CHAPTER II
REVIEW OF LITERATURE

2.1 Introduction

The literature concerned with farmers’ preferences and satisfaction with primary retail pesticide suppliers is limited and not widely available in the public domain. However, marketing studies focusing on the purchasing behavior of farmers with respect to different production inputs are available. These reviews were largely published in the 1980s and 2010s and generally focuses on production inputs such as fertilizer, seed, feed, and farm equipment.

Funk and Downey (1981) analyzed Indiana farmers, focusing on fertilizer product/service needs, buying behavior, attitudes, preferences of farmers, and the manner in which this information could be used to develop product, price, promotion, and distribution policies for manufacturers and dealers. One hundred fifty central Indiana farmers from 12 counties were surveyed. Major findings were as follows: local fertilizer dealers, other farmers, and family members are the most widely used influence groups; most dealer contacts are initiated by farmers, not fertilizer dealers. Additional findings showed that other farmers are highly influential in dealer selection, word-of-mouth communications among farmers are important in dealer selection, and importance is attached to the fertilizer dealer for providing various types of information such as price, product, technology, and application information. Two-thirds of those surveyed disagreed with the statement that price is the most important consideration in purchasing fertilizer, while two-thirds agreed with the notion that establishing a good long-term relationship with one fertilizer dealer is more important than any price savings which might be possible by changing dealers frequently.

The author mentions that demand for specific services was found to be dependent upon the characteristics of the farmers. Services listed as most important by respondents included condition and availability of application...
equipment, provision of information through staff, outside experts and farmer meetings, provision of custom application services, provision of soil testing services, plant tissue analysis, custom application of pesticides, and demonstrations. Major reasons for dealer selection were dealer nearness, cheaper price, and availability of product when needed. Other reasons mentioned for dealer selection are: dealer loyalty, buy or sell other products from dealer, equipment considerations, availability of specific products, dealer being personal friend/relative, good delivery, cooperative member/shareholder, good working relationship, and knowledgeable dealer/salesperson/staff. Around 50 per cent of the farmer respondents used only one dealer, while close to 40 per cent used two dealers, and the remaining 10 per cent used three. Only around 38 per cent of the farmers surveyed did not switch dealers at least one time in 1979. About 42 per cent of the respondents stated they had used at least three dealers within the last five years. Interestingly, only 45 per cent of farmers purchased fertilizer from their nearest dealer. Several reasons were identified as influential in the decision to use more than one dealer. They were availability of specific fertilizer product(s), price considerations, proximity of a specific product, availability of specific service(s), better service at a particular dealer, availability of specific application equipment, good dealer relationship, and dealer loyalty.

Schrader (1983) quantified farmers’ loyalty-related behavior in the purchase of farm supplies, compared the loyalty exhibited by farmers patronizing cooperatives and other types of farm supply firms, and examined the relationship between a patron’s loyalty and his decision to voice complaints about firm performance rather than immediately switching his patronage. A loyalty index was developed as a composite of three measures: the proportion of total purchases made from the major supplier, the number of switches of suppliers occurring during a given period, and the number of outlets available. Another indicator of farmer loyalty was based on a sample of farmer’s reactions to a hypothetical situation in which the product involved was offered.
by a competing supplier at a lower price. The production input studied relevant to this study was corn herbicides. A mail survey was administered to 917 corn herbicide purchasers in Illinois.

The results showed that the majority of farmers perceived that they had a number of alternative pesticide supply sources. Farmers agreed with the statement that they had a good working relationship and were very satisfied with their primary herbicide supplier. Even at the largest price reductions tested, some farmers indicated no action to inform or switch their primary supplier, and no more than 16 per cent indicated a switch without informing their current supplier. Farmers stated that good service and convenient location were the reasons for lack of switching primary suppliers. Lastly, Schrader found that the existence of alternatives and the presence of 10-20 per cent of farmers willing to change suppliers for a price advantage of as little as 2-3 per cent are sufficient to ensure price discipline within the market.

