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Chapter 18

A case study on changing pattern of agriculture and related factors at Najibabad region of Bijnor, India

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Abstract

The study was conducted to assess the changing pattern of agriculture and related factors at Najibabad in Bijnor district of Uttar Pradesh. Survey was conducted in the study area for data

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collection. Data were collected from the villagers and farmers following simple random sampling technique, compiled and interpreted as per objectives of the study. Most of the farmers were middle aged and they had primary level of education with small and large farm size. Education level was increased among the farming families but the famers do not want to involve their educated children in farming therefore it was very difficult to increase the awareness among the farming families. A very less number of young aged children were found in the farming profession. About 70% of the farmers had medium knowledge on use of agro-chemicals in the crops. Land consolidation was also observed in the study area. During the last eight years minimum and maximum temperature was found nearly constant in the study area. During the last eight years rainfall was decreased from 170mm to 90mm. Therefore arrangement of need based training with more extension contact for the farmers and awareness campaign will be helpful to improve the behaviour of using agro-chemicals.

Keywords: Agro-chemicals, Crop production, Contaminants, Hand to mouth, Land consolidation, Land fragmentation

Introduction

Agriculture is the science and art or practice of cultivating the soil for the growing of crops, and raising livestock and the rearing of animals to provide food, wool, and other products and marketing of the resulting products. After hunting agriculture is the second oldest profession that mankind has learnt. Agriculture accounts for about one seventh of the GDP, provides sustenance to nearly two-third of our population. Besides, it provides crucial backward and forward linkages to the rest of the economy (MOCF, 2018). Agriculture has progressed from the primitive nomadic hand to mouth exercise to the present commercially profitable practice with the advancement of agricultural research and development efforts over several centuries. During last few decades it is observed that Indian agriculture has continuously switched over from traditional to scientific manner (Kuba and Jha, 2008). It is well known that agriculture is one of the backbones of the Indian economy and sustainability in the agricultural sector must address the issues of food security and stable generation of income for a fastly growing population (Lee, 2005; Bhutto and Bazmi, 2007). To achieve maximum production and to earn maximum profit Well-judged application of fertilizers by the farmers in crops is very much essential. Most of the farmers are using continuously larger quantities of chemical fertilizers to increase production without knowing the fertility status of the soils of their fields (Srivastava and Pandey, 1999; Yadav *et al.,* 2006). Declined soil fertility can be combat by traditional practices. The traditional practices include a wise use of livestock in cropping systems, where livestock provides traction power for tillage, manure for organic matter and cash income for the purchase of mineral fertilizers. The manure is obtained through symbiotic arrangements between farmers and herdsmen where animals are corralled on farmers' fields in exchange for food (Enyong *et al.,* 1999).

Adoption of new agricultural technology is influenced by physical, mental and socio-economic factors including, agro-ecological conditions, age, family size, education, source of information, and farmer's attitudes towards the technology (Feder *et al.,* 1985; Rogers, 2003; Neupane *et al.,* 2002). Farmers of high rainfall regions are more likely to be found to adopt improved maize varieties and chemical fertilizers (Kaliba *et al.,* 2000; Hintze *et al.,* 2003). In comparison to old farmers, young farmers easily adopt a new technology because they have had more schooling and are more susceptible to attitude change (CIMMYT, 1993; Byerlee, 1994). Education level also affects the decision making and the adoption of agricultural technologies. Family size plays a role on labour provision. Adoption of new varieties requires more labour inputs (Feder *et al.,* 1985). Knowledge influences adoption. Farmers who have sufficient knowledge of technology use are likely to adopt it easily (Abebaw and Belay, 2001; Rogers, 2003). Farmers' attitudes determine adoption of improved technology. Attitudes are evaluative responses towards the technology, and are formed as farmers gain information about it. Adopters tend to hold positive attitudes towards the technology (Chilonda and Van Huylenbroeck, 2001).

