



A study on farmer's perception on ill effects of agro chemicals in north eastern part of Karnataka

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Abstract: The present study was conducted in Yadgir district of Karnataka to know about the perception of farmers on the ill effects of agro chemicals. One hundred and twenty farmers were interviewed personally with the help of pre-structured schedule. The results revealed that a large number of respondents had perceived delay in ripening (70.83%), less resistance to diseases (76.66 %), through emission of toxic gases (80.83%) and changes in soil organic matter decomposition (80.00%). Cent per cent respondents expressed resistance developed to pesticides by helicoverpa, spodoptera and parthenium and beneficial organisms like earth worms and predators were affected. Killing of natural enemies by pesticides affect Trichogramma (80.00%) and lady bird beetle (75.00%), while handling agro chemicals cent per cent perceived it is going poison human body. The correlation indicates attitude towards chemical fertilizers, extension participation and mass media had shown positive highly significant at 1% level. Regarding factors influencing on agro chemicals land holding and education observe 50.63 per cent of variation. On the other hand farmers were suggested to make the availability of pest resistance variety by majority (83.33%) of the respondents.

Keywords: Agro chemicals, Environmental pollution, Health problems, Ill effects, Pesticides

INTRODUCTION

Agriculture and the environment have always been closely inter-linked. We depend upon the environment, on the resources of land, water, sunlight and biological organisms for agricultural production. The environment provides opportunities for agriculture, but it is hampered by several activities. The environment of the world is slowly degrading due to industrial and agricultural emissions and the people are very anxious about the degradation or pollution as this may cause serious damage to lives on the earth (Brodt *et al.*, 2011). Today, it is an established fact that agriculture sector beside industry is another major polluter of environment on a local, regional and global basis (Muhammad and Ruslan, 2012).

About 70 percent of pesticides is being used in developing countries and remaining 30 per cent in developing countries. More than 1000 agro chemicals are being manufactured and used for agriculture as well as public health purposes. About 90 per cent of this quantity is comprised of insecticides and herbicides with about equal share each. Fungicides represent about 10 percent of the total. Use of pesticides in India is increasing at the rate of two to five per cent per annum and is about three per cent of total pesticides used in the world. About 90,000 metric tons of technical grade pesticides are currently produced and more than 67 per

cent is used in agriculture sector alone (Nigam and Murthy, 2000).

Indiscriminate use of high dosage fertilizers has caused several problems on the farm as well as outside farm. Plants become more susceptible to pests and diseases and their control could be effectively done by using high potency poisonous chemicals. As a result, their residue on plants and in the soil had lead to health hazards (Malathi and Bangarusamy, 2001). Similarly, excess nitrogen as nitrate and phosphate leached through the soil and entered natural sources of drinking water also responsible for health hazards. The chemical detrimental effects of fertilizers on plants are reduction in germination, retardation in seedling growth, scorching and increased susceptibility to diseases (Asha *et al.*, 2001). Methemoglobinemia (blue baby disease) in infants, cancer and respiratory illness in human beings, eutrophication and plant toxicity due to excessive availability of inorganic and organic nitrogen in surface water and soil (Addiscot, 1996).

In order to mitigate these health hazards and bring out natural balance and protection of ecosystems, the organic movement has started in several parts of the world, in which no chemical fertilizer and plant protection chemical is used in the cultivation of field crops, vegetables and fruits. The investigation of farmer's perception regarding pesticides impact on sustainable environment is an active area of research in crop sci-

ence, agricultural extension and environmental studies. Already, more than a few studies have been conducted regarding farmers' perception, but they focused on climate change, untreated wastewater irrigation, or soil degradation etc. The present study is an attempt to investigate the farmer's perceptions towards ill effects of agro chemicals, their relationship with socioeconomic factors and suggestive measures to minimize the ill effects of agro chemicals as perceived by farmers.

MATERIALS AND METHODS

Descriptive survey design for data collection was adopted in the present study. The study was conducted in Yadgir district of Karnataka in India. The main crops grown in the district were paddy, cotton chili, cabbage, carrot, tomato and cucumber (Anonymous, 2015). Because of favourable climatic condition prevailing in the study, majority of crops were affected by pests and diseases. In order to mitigate these pest and diseases, the farmers were heavily relying on agrochemicals. From this district Yadgir and Shahapur taluks were selected due to maximum area under irrigation and cultivation. Further two villages were selected from each taluk which have maximum area under irrigation and cultivation. From each village, 15 farmers were selected randomly, who were growing mainly cotton, paddy and chili making a total of 120 farmer respondents.