Duffy (1983)³ studied the use and practices of pesticides in USA. The study reported the nature and extent of pesticides use by crop, using data from the ERS-USDA's 1982 Crop and Livestock Pesticide Usage Survey. The survey covered 13 major field crops in 33 states with data from 6520 respondents. It was reported that 11 per cent of farmers used professional scouting for pest problems, 59 per cent self scouted their fields, and 12 per cent were aware of beneficial insects and diseases. Almost 70 per cent of the farmers with livestock used insecticides for livestock insect control.

Sagar and Pal (1984)⁴ made an attempt to identify the problems and observed that more attention has to be paid on adequate quantity and timely supply of pesticides, skilled labour for pesticide application are needed to make the farmers to adopt plant protection. Farmers are facing numerous problems in the purchase of pesticides at a nominal price, when most needed in desired quantity and quality. Farmers were also dissatisfied regarding the steps taken by government agencies in handling cost-free pesticides.
Prabhu (1985) examined the relevance of production function framework for the analysis of pesticide use behavior in cotton cultivators in Coimbatore district of Tamil Nadu. It was argued that production functions framework based on the assumption of perfect certainty and suitability of inputs was not suitable for yield saving, inputs like pesticides, the use of which was influenced by uncertainty regarding yield and technical complementarily with yield increasing inputs. The argument was sustained by the conclusion derived from empirical production function.

Govindarajan (1987) used linear multiple regression model to study the dealer loyalty through price of cotton seeds, credit availability, faith with the dealer, availability of preferred variety, quality of seeds, peer group influence and distance from farm to seed depot. To study the factors contributing to the dealer loyalty of the farmer, linear multiple regression model was used by the author. The factors considered for the study were price of the pesticides, credit availability, availability of preferred brand, customer service, discount, advertisement, distance from the farm and malpractices. For this study, if a farmer made 75 per cent of his purchases from a particular dealer for more than one year, he was considered to be loyal to that dealer.

Verma (1988) identified nine major constraints for slow adoption of pesticides such as lack of knowledge, not convinced by extension agency, high cost, untimely availability, lack of curiosity for spraying entire area, high cost of application, lack of finance, problems in preparation of correct solution and scarcity of labour. High cost was the major impediment to the adoption of pesticides among small farmers.

Srivastava and Patel (1988) reported that farmers get substandard quality of product from local formulators. Non-availability of credit, shorter credit period and farmers illiteracy which leads to cheating by dealers are some problems in pesticide usage. The farmers are also not able to recognize the pest attack and type of diseases in their crops. Resistance to insecticides
developed by pests, residues left by pesticides in food and destruction of natural pest control agents are some of the problems in pesticide usage. For this study, pesticide use refers to the quantity of pesticides used by farmers at various stages of crop growth to get rid of pest and disease infestation. Dealer loyalty is another significant factor which influences the buying behaviour of farmers and through this the buying behaviour could be explained.

Kumar et al. (1989)\textsuperscript{9} concluded that the adoption of plant protection measures are varied among the different categories of farmers. The various practices like control of disease, seed treatment, soil treatment, rat control, etc., are being advocated without a coherent strategy which is reflected in differential level of achievement of targets by the plant protection staff in the district.

Perritt (1989)\textsuperscript{10} revealed that 95 per cent of farmers purchase and apply pesticides to protect subsistence food crops in the field and during storage. The use of pesticides is more complicated because it requires appropriate training to identify the pest, to select the appropriate pesticide and to use it in required quantities at the right time. Because of this, the use of pesticides continue to be at a lower level and disproportionate to fertilizers used in the country. Mann indicated that the use of pesticides in oil seeds and pulses were considerably low affecting the yield. The pesticide use decisions of cultivators were based on their expectation regarding the timing and intensity of pest attack and effectiveness of pesticides.