Presently the world shows considerable worries on the destructive effects of advanced agricultural technologies on the environment, natural resources and long-term sustainability of agronomy systems (Sadati *et al.,* 2010). Soil erosion, water pollution, excessive use of chemicals, waste of water, destruction of natural habitats for wildlife and insects and pests resistance against insecticide and pesticide are only a few of the concerns expressed by environmentalists, public, agricultural professionals, policy makers and farmers (Leeuwis, 2004; Al-Subaiee *et al*., 2005). Despite these environmental effects at many places, the modern agriculture has been involved in many economic and social changes both in the industrial and developing countries. Among this involvement one may name: loss of job, transfer of economic opportunities from men to women, increasing specialization in livelihood, the rural institutions becoming governmental and many other cases (Pretty, 1995; Atte, 1989; Minakshi and Pirabu, 2015). Large number of small and marginal farmers (82%) pose momentous challenge to Indian agriculture (Bhalla *et al.,* 2012) because it rises the problems like land fragmentation, poverty (Chand *et al.,* 2011), low bargaining power to farmers, low risk bearing ability, low productivity, low extension contact etc. (Hegde, 2010; Nikam *et al.,* 2015). The problem of productivity dissimilarity (risk) among farms is more noticeable in areas with uncertain water supply (Abel, 1975). The presence of risk in agriculture has long been viewed as having a serious impact on farmers' production decisions (Bond and Wonder, 1980; Sekar and Ramasamy, 2001).

Due to uncertain and low rainfall, harsh weather, degraded soil fertility, lack of knowledge and lack of irrigation facility the agriculture in the area under study is going to become restrict to only some people. A large number of the people handover their agricultural land to other people on share basis. As the census indicates that population in the city become approximately four times during the last twenty years. Increasing population put a pressure on the natural resources as well as on the agriculture. Large population demands more food but area available for agriculture is decreasing continuously.

The present study was undertaken to study the problems of agriculture, changing Pattern of crops and use of fertilizers by the farmers. The objectives of the present study are as follows:

- To study the increase or decrease in the number of farmers in the selected villages.
- To study the changing pattern of crops and agricultural land in the area.
- To study the changing pattern of fertilizer used by the farmers.
- To study the type of pesticides, insecticides and herbicides used by the farmers.

Materials and methods

Study area

The study was conducted at city Najibabad (Figure 18.1) in in Bijnor district of Uttar Pradesh. Bijnor, or more correctly Bijnaur occupies the north–west corner of the Rohilkhand (between 29°2′ and 29°57′ North latitude and 77°59′ and 78°56′ East longitude) and is roughly triangular stretch of country with its vertex to north. The western boundary is formed throughout by the deep stream of the river Ganga. Other rivers in the district are the Kho, Ban, Gangan, Karula, Malini, Chhoiya, Pili, Ghosan, Dara Panaili, Dhink, Pandhoi and Ramganga. The district may be described topographically as plain tract with slight undulations caused by the valley of few rivers. The summers are very hot while winters are fairly cool. In summer, the temperature goes upto 44°C in the month of May and June with desiccating dust-sweeping winds locally known as "*Loo*". The variation in temperature is observed from season to season, and month to month.