Data were collected using a well structured pre-tested interview schedule and direct observation (Kumar, 2012). The interview schedule had three sections: (i) information on socio-economic profiles (ii) perceptions farmer towards the ill effects of agro chemicals and (iii) Measures to minimize the ill effects of agro chemicals. The socioeconomic characteristics studied were age, education, land holding, annual income, attitude towards chemical fertilizers, extension participation, institutional participation and mass media use (Venkataramaiah, 1990). A teacher made perception test was developed to measure the perception level of farmers about the ill effects caused by indiscriminate use of agro chemicals. Information regarding the different ill-effects of agricultural chemicals like their effect on human health, toxicity to animals, hazardous to environment and non-target organisms, resistance developed by pests, etc., was collected from a good number of relevant literature, books and consulting experts from University of Agricultural Sciences in the concerned departments of like entomology, soil science, agronomy, plant pathology, soil science, environmental science and horticulture. To get the rural people's perception towards the ill effects of agro chemicals, 14 selected indicators on ill effects of indiscriminate use of agro chemicals were incorporated in the schedule and their degree of importance were measured by yes or no responses by the respondents. The observed data were analyzed on MS Excel and Statisti-

cal Package for Social Sciences (SPSS) software with the level of significance set at $p < 0.05$. The statistical tools viz., frequency (f), percentage (%), average (\bar{x}), standard deviation coefficient of correlation and simple regression were applied for analysis of the data as per Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

The results on the ill effects of agro chemicals as perceived by the farmers were presented in the Table 1. Regarding excuses use of nitrogenous fertilizers and its ill effects, 16.66 per cent of the farmers perceived that it increased the level of nitrates in soil, delays ripening of grains (70.13%) and thirty per cent of the farmers perceived it leads to lodging of crops. Further, two-third of the respondents (76.66%) believed it was less resistance to diseases. Excessive quantity of nitrates in drinking water causes Blue-baby syndrome was perceived by only 6.66 percent of the respondents.

Regarding the changes or alter in fundamental soil properties brought about by pesticides, majority (80.00%) of the farmers perceived that it affects on the organic matter decomposition and only 6.66 percent perceived it affects on the nitrogen transformation. Whereas 1.66 and 52.50 percent of the farmer respondents perceived the pesticides affects soil process such as phosphorus availability and soil enzyme activity respectively. Cent per cent of the farmer respondents perceived fertilizer and pesticide factories pollute the environment by allowing the factory effluents run into rivers. While 80.83 per cent of respondent's perceived factories polluted the air by the emission of toxic gases. It has been noted that most the crops requires lower rates of agro chemicals to increase yield and higher rates suppress yield (Glover-Amengor and Tetteh, 2008). The results clearly indicate that the respondent farmers had the effects of the use of pesticides. They were aware of the fact that pesticides cause pollution, can affect soil fertility and impose toxic effects on the soil. Commercial inorganic fertilizer makes soil hard and difficult to cultivate and kill beneficial organisms in the soil (Robert, 2013).

Perception of farmer towards the ill effects of pesticides is indicated that, 16.66 percent of the farmer perceived the ban on organochlorine insecticides such as DDT, BHC and Aldrin persist in soil for a longer period. While 5.00 per cent of the farmers perceived these chemicals were translocated from soil to plants. An equal percent (6.66%) farmer respondents perceived that they were detected in all water bodies make unsafe for drinking purpose and residues of these chemicals were detected in human breast milk, blood and adipose tissues increasing the risk of cancer. Whereas 10.00 per cent of the respondents perceived residues detected in almost all food and feed stuff which are reported to be carcinogenic. The resistance developed by pests to the pesticides, majority (69.16%) of farmers perceived

Table 1. Perception of farmer towards the ill effects of agro chemicals (n=120).