Varma (1990)\textsuperscript{11} in the study reported that in the village of Ghaziabad on an average 20.5 per cent farmers used insecticides, 13.6 per cent used fungicides and none had ever used any weedicide. Availability of easy and cheaper control measures, availability of skilled labour and applicationes and finance in time influences plant protection use.
Sankari (1991)\textsuperscript{12} identified that credit availability, distance from farm to dealer location, price of the product, peer group influence and availability of preferred brand were the factors contributing to the dealer loyalty of farmers. Kenmore (1991)\textsuperscript{13} had commented that one of the major constraints in establishing an IPM (Intergraded Pest Management) programme is the lack of adequate information about farmers’ knowledge, perceptions and practices (KPP) in pest management.

Jennings (1991)\textsuperscript{14} indicated that the benefits confessed by pesticide use are reduction in both labour cost of food production and risk of crop losses and removal of some of market uncertainties, the possibility to specialize and concentrate production with greater flexibility and for monoculture farming, the support of pesticides for a complex arrays of markets and economic regulations affecting price, quality and availability of food. The major factors which determine the quantity of pesticides was the type of pest followed by intensity of pest and disease. The objective of efficient pesticide usage can be defined as the application of an adequate dose of a suitable pesticide to a pathogen or pest at the correct time. The author reported that chemical control using pesticides is the widely used method of pest control because it ensures maximum control in minimum possible time which is necessary in a developing country like India.

Kruger et.al (1991)\textsuperscript{15} showed that while many developed countries continue to protect agriculture, developing countries do not do so. However, no formal attempt or theoretical framework has yet been used to assess the extent of negative protection in Indian agriculture. The implementation of economic reform in the Indian agricultural sector has been a gradual process. These include an 87 per cent cut in tariff on agricultural products, sustenance of high-yield crop varieties, removal of minimum export price on selected agricultural products, a lift on quantity restrictions on the export of some crops and various land reforms related to tenancy rights and land ceilings.
Sivakumar et al. (1994)\textsuperscript{16} analysed buying behaviour of farmers with respect to pesticides, considering the factors influencing loyalty of farmers towards dealer and brand. Friends, neighbours and relatives were the major source of information about dealers. In case of brands, it was extension personnel of the Department of Agriculture. The price, quality and advertisements of the brand contributed significantly to brand loyalty. Credit availability, advertisements and price of products available with dealer contributed significantly to dealer loyalty.

Gulati and Sharma (1995)\textsuperscript{17} show that the input subsidy in per cent of GDP increased from 2.13 in the triennium ending 1982-1983 to 2.73 in the triennium ending 1992-1993. But the benefits of these subsidies have accrued only to certain classes of farmers in some regions cultivating irrigated crops. Furthermore, highly subsidized prices of inputs such as irrigation water and electricity for pump sets have encouraged cultivation of water-intensive crops, over-use of water, ground water depletion/salinity and water logging in many areas. Subsidy for nitrogen fertilizer on the other hand has resulted in nitrogen phosphorous potassium imbalance and acted as a disincentive for use of the environmentally friendly organic manure. As a result, the linkage between food crops and non-food crops, which include fodder, has been reduced. These adverse consequences are a drain on the fiscal burden of central and state Governments. Thus, if not properly monitored, input subsidies can be counterproductive and, in this context, protection to lower costs of production should be done selectively in the course of liberalization.

According to Gandhi and Vasant P (1997)\textsuperscript{18} the pesticide industry is the most dynamic agricultural input industry in India, being substantially in private hands. Yet the pesticide use levels in India are among the lowest in the world. This paper presents an overview-analysis of the pesticide scenario in India. It develops a framework of the market environment within which the growth of pesticide use takes place in developing countries. It, then, uses this framework to study the growth and patterns of pesticide use in India. It finds that pesticide
use in India is highly concentrated by crop and geographic area, and is therefore showing declining growth rates. A major reason appears to be very limited market development efforts by the firms leading to poor conversion of a large potential into effective demand. Output markets/prices, input prices, high yielding varieties and wage rates play important roles in determining use. However, many non-price factors are also very important. Pesticides are also seen as insurance by the farmers and therefore higher than optimum use is frequently reported. The new economic environment in India will offer ample opportunities for growth. However, the industry will need to look at the market environment more comprehensively and will need to play a proactive role in market development.