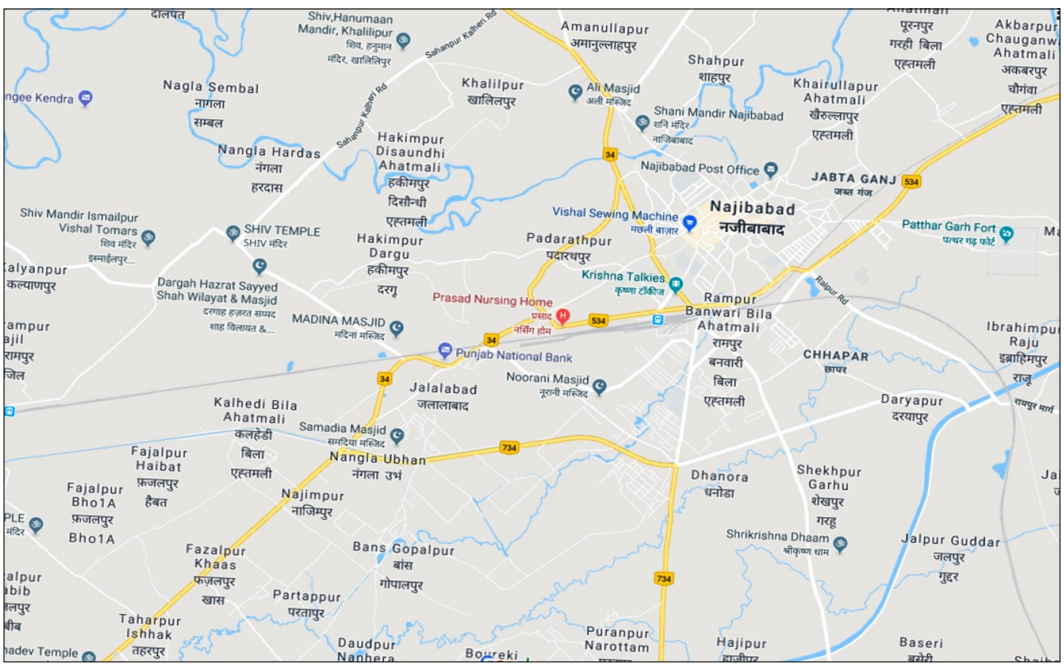

Figure 18.1. *Map Showing the city Najibabad and the village around the city.*

The summer season is characterized by heat with maximum temperature of 44°C, while in winter season cold waves are frequent which bring down the temperature to a minimum of 2°C. The soils in this area are originated from Siwalik Belt of Himalaya. Generally sandy, clay-loam and light loam soils are found. The city of Bijnor under study is Najibabad (29.63°N 78.33°E). It has an elevation of about 295.5 metres (1014 feet). In 1901, Najibabad had a population of 19568 while in 2011 it was 88535.

Study design and data collection

The study was conducted in the selected villages of city Najibabad in Bijnor district of Uttar Pradesh. The Area was selected for time and resources availability, well communication facilities to carry out the research study in this area. The total numbers of farmers of the research villages were the population of the study. Data were collected through direct interview using questionnaire of questionnaire. The interview schedule was prepared in Hindi for easy understanding and for the easy collection of data (Iqbal *et al.,* 2014). Some data was collected from the official website of Krishi Vigyan Kendra, Bijnor. The Methodology was adopted from Nikam *et al.* (2015) and Zaidi and Munir (2014). Simple random sampling technique was used for the data collection among the total population. The population for the study of the objective 2, 3 and 4 were the farmers, private shopkeepers and Shahkari samities (Govt. Shop of fertilizers and pesticides). For the first objective the population was the villagers and farmers.

Results and discussion

A survey was carried out in the study area to know the status of agriculture and related factors. Survey was carried out with help of personal interview using questionnaire and with the help of meetings with the elder persons of the villages.

Change in the rainfall

The amount of rainfall in mm and the number of rainy days was presented in the Figure 18.2. From the figure it was observed that amount of rainfall was decreasing continuously from 2010 to 2018. More than 150 mm rainfall was observed in 2010 but it reduced to 110 mm in 2011. During 2012 and 2013 the rainfall was same and it was approximately 140 mm. During 2014 the rain fall was found below 50 mm (approximately 40 mm) while in the year 2015 the rain fall was found above 50 mm (approximately 60 mm). During 2016, 2017 and 2018 the rainfall was about 75 mm to 90 mm. During last 18 year the rainfall was decreased approximately 50 mm. During all the years the rainfall was uncertain. Although in the some villages of study area irrigation facilities are available but not in all the villages. In most of the villages the sources of irrigation are surface water bodies such as pond and rivers and in some cases tube well driven by the tractors or other engines due to lack of power supply.

Decreased amount of rainfall increased the cost of the crops as well as type of crops grown in the

study area. There is a shift in the type of crops grown by the farmers towards the crops which can bear the shortage of water such as sugarcane. A large damage of crops was also observed in the study area sometimes due to shortage of water (in summer season) and sometimes due to lodging of water (in monsoon season) and also due to soil erosion by the river water (in some villages Malin was responsible and in some villages Rāmgangā was responsible).