S. N.	Particulars	Frequency	Percent
1	Excessive use of N fertilizers leads to Increase in level of nitrates in soil	20	16.66
	Delays ripening of grains	85	70.83
	Leads to lodging of crops	35	29.16
	Lessens resistance to diseases	92	76.66
2	Excessive quantity of nitrates in drinking water mainly causes Blue-baby syndrome	08	06.66
3	Release of Nitrous oxide damage soil and ozone layer which leads in the increasing temperature	30	25.00
4	Fertilizer and pesticide factories contribute to environmental pollution	97	80.83
	Through emission of toxic gases By allowing effluents to run into river, lakes etc.	120	100.00
5	Organochlorine insecticides like DDT, BHC, Aldrin are banned because		
	Persist in soil for a longer period		
	Translocated from soil to plants	20	16.66
	Detected in almost all water bodies making it unsafe for drinking	06	5.00
	Residues are detected in human breast milk, blood and adipose tissues, increasing the risk of cancer	08	6.66
	Residues are detected in almost all foods and feed stuffs which are reported to be carcinogenic	08	6.66
6	Pesticides in soil change or alter fundamental properties		
	Organic matter decomposition	96	80.00
	Nitrogen transformation	08	6.66
	Phosphate availability	02	1.66
7	Soil enzyme activity	63	52.50
	Use of the same pesticides for the same crop over a period of time induces resistance in pests	83	69.16
8	Pests resistant to chemicals		
	Helicoverpa	120	100.00
	Spodoptera	120	100.00
	Whitefly	52	43.33
	Thrips	35	29.16
9.	Weeds resistant to chemicals		
	Parthenium	120	100.00
	<i>Cynodon dactylon</i>	110	91.16
	<i>Cyprus rotundas</i>	116	96.66
10	iv. <i>Phalaris minor</i>	63	52.50
	Pesticides not only kill pests, but also beneficial/non target organisms like		
	Earthworm	120	100.00
	Honeybees	97	80.83
	Predators	120	100.00
11	Birds	75	62.50
	Killing of natural enemies (predators and parasites) of pest leads to resurgence of major pests		
	Lady bird beetle	90	75.00
	Green lacewing	40	33.33
	Trichogramma	96	80.00
12	Mantid	30	25.00
	Have experienced/seen/heard of the effects of pesticides when came in contact while handling, mixing, spraying, dusting of chemicals	23	19.16
	Vomiting	68	56.66
	Nausea	120	100.00
	Poisoning	72	60.00
	Rashes	72	60.00
13	Irritation to skin and eyes		
	In what ways that pesticide residues in food a feed stuffs affect human life causes		
	Cancer	18	15.00
	Blindness	11	9.16
	Lung problems	23	19.16
	Nervous weakness	09	07.50
	Skin diseases (rashes)	72	60.00
Reduces resistance power to diseases	17	26.00	
14	Effect of pesticides on domestic animals like milch, drought animals and poultry birds	07	05.83
	By accumulating in their blood, fat, which may cause cancer		
	It contaminates the milk, meat and egg with residues	12	10.00
	Causes disturbances in central nervous system and cause skin diseases if exposed to severe toxicity	05	04.16
	Affects the reproductive capacity of animals	17	26.00

Table 2. Correlation between perception of ill effects of agro chemicals with other research variables (n=120).

S. N.	Characteristics	Correlation coefficient (r)
X1	Age	0.0548NS
X2	Education	0.1667*
X3	Land holding	0.1351NS
X4	Annual income	0.1519*
X5	Attitude towards chemical fertilizers	0.1759**
X6	Extension participation	0.2332**
X7	Institutional participation	0.1691*
X8	Mass media use	0.2022**

NS – Non significant, * Significant at 5 per cent level, ** Significant at 1 per cent level

it was due to the frequency of resistant genes present in the population and the rate at which the pest population breeds (Number of generation/year). Many of the chemicals used in pesticides are persistent soil contaminants, whose impact may endure for decades and adversely affect soil conservation. The use of pesticides decreases the general biodiversity in the soil. Not using the chemicals results in higher soil quality (Johnston, 1986). The insecticides DDT, methyl parathion, and especially pentachlorophenol have been shown to interfere with legume-Rhizobium chemical signalling. Reduction of these symbiotic chemical signalling results in reduced nitrogen fixation and thus reduced crop yields (Rocket, 2007). Eutrophication of lake and river water bodies, nitrate pollution of ground water, increased emission of gaseous nitrogen and metal toxicities are the major fertilizer related environmental damages (Katyal, 1979).

Regarding the pests and weeds which have become resistant to the chemicals cent per cent of the farmers perceived Helicoverpa and Spodoptera had become resistance. Whereas, 43.00 and 29.16 percent perceived whitefly and thrips become resistant respectively. With regard to resistance to weeds to herbicides majority of them perceive that Parthenium (100.00%), Cynodondactylon (91.16%), Cyprus rotundas (96.66%) and Phalaris minor (52.50%) was perceived resistant. Pests may evolve to become resistant to pesticides as a result of continued use of pesticides in a particular environment. Many pests will initially be very susceptible to pesticides, but some with slight variations in their genetic makeup they become resistant and therefore survive to reproduce (James, 2011). Razali (1997) reported that it is becoming difficult to produce on many of the farms without using pesticides. That's why, farmers use different types of pesticides. It is important for all the farmers to have an perception of the appropriate use of various pesticides needed for different crops.