According to Aspelin (1997)\textsuperscript{19} the worldwide consumption of pesticides has reached 2.6 million metric tons. Of this 85 percent is used in agriculture. Although the largest volume of pesticide use is in developed countries, pesticide usage is growing rapidly in developing countries. The quantity of pesticides used per acre of land has also increased. In addition to the increase in quantity of pesticides used, farmers use stronger concentrations of pesticides, they have increased the frequency of pesticide applications and increasingly mix several pesticides together to combat pesticide resistance. These trends are particularly noticeable in Asia as well as in Africa.

Yudelman et al. (1998)\textsuperscript{20} say that pest control becomes a social need in countries where the food supply is short and there is an urgent necessity to increase rice production. Before the green revolution pesticide use was largely confined to the industrialized nations. Today, pesticides are produced and used globally. The third world's use of pesticides increased greatly during the Green Revolution in the 1960’s and beyond, and it is related to the changed growing conditions which was brought about by the use of green revolution varieties and technologies. Monocultures coupled with increases in irrigation and
fertilization often improves conditions for pests, necessitating more control efforts.

According to Sharma (1998) many developing countries still ignore an IPM approach and rely on pesticides for a quick solution to deal with pest problems. This has often been aided by commercial advertisements by chemical companies and by the pesticide sellers, who often have more influence on farmers than extension officers do.

Reddy and Raju (1999) studied about buying motives of rural consumers towards purchase of seeds. Different sources of information about brands with regard to seeds. Factors influencing brand loyalty of farmers were dealers suggestion, quality product and co-farmers. The problems faced by farmers with regard to seed are supply of poor quality of seed, higher private, adulteration and irregular supply of seeds.

Santha Kumar and Dandapani (2000) studied frequency, intensity and determinants of pesticide use in rain fed cotton, by using farm level cross sectional data from Nanded district of Maharashtra. Average pesticide use was 3.2 kg active ingredient per hectare of cotton area. Farmers also used a number of cultural and physical methods directly or indirectly to limit the crop loss due to pest and diseases. The attitude of farmers towards insect pest risk varied and accordingly the use of pesticides. Risk averse farmers used pesticides excessively and indiscriminately. Findings suggested that improving existing stock of knowledge of pests and management practices could help reduce pesticide use.

Sultana Parveen and Nobukazu Nakagoshi (2001) say that the so-called Green Revolution package was introduced into Bangladesh agriculture system in mid 1960s. It promised to increase production of cereal crops, particularly rice by the introduction of HYV seeds, application of chemical fertilizer and pesticide, and irrigation. HYVs rice has contributed significantly
to the progress towards the food self sufficiency in Bangladesh on the contrary increased to the environmental degradation due to the intensive use of agrochemical and other modern technology. The use of pesticide has been increased 400 per cent per acre and its cost increased 600 per cent during the last couple of decades. Between 1985 and 1990 the sales of pesticide became double. At present, 84 pesticides active ingredients belonging to 242 trade names have been registered in Bangladesh. Out of the total pesticide use, over 80 per cent are used in rice fields. The rapid increase of pesticide use is causing detrimental effect on environment and health of farm workers and consumers. Pesticides are contaminating ground and surface water, which is causing depletion of inland fishing resources and ecosystem. Therefore, the present study evaluates the level of farmers' pesticide use practiced to rice pest control, their knowledge and perception of the impact of pesticides on environment.

A questionnaire survey has been conducted to collect the data from the farmers. Data have been collected from 86 rice farmers of Bangladesh. The study revealed that the respondent farmers used mostly insecticides at the rate of 1 to 10 kg active ingredients per hectare of cropland and the time of application varied from 1 to 4 sprays per crops. The richer farmers used pesticide more frequently as compared to small and medium farmers. But most of the pesticides belong to extremely and highly hazardous category as classified by WHO. Considering the cropping intensity and toxicity of the pesticide, the environment and farmers health are at high risk under the pesticides contamination. The average level of knowledge and perception of the respondents was found poor to moderate. In general, the respondents showed favorable attitude towards the pesticide use. Among the insecticides used by the farmers, Bashudin 10 G, Diazinon 60 EC, Sumithion 60 EC and Padan 50 SP have already been banned for use on rice in other developing countries. The use and availability of Bashudin, an obsolete pesticide indicates that existing pesticide laws and regulations are not strictly enforced in relation to import, formulation, repackaging, distribution, advertising and use of
pesticides. Therefore, in Bangladesh the laws and regulations of pesticide should be enforced more strictly and a new policy should be enacted to educate the farmers regarding the harmful impacts of pesticides. There is an urgent need to assess the impact of pesticides on human health and pollution level of pesticides in soil, water, and air in Bangladesh.