Change in temperature

The minimum, maximum and average temperature was presented in the Figure 18.3. During the last eight years a very small change in temperature was observed. Maximum temperature during summer season was ranged from 38°C to 42°C while during winter season was ranged from 19°C to 22°C. During summer season minimum temperature was ranged from 26°C to 28°C while

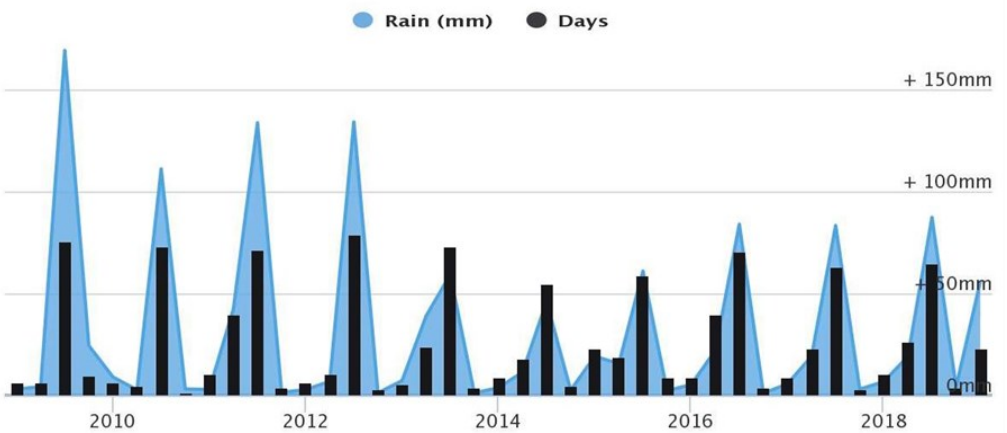

Figure 18.2. *Rainfall amount (mm) and Rainy days of Najibabad city from 2010-2018 (Source: Website of KVK Bijnor).*

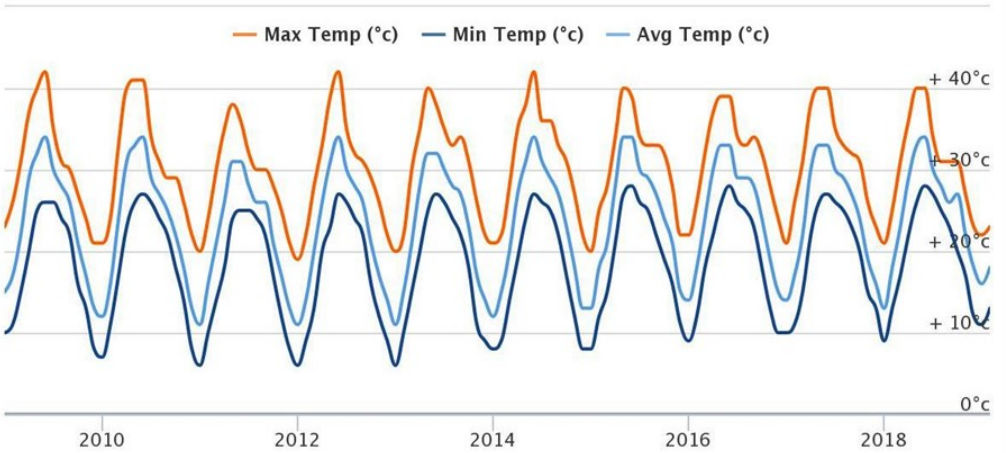

Figure 18.3. *Maximum and minimum temperature of Najibabad city from 2010-2018 (Source: Website of KVK Bijnor).*

during winter season minimum temperature was ranged from 6°C to 10°C. Pattern of temperature change was found similar to the pattern of rainfall in the study area. Temperature has direct effect on the produce of some crops such as wheat and paddy. In the study area a sharp increase was observed in the temperature during late winter which affects the yield of wheat crop in the area. Crops sown earlier give a better yield than the crops sown later. Similar findings were observed by Zhao *et al.* (2017) and Asseng *et al.* (2015).