Regarding harmful effect of pesticides to beneficial/non-target organisms cent per cent of farmer's perceived organisms such as earthworm and predators

were affected. While 80.83 and 62.50 percent perceived honey bees and birds are also affected. The effect of chemicals on natural predators 80.00, 75.00, 30.33 and 25.00 per cent of the respondents perceived it affected tricogramma, lady bird beetle, green lacewing and mantids respectively. Some natural pollinators, such as honeybees and butterflies, are very sensitive to pesticides. Pesticides can kill bees and are strongly implicated in pollinator decline, the loss of species that pollinate plants, including through the mechanism of Colony Collapse Disorder (Hackenberg, 2007). Some pertinent examples associated with birds are killed as a result of pesticides includes diazinon and carbofuran which are well documented as causing bird kills in many parts of the world (Kegley, 1999).

Regarding the ill effect of pesticides on human health while handling chemicals 19.16 per cent perceived it induced vomiting at the time of application and nausea was perceived by 56.66 per cent by the farmers. Cent per cent of the farmers perceived chemical induced poisoning. Whereas an equal percent (60.00%) of the respondents perceived that it affect rashes and irritation to skin and eyes. Pesticide residues in food stuffs affect human life causes cancer (15.00%), blindness (9.16%), lung problems (19.16), nervous weakness (7.50), skin diseases or rashes (60.00%) and reduces resistance power to diseases (26.00%) was perceived by the respondents. Elzimaity (1998) reports that change in one or more of the physical, chemical properties, or all or some of the vital components of the environment would lead to adverse effects to humans, plants and animals. This high level of knowledge about pesticide hazards which the end users of pesticides have is important for the prevention of acute poisoning (Hong, 2007), (Adeola, 2012). Pesticides generally affect people's health, cause skin, eye irritation, stomach irritation, vomiting and dizziness (Robert, 2013). Pesticide residues affect human health. In fact, pesticide application has become a great threat to human health (Buczynska, and Szadkowska-Stanczyk, 2005), (Elfvendahl *et al.*, 2004), (Leyket *et al.*, 2009), (Sivanesan *et al.*, 2004). Studies have shown that long-term low-dose exposure to pesticides leads to the development of respiratory diseases such as asthma (Hoppin *et al.*, 2002). Such exposure also leads to reduced sperm quality and sperm count, causing sterility (Tuc, 2007) (Govinda, 2014). Exposure to pesticides can range from mild skin irritation to birth defects, tumours, genetic changes, blood and nerve disorders, endocrine disruption, and even coma or death (Miller, 2004). Pesticides can enter the human body through inhalation of aerosols, dust and vapor that contain pesticides, through oral exposure by consuming contaminated food and water; and through dermal exposure by direct contact with pesticides with skin (Sacramento, 2008).

Regarding the ill effects of chemicals on domestic animals like milch, draft animals and poultry birds, only a

Table 3. Factors influencing perception towards ill effects of agro chemicals.

S. N.	Characteristics	Regression coefficient	S.E. of Standard error	't' value
X1	Age	-0.0059	0.0093	- 0.6356
X2	Education	0.1555*	0.7580	2.0512
X3	Land holding	0.1632*	0.0541	2.6988
X4	Annual income	0.0292	0.0694	0.5943
X5	Attitude towards chemical fertilizers	0.0160	0.0122	1.3176
X6	Extension participation	0.1050	0.0770	1.3637
X7	Institutional participation	0.0191	0.0844	0.2268
X8	Mass media use	0.0732	0.0495	1.4774

R² = 0.5063, F value = 2.6924**, * Significant at 5 per cent level, ** Significant at 1 per cent level

Table 4. Measures to minimize the ill effects of agro chemicals (n=120).