In a research conducted by Aktas (2001)\textsuperscript{25} the place of pest sellers in the agricultural extension system was investigated and it was found that at the macro level there is a lack of law and regulations, which will direct the optimal use of chemicals and pesticides. Soil pollution in the locality is basically caused by improper use of farm machinery, improper use of chemical fertilizers and pesticides, improper irrigation and lack of modern irrigation systems such as trickle and drip irrigation, deforestation, early and excessive gazing of range lands, and farm land being used for housing and industrialization purposes.

P. Van Mele et.al (2002)\textsuperscript{26} had conducted a empirical research work in 1998 ± 99, about 150 citrus farmers and 120 pesticide sellers were interviewed in Can Tho and Dong Thap province, Mekong Delta, Vietnam. Media, pesticide sellers and extension staff had different influences on farmers’ pest perception and management practices depending on the region and intensity of the cropping system. Pesticide sellers were notified by about 95 per cent of the farmers about their major pest problems, and the type of pesticides sold in their shop was primarily based on farmers’ demand (87 per cent) and then on company promotion (56 per cent). Those farmers relying on pesticide sellers used more of the banned insecticide methyl parathion. Probably for fear of being accused of illegal practices, none of the pesticide sellers mentioned that they recommended this product or that farmers asked for it. In the intensive Tieu mandarin cropping system, media and extension activities increased farmers’ knowledge of difficult-to-observe pests such as the citrus red mite Panonychus citri and thrips, Thrips sp. and Scirtothrips sp. Since extension was weak in sweet orange, those farmers exposed to media only reported the damage symptom of mites, not knowing the causal agent. Media alone
seemingly did not suffice to acquaint farmers with these small organisms. Farmers getting advice from the media advertisements applied more different pesticide products and sprayed insecticides more frequently, whereas the extension has stimulated the use of acaricides and increased the number of both insecticide and fungicide sprays. The traditional practice of biological control with the ant Oecophylla smaragdina might be endangered with growing media influence and when extension activities remain confined to chemical pest control. Constraints and potentials of different information sources are discussed in relation to developing IPM programmes for citrus.

Renuka Mahadevan’s (2003) empirical work traces the process of Indian agricultural sector. The author analyses its effects on agricultural productivity and growth and discusses the problems and prospects for globalization to draw policy implications for the future of Indian agriculture.

According to Rathinam et.al (2005) conventional farming demands excessive use of chemicals in the form of synthetic fertilizers and pesticides, confirming to the norms of Green Revolution. Farmers in general, specifically in the developing countries resort to injudicious and excessive use of pesticides which is linked to the illiteracy and poverty of the rural farming community. Their overriding concern for profitable agriculture, has rendered the health of the farmers at a greater risk of developing dreadful maladies including various type of cancers, reproductive disorders, respiratory, dermal, and neuropsychological problems etc. The possible means of reducing the health risks are discussed, including the global effort to regulate the manufacture, transport and use of highly toxic pesticides. Slow and programmed transition to alternative agriculture and strengthening of farmers’ knowledge on health, ecosystem and environment will prove effective.

Corinne et.al (2005) say that for agribusiness managers and salespeople, understanding customers and their preferences and behaviors is crucial to success. Their empirical study used cluster analysis to identify five
distinct buyer segments for expendable input purchases for U.S. crop and livestock commercial producers. A multinomial logit model is used to predict segment membership based on demographic, behavioral, and business management factors. Results provide important information for agricultural input suppliers.