Change in the percentage of farmers

An extensive survey was carried out to know the change in the number of farmers in the study area and data was presented in the Table 18.1. A drastic decrease was found in the number of farmers in the study area. People do not want their children to adopt this profession because of

Table 18.1. *Villages, population and percentage of farmers in the villages of study area.*

Name of the site	Present population	Percentage of farmers	
		Before 2000	*After 2000*
Akbarpur Chauganna	2950	65	20
Akbrabad	6238	60	25
Alipura	4767	65	30
Barampur	2,390	65	30
Basera	1024	65	28
Bhaguwala	13036	60	18
Budgara	3422	70	28
Budgari	2325	70	30
Chandouk	2900	65	30
Dhansini	2649	75	25
Dhanora	2549	70	25
Fajalpur Habib	3413	80	30
Harsuwara Ahatmali	4028	50	15
Humayun Puriddu	1429	75	30
Issepur	2897	70	25
Jaswantpur	5064	80	30
Jatpura Bhonda	2483	80	30
Jawalilala	2698	85	35
Kalhedi Bila Ahatmali	1078	60	15
Kalyanpur	514	85	30
Kamrajpur	3244	80	25
Kishorpur Ahatmali	2134	85	32
Mauzampur Sadat	1752	85	30
Meman	5527	70	25
Mohamadalipur Hirdey	3527	60	12
Mubarakpur	3244	50	10
Najimpur	636	70	20
Nangal	6576	80	28
Nangla Ubhan	1181	85	30
Narayanpur Inchha	402	90	40
Puranpur Garhi	3216	80	30
Purshotampur	2251	70	30
Rahatpur Khurd	3789	70	25
Sabalgarh	4187	75	22
Samipur	4533	60	18
Shyami Wala	3945	70	20
Tisotra	3921	65	20

uncertainty in the yield of crops due to different factors. In some villages we found that some families completely turned towards other profession. In most of the villages we found that land owner were performing agriculture on the sharing basis by other peoples while they himself was involves in other business. An alarming situation of agriculture was observed in the study area. A very less young generation was found involved in the profession of agriculture. During the survey we found that in all the villages percentage of people involved in the agriculture was decreasing. Before 2000 in all the villages percentage of farmers was ranged from 50% to 90% while after 2000 percentage of farmers was ranged from 10% to 40%. Maximum percentage of farmers before and after 2000 was observed in the same village named Narayanpur Inchha due to low education level and more number of financially backward families.

Change in cropping pattern

Earlier the farmers of the study area used to grow maize, barley, jowar or bajra, wheat, rice, pulses vegetables and sugarcane. But now the farmers grow only wheat, rice, vegetables and sugarcane. Only few farmers grow maize, barley and Jowar or bajra and they grow these crops only for animal feeds and not for the human consumption while in olden day's people grow these crops for both the purposes. Zaid crops such as watermelon, muskmelon and cucumber are grown by only a few farmers. In the study area Cucumber dominates among all the zaid crops. The whole study area is observed dominated by sugarcane due to its high resistance to water scarcity and because of its regeneration power.

During the survey we observed that pulses and vegetables are completely vanished from some villages along with zaid crop. Before 2000, approximately 50% farmers in the study area used to grow ground nut but now only few farmers in few villages grow ground nut and in most of the villages people do not grow this crop. Cropping pattern of study area along with whole state is dependent on the monsoon rainfall and water availability (Singh *et al.,* 2011). The major cropping pattern of study area observed during the survey is Rice-wheat and sugarcane. Similar findings were observed by Singh *et al. (*2011) and Goyal and Kumar (2013).

Change in the fertilizers use patterns by the farmers

During the survey we found that the average farmer doesn't know as much about fertilizer as some think he does. They do not want to go in the detail of the fertilizer. There are only few farmers who know about the different type of chemical and biological fertilizers. We found that farmers did not have any idea about the dosing of fertilizer and they also did not know about the soil testing facility available in the area and most of them are unaware of the term "soil testing" due to lack of education. Before 2000 farmers prefer to put manure in their fields but after 2000 there is an era of chemical fertilizers. But now we observed reducing trends of chemical fertilizers among the farmers of the study area. Farmers now preferring organic fertilizer instead of chemical fertilizers due to the bad consequences of chemical fertilizers.

