, *Family Budgets of Cultivators In Punjab 1999-2000.*
98. Government of Punjab, *Family Budgets of Cultivators In Punjab 2000-2001.*
99. Government of Haryana, *Economics of Farming In Haryana 1990-91.*

100. Government of Haryana, *Economics of Farming In Haryana 1991-92.*
101. Government of Haryana, *Economics of Farming In Haryana 1992-93.*
102. Government of Haryana, *Economics of Farming In Haryana 1993-94.*
103. Government of Haryana, *Economics of Farming In Haryana 1994-95.*
104. Government of Haryana, *Economics of Farming In Haryana 1995-96.*
105. Government of Haryana, *Economics of Farming In Haryana 1996-97.*
106. Government of Haryana, *Economics of Farming In Haryana 1997-98.*
107. Government of Haryana, *Economics of Farming In Haryana 1998-99.*
108. Government of Haryana, *Economics of Farming In Haryana 1999-2000.*
109. Government of Haryana, *Economics of Farming In Haryana 2000-01.*
110. Government of Punjab, *Economics of Farming In Punjab 1990-91.*
111. Government of Punjab, *Economics of Farming In Punjab 1991-92.*
112. Government of Punjab, *Economics of Farming In Punjab 1992-93.*
113. Government of Punjab, *Economics of Farming In Punjab 1993-94.*
114. Government of Punjab, *Economics of Farming In Punjab 1994-95.*
115. Government of Punjab, *Economics of Farming In Punjab 1995-96.*
116. Government of Punjab, *Economics of Farming In Punjab 1996-97.*
117. Government of Punjab, *Economics of Farming In Punjab 1997-98.*
118. Government of Punjab, *Economics of Farming In Punjab 1998-99.*
119. Government of Punjab, *Economics of Farming In Punjab 1999-2000.*
120. Government of Punjab, *Economics of Farming In Punjab 2000-01.*
121. Government of Haryana, *Sterilization Programme In Haryana: An Evaluation Study*, 1987.
122. Government of Haryana, *A Study on Impact of Investment of "Energisation of 12 tubewells and laying of R.C.C.pipe lines" on beneficiaries in Block-Pinjore of District Panchkula.*
123. Government of Haryana, *Evaluation Study of Flat Rate Tariff On Tubewells In Haryana*, 1984.
124. Government of Haryana, *An Evaluation Study of Sprinkler Irrigation in Haryana*, 1995.
125. Government of Haryana, *Evaluation Study of the Impact of Seed Production and Distribution of Foodgrains in Haryana*, 1986.
126. Government of Haryana, *Evaluation Study of Demand, Availability and Problems of Institutional Finance for Agriculture and Rural Industries in Haryana*, 1990.
127. Government of Haryana, *Household Consumer Expenditure And Employment-Unemployment Situation In Haryana*, 2003.
128. Government of Haryana, *Unorganised Manufacturing Enterprises In Haryana*, 2003.
129. Government of Haryana, *Condition of Slums In Haryana*, 2004.
130. Government of Haryana, *Estimates of Gross Fixed Capital Formation Haryana 1993-94 To 2001-2002*, 2004.
131. Government of Haryana, *State Domestic Product of Haryana 1993-94 To 2002-03*, 2004.
132. Government of Haryana, *Index of Industrial Production in Haryana 2001-02*, 2004.

133. Punjab State Seed Certification Authority Chandigarh, *26th Annual Progress Report 2001-2002.*

134. Government of Punjab, *Deep Tubewells Installed By Punjab State Tubewell Corporation* , 1990.