Shakirullah et al. (2006)\textsuperscript{30} studied the nature and extent of adoption of pesticides among small, medium and large farmers in Union Council Palosi, District, Peshawar. The results revealed that the pesticides were used by 78.75 per cent of the farmers, while 2.25 per cent did not use them. Majority of the farmers (41.25 per cent) started using pesticides 6-15 years ago for different pests. The per annum average cost of pesticide purchase was significantly higher at 1 per cent level for large farmers than medium and small farmers. This shows that the larger farms applied more pesticides.

Gregory and Bumb (2006)\textsuperscript{31} identified five pillars that are required to develop agriculture input markets and achieve market efficiency. Increasing supplies and market efficiency can reduce input prices. These five pillars are the policy environment; human capital development; access to finance; market information; and regulatory frame works. These generic components need to be adopted in the context of country-specific situations. Holistic improvements in all areas will reduce transaction costs and improve accessibility to fertilizers in rural areas.

Prabuddha (2007)\textsuperscript{32} studied the pattern of pest infestation on vegetables and the extent of the use of pesticides by vegetable growers in 18 villages in Katwa-1 block, Bardhaman district, West Bengal, India. The study found that the intensity of insect pest infestation on aubergine, pointed gourd (Trichosanthes dioica), cabbage and cauliflower was greatest during the Rabi season, followed by the kharif and pre-kharif seasons over the last five years. Most of the farmers applied pesticides on aubergine and cabbage, but the
application rates, number of chemical groups of pesticides and application frequency adopted by the farmers were more than the recommended. This practice was most pronounced for aubergine, followed by cauliflower, cabbage and pointed gourd.

Udaykumar V. Hosamani (2008)\textsuperscript{33} in his research work has documented the fact that the excess use of the pesticides in agriculture has not only increased production costs but also led to ill effects of pesticide use. The present study attempted to analyse economic consequences of pesticides use in paddy in Koppal district of Karnataka. The study was based on the primary data obtained from 120 randomly selected farmers growing paddy spread across two taluks of Koppal district. Multiple log linear regression was used to compute the plant protection chemicals expenditure elasticity. The total cost of cultivation of paddy was found to be Rs 65591.53/ha of which the cost of pesticide accounted for 5.50 per cent. On an average, the expenditure on pesticides in paddy cultivation was Rs. 3607.57/ha. The yield obtained by the sample farmers was 66.90 quintals. The farmers realized net returns of Rs. 17145.14/ha of paddy cultivation. The elasticity coefficient of labour and manures and fertilizers were negative and significant indicating that increase in the use of labour, fertilizers and manures would lead to decrease in gross income. The resources such as seeds and pesticides have contributed positively to the gross income thus, indicated that there is scope for re-organization of the inputs for profit maximization.

The author has mentioned that about 50 per cent of the farmers applied pesticides five times for paddy during its production cycle. The number of pesticide application went up to even seven times. The optimum quantity of pesticide was estimated to be 0.97 l/ha, whereas the farmers were found to be use (1.95 liter/ha) almost double the optimum quantity. Number of pesticide applications and area under paddy were contributing positively and significantly to the expenditure on plant protection chemicals. The farmers
should be educated to identify the threshold level of pest infestation and take measures only after that instead of blindly following the neighboring farmers while applying plant protection chemicals.

A.V.F. Ngowi et.al (2008) mention that small-scale farmers in Northern Tanzania grow vegetables that include tomatoes, cabbages and onions and use many types of pesticides to control pests and diseases that attack these crops. Based on the use of questionnaires and interviews that were conducted in Arumeru, Monduli, Karatu, and Moshi rural districts, this study investigates farmers’ practices on vegetable pest management using pesticides and related cost and health effects. The types of pesticides used by the farmers in the study areas were insecticides (59 per cent), fungicides (29 per cent) and herbicides (10 per cent) with the remaining 2 per cent being rodenticides. About a third of the farmers applied pesticides in mixtures. Up to 90 per cent had a maximum of 3 pesticides in a mixture. In all cases, there were no specific instructions either from the labels or extension workers regarding these tank mixtures. Fifty three percent of the farmers reported that the trend of pesticide use was increasing, while 33 per cent was constant and 14 per cent was decreasing. More than 50 percent of the respondents applied pesticides up to 5 times or more per cropping season depending on the crop. Insecticides and fungicides were routinely applied by 77 per cent and 7per cent, respectively by these farmers. Sixty eight percent of farmers reported having felt sick after routine application of pesticides. Pesticide-related health symptoms that were associated with pesticides use included skin problems and neurological system disturbances (dizziness, headache). Sixty one percent of farmers reported spending no money on health due to pesticides. These results can be used to develop a tool to quantify the cost of pesticide use in pest management by small-scale vegetable farmers in Northern Tanzania and contribute to the reformation of pesticide policy for safe and effective use of pesticides.