One thing was also observed during the survey that before the farmer buys fertilizer, he often

turns to others around him for advice. Nearly 60% covered in the study report one or more talks with people close to the situation. Most often the farmers consult with dealers of local market due to lack of knowledge (Zaidi and Munir, 2014).

Change in the land possession pattern

In the study area from the survey it was revealed that in olden days most of the people hold small piece of land but now the land consolidation was observed (number of land owner was decreased and size of land holding was increased). Size of farms was increased in comparison to olden days. Most of the people were found leaving farming profession due to damage of crops by natural as well as anthropogenic factors. Uncertain rainfall, damage due to animals and a very increment in the price of fertilizers

(urea from Rs. 210 to Rs. 270, DAP from Rs. 500 to Rs. 1250) pesticides and a very low increase in the price of crops. From the last of 5 years price of sugarcane increased from Rs. 240 to Rs. 310. This may be the reason that peoples are leaving farming. Due to this land fragmentation decreased and land consolidation increased.

Change in the education pattern

Illiteracy is a serious problem of India. In rural India, literacy rate is too painful. The role of education in the development of agriculture hardly needs any emphasis. Education creates a favourable mental attitude among the farmers for the acceptance of new practices, especially information-intensive and management-intensive practices (Waller, 1998 and Caswell, 2001). During the survey we observed an increasing trend of education among the villager. However dominant education level was found senior secondary. Figure 18.4 gives the

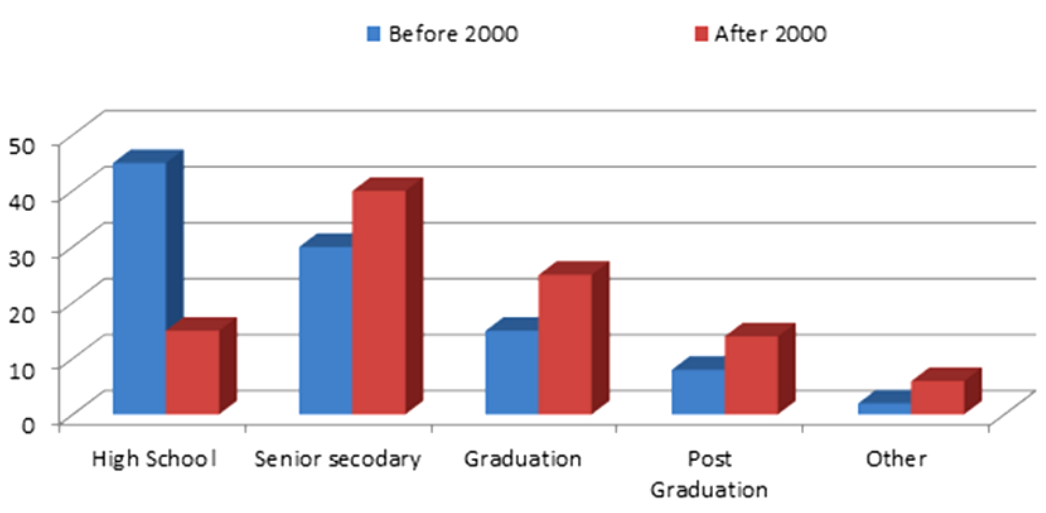

Figure 18.4. *Percentage of different education groups.*

graphical representation of this data.

Willingness and ability to adopt new farming techniques

Farmers, who are motivated and have the required skills, are likely to be the most successful technology adopters. As shown in Figure 18.5, program designers can more cost effectively target interventions if information about both farmer ability and farmer willingness is available. Education also plays an important role in the adoption of new technology. The farmers which have intermediate level of education easily adopt the new technology. The age group also have an impact of on the adoption of new technology (Gaffney *et al.*, 2013).

Change in the pesticides use patterns

India is the second largest manufacturer of pesticides in Asia after China and ranks 12th globally (Mathur, 1999). Herbs compete with the crops for nutrient and sunlight such as *Phalaris minor* (Locally known as Bandri grass**)** compete with the winter crops mostly with the wheat crop. It is essential to remove these weeds and insects from the crops for healthy crops and good crop yields. The use of bio-pesticide has increased 66 times in India in 10 years—from 123 tonnes in 1994-95 to 8110 tonnes in 2011-12 resulting a declined in chemical pesticide by one-third from 75033 tonnes in terms of technical grade in 1990-91 to 50583 tonnes in 2011-12. Consumption of pesticides in India is less than 1 kg/ha as against 4.5 kg/ha in USA and 11 kg/ha in Japan.

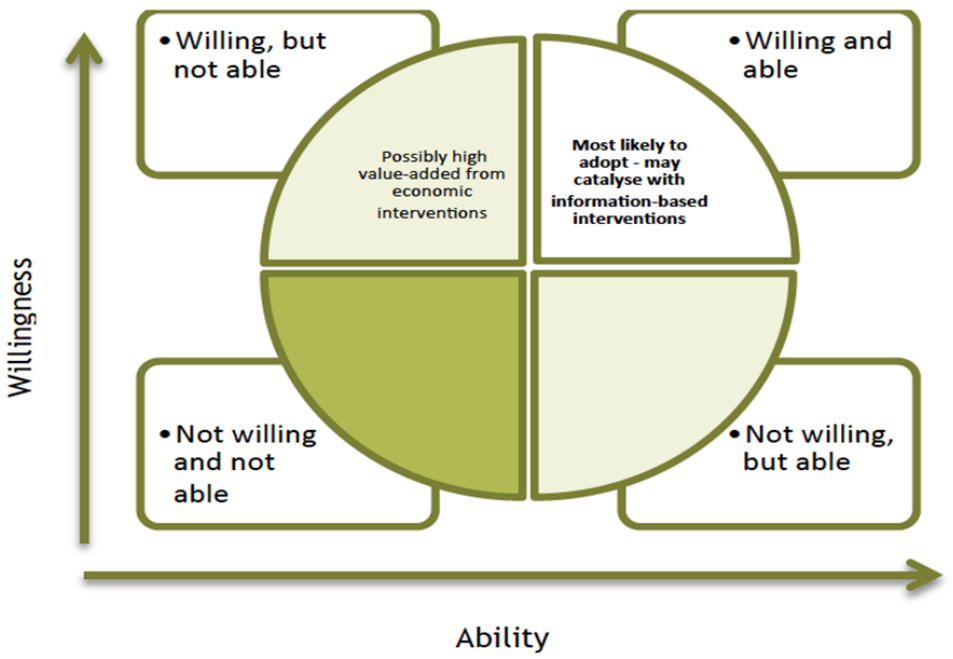

Figure 18.5. *Willingness and ability to adopt new technology (Source: Gaffney et al., 2013)*