N. Mahantesh and Singh, Alka (2009) comment that pesticides have substantially contributed for controlling pests and increasing crop yields. But
over the years, there is growing concern about indiscriminate use of pesticides in agriculture. This paper attempts to understand the farmers’ knowledge and perceptions of pests and pesticide use in vegetable cultivation and analyzes the pesticide use practices and the intensity of pesticide use in vegetable cultivation. The result shows that on an average 41 per cent of the farmers were aware of pesticide hazards in vegetable cultivation. Most of the farmers (88 per cent) perceived that frequency of insects and disease infestation has increased over the past 10 years. It was also observed that farmers have not followed adequate safety measures regarding pesticide application. The high pesticide use cost was observed in vegetables especially in tomato and brinjal and most of the pesticides belonged to high and moderate risk chemicals. Increasing farmers’ awareness of pesticide hazards to the environment and promotion of alternative pest management strategies such as use of bio-pesticides and IPM is essential for reducing adverse effect on environment.

Liu Yu et.al’s (2009)\(^{36}\) empirical study tested the major factors which affect fertilizer application amount using econometric models and micro-level data from Jianghan plain in Hubei province by year 2006. The results demonstrate that housemaster’s education level, family’s management scale, land fragmentation are major factors affecting farmer’s decision-making process. When farmers have consciousness of scientific fertilization, higher agricultural labor proportion, farther land distance, longer production period could decrease fertilizer application amount. In the field of agricultural public policy, training for technical generalization is helpful in reducing fertilizer consumption.

Indira Devi (2009)\(^{37}\) in her empirical research work comments that despite low level of consumption, the externalities due to pesticide-use have been reported high in most of the developing countries. It may be attributed to the level of awareness, handling and use-pattern of pesticides. This paper has analysed the level of awareness regarding pesticide use/ handling and has
compared it with the adoption pattern and experiences of health risk episodes, in a society with high level of education and literacy.

The author has also drawn references that the responses to the key factors on scientific use of pesticides have reflected the awareness regarding the handling practices are fairly good in certain aspects, while in certain others, it is quite low. The workers are not given adequate training and education to understand the toxicity level of pesticide by looking at the colour code on the packet, though they have been found aware of the different options available in the market. Often, their perceptions of toxicity level of chemicals they handle have not been found in conformity with the actual situation and they handle toxic chemicals thinking them to be safe. Despite high literacy level, most of them do not care to read the instructions on the packets and follow them. Though a majority of the respondents have satisfactory health status, as evidenced by the body mass index values, most of them have reported short term health risks upon occupational exposure. Surprisingly, their perceptions in this matter do not match with their experience. The frequency of health risk episodes increases as one has more years of experience in the work. It has been attributed to their inadequate understanding of the toxicity levels, unscientific handling practices and poor personal protective mechanism. Similar to the situations in other developing countries, the workers do not adopt scientific personal protective gadgets, though they are aware about the health risks and impacts. The study has highlighted the need for targeted trainings to farm labourers on scientific management of pesticides and undertaking of massive awareness creation programmes. The literacy level may be a contributing factor in the easy dissemination of information, though it seems not a sufficient condition for awareness generation.