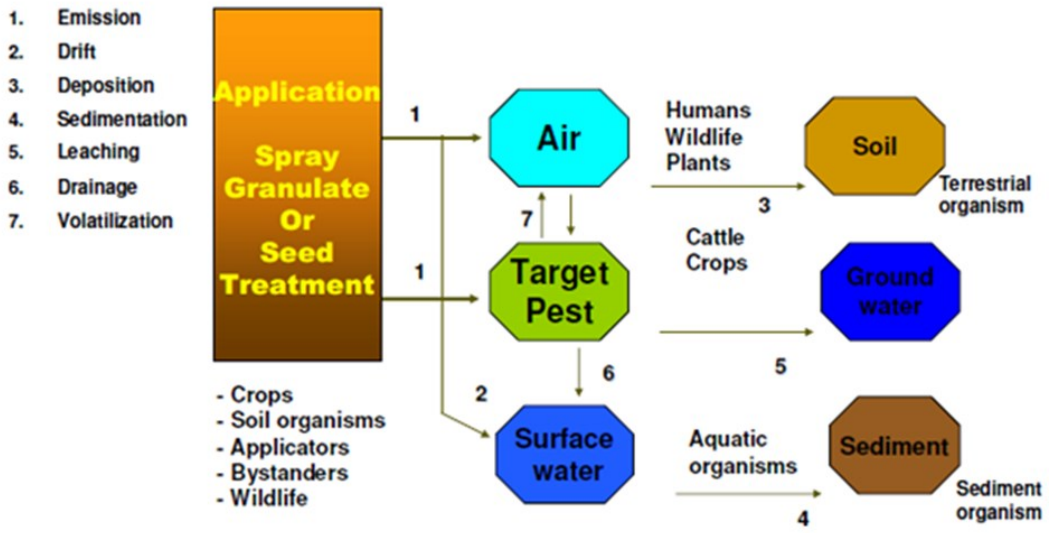

Figure 18.6. *Origin, transport and fate of pesticides (Source: WHO, 2002)*

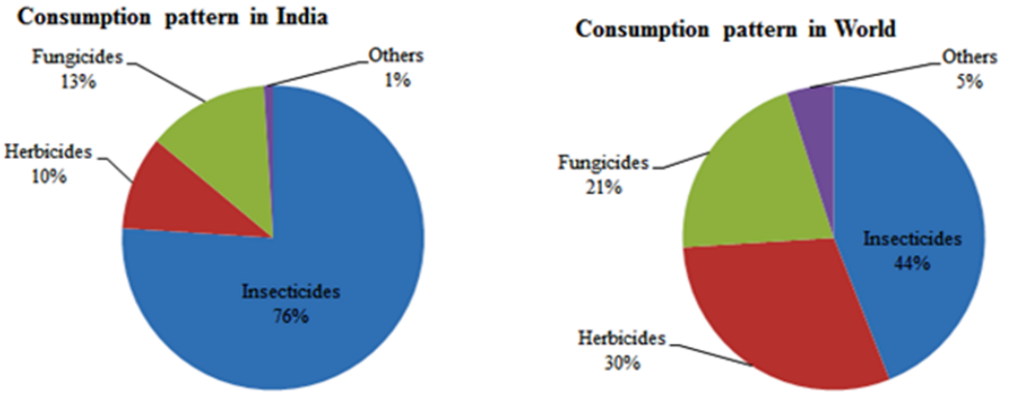

Figure 18.7. *Consumption pattern of pesticides (Source: Mathur, 1995)*

Presently there are only 230 registered pesticides in India, while it's more than 1000 in the US and for the EU, it is around 700.

Out of these, 66 pesticides are banned in India but are exported (MOCF, 2013). This is because use of pesticides tends to be more intense and unsafe, and regulatory, health and education systems are weaker in developing countries (UNEP, UNICEF, WHO, 2002). In the study area similar trend in the use of pesticides was also observed. Now the farmers preferred bio-pesticides (onion and Neem leaves) instead of chemical pesticides. The distribution route and how these pesticides affect receptor organism were shown in Figure 18.6. Pesticide usage pattern in India is different from that for of the world. From the Figure 18.7, it can be seen that in India 76% of the pesticide used is insecticide, as against 44% globally (Mathur, 1999). If the credit of enhanced economic potential in terms of increased production of food and fibre and reduction of vector-borne diseases goes to pesticides then their impacts have resulted in serious health implications to man and his environment (Aktar *et al*., 2009).

Conclusion

On the basis of present study it was concluded that the percentage of famers was continuously decreasing in the study area. Number of young people involved in the farming was also found decreasing in the study area. Due to industrialization job opportunities was increased resulting in the less involvement of young people in the farming and related activities. Land consolidation was also observed in the area. This study has confirmed that extension should strengthen farmers' knowledge and skills in fertilizer application through literacy programs. A very less number of awareness campaign was observed in the study area resulting in the lack of knowledge of modern tools and techniques, about fertilizers and pesticides. So there is an urgent need of such awareness programme in the study area.

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