JL Bond et.al (2010)\textsuperscript{38} draw references of the World Vegetable Center (AVRDC) identified that indiscriminate pesticide use was common amongst vegetable farmers in Jharkhand State, India. Subsequently, an Integrated Pest Management (IPM) research and development project was initiated to promote
safe vegetable production. This study employed the Theory of Planned Behaviour (TPB) to gauge farmers’ attitudes, subjective norms and perceived behavioural control towards pesticides in combination with Participatory Rural Appraisal (PRA) tools to adapt an extension program promoting IPM in Jharkhand. Farmers had a strong behavioural intention and favourable attitudes, subjective norm and perceived behavioural control to apply pesticide in the coming season. The extension program is likely to be more successful if it dispels myths of pesticide function and includes women and marginal farmers in activities. The key learnings from the study are that farmers have a favourable intention towards pesticide use; attitude was the most important factor influencing behavioural intention; and the applicability of the TPB to a development extension context.

P.K. Shetty et.al (2010) had conducted intensive survey involving 1039 farmers belonging to 28 districts in 12 Indian states which was carried out in pesticide use predominant regions to study the influence of farmer’s awareness, education and practices related to pesticide use as well as Integrated Pest Management (IPM) measures. Data were collected through pre-tested schedules by trained field investigators and the data were analysed by suitable statistical package (SPSS). The results revealed that though overall consumption of pesticide decreased, the expenditure incurred on pesticides remained high. Most of the respondents in the surveyed area followed their own spraying schedules and pesticide doses to manage ever increasing insect pests and disease problems. More than 50 per cent of the respondents applied both single and cocktail pesticides to manage their crop pests. Greater number of the literate farmers had strong perception on the negative impacts of pesticides on soil, water, air and beneficial organisms. Only 20 per cent of the respondents obtained their information on plant protection aspect from the agricultural extension officer and the rest of 80 per cent of the farmers used unreliable information in crop production of surveyed areas. The respondents in the study regions were of the opinion that chemical methods of pest control
are very effective in combating serious pest infestation. In the study area, it was observed that only 3 per cent of the respondents followed organic farming in a successful way. The total area under organic farming in India is negligible. There is a tremendous scope for agricultural extension activity through which stewardship can be achieved in these pesticide predominant regions. Nevertheless, costs on ever increasing safety measures for pesticide applicators would be an additional burden which is to be considered seriously under-resource, poor, small and medium holding systems in India.

Marika Krausova and Afua Branoah Banful (2010) comment that knowledge of the characteristics and size of the agricultural input sector of a country is critical for policymakers to design appropriate interventions that not only foster growth in the sector, but also support the agricultural development goals of the country. In 2009, the International Food Policy Research Institute and the International Fertilizer Development Center jointly conducted a census of agricultural input dealers in Ghana to fill a critical data gap on the nature of the country’s agricultural input sector. This paper presents a detailed description of the sector’s structure, market practices, and supply chain. It also assesses the sector’s response to recently implemented fertilizer subsidies, and findings show that, despite the government’s goal of making the subsidy program supportive of the private market, the majority of fertilizer retailers were excluded from participating.

In focus (2011) industry research report states that pesticide consumption in India is one of the lowest in the world with per hectare consumption of less than one kg compared to US (4.5 kg/ha) and Japan (11 kg/ha). Consumption could be low for the following reasons: Lack of awareness among the farmers about different types of pesticides available and their impact on environment and pesticide is the last input in agricultural cropping operation; hence, farmers generally have no surplus money left and start using them only after the pest attack.
2.2 Conclusion

The agricultural input sector has critical impact on the agricultural productivity of a nation as it influences farmers’ access to and use of productivity enhancing inputs. For several years, information about this sector in India, such as the types of products sold as well as the number of dealers and how they are dispersed across the country, has not been accurately known. The most concrete estimate about the number of retailers in the sector, which emerged from a review of the literature is also very few. This is identified as the major researchable gap based on the market potential of pesticides sales in India and the need to fulfill the gap between the demand and supply of pesticides consumption. Thus, the current study aims to analyse the users’ perception towards pesticides marketing in India and the indefinable role played by the private label retailers/dealers of pesticides.
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