S. N.	Suggestions made by farmers	Frequency	Per cent
1	Making available pest resistant varieties	100	83.33
2	Organizing training on eco-friendly practices	88	73.33
3	Encouraging farmers to grow organic crops through subsidies, technical guidance etc.,	82	68.06
4	Ensure strict quality control measures for pesticides	80	66.66
5	Use of bio-pesticides and bio-fertilizers must be increased	73	60.59
6	Use of bio-control agents in the control of pests must be increased	69	57.27
7	Give premium price for organically grown crops	64	53.12
8	Educate public and farmers about the environmental issues	49	40.67
9	Establishing a network of farmers adopting organic farming	44	36.52
10	Introducing environmental education at the secondary level	25	20.75

mere percent of farmer respondents perceived it will accumulate in their blood and fat, which causes cancer (5.83%), it contaminates the milk, meat & egg with residues (10.00%) and causes disturbances in the central nervous system and causes skin diseases if exposed to severe toxicity (4.16%). More than one-fourth of the respondents perceived chemicals affected the reproductive capacity of the animals (26.00%). The ill effects of indicated above seem to be complex to understand and remember. Most of them need scientific analysis to identify and determine a cause for the ill effect noticed. It can be said that many of the above mentioned ill effects are beyond the comprehension of farmer's level of understanding. Probably these facts might be the reasons for the less perception by the farmer respondents. Pesticides are sprayed onto food, especially fruits and vegetables, they secrete into soils and groundwater, which can end up in drinking water and pesticide spray can drift and pollute the air. In some areas, pesticides have created the pollution problems and the environmental issues due to their excessive use. Similarly the damage of toxic pesticide contamination, however, farmers had the lowest level of knowledge of the pesticide damage on atmospheric layer/cover and the growing plants (Alteieri, 2000).

Correlation between perceptions on ill effects of agro chemicals with other research variables: The results in the table indicated that there is a direct correlation between the level of education, annual income, institutional participation with 0.05 correlation coefficient and attitude towards chemical fertilizers, extension participation, mass media use (as independent variable) with 0.01 correlation coefficient on perception of ill effects of agro chemicals (as the dependent variable) with potential level of 0.1667, 0.1519,

0.1691, 0.1759, 0.2332, 0.2022 respectively. This means that the farmers with higher the higher levels of education will have increased annual income, attitude towards chemical fertilizers, extension participation, institutional participation and mass media use. Increased level of perception on the adverse effects of agrochemicals and the high level of income and education were important factors to have the assessment of mental approach of the farmers and the usefulness of material about the adoption of modern methods and practices. Educated farmers can easily deal with pesticides and are their awareness level on the consequences of using the incorrect pesticides and the negative effects inappropriate use on the environment is certainly higher. As revealed in table there is positive correlation between personal characteristics of respondents and their perception regarding the ill effects of agrochemicals. The level of perception of respondents about the adverse effects of agrochemicals is significantly influenced by the parameters like the level of education, education, annual income, institutional participation, attitude towards chemical fertilizers, extension participation and mass media use (Banjo *et. al.* 2010 and Al-Zaidi *et al.*, 2011).

Factors influencing on ill effects of agro chemicals: Farmer's show that an overall satisfaction level on perception of the ill effects of agro chemicals. It was observed that eight independent variables included in the study could explain 50.63 percent variation in the perception level of farmers towards ill effects of agro chemicals. Out of eight variables considered, only land holding and education were found to be positively significant in influencing the perception of farmers towards ill effects of agro chemicals with regression co-efficient of 2.0512 and 2.6988 at 0.05 level of sig-

nificance respectively. Hence, these two variables could be termed as good predictors of the perception of farmers towards ill effects of agro chemicals. Landholding and education were the most significant socio-economic variables affecting the farmer's perception of the importance of the ill effects of agro chemicals. Those who have larger landholdings perceive the ill effects of agro chemicals. This indicated that the selected variables could explain fifty per cent of the variation in the perception and remaining fifty percent variation could be attributed to some other variables which were not indicated in the study. Even there was a significant change in the perception of farmers towards ill effects of agro chemicals can be brought about by bringing positive changes in these two variables. This leads to the conclusion that land holding and education had significantly contributed to increase in perception of farmers towards ill effects of agro chemicals. The factors found to be associated with pesticide poisoning in this study indicate that implementation of specific intervention strategies and education of farmers is needed in order to improve safe handling, use and disposal of pesticides and reduce incidents of acute pesticide poisoning (Ncube *et al.* (2011).

Measures to minimize the ill effects of agrochemicals: It is found that majority (83.33%) of the respondent's suggested making the availability of pest resistant varieties. This could be attributed to the reason that there are only few companies releasing good high yielding resistant varieties and which are costlier to purchase. Nearly three-fourth (73.33%) of respondents said organizing training on eco-friendly management practices. This might be due to the rising costs of agro chemicals, which are very high, and resistance in pest is also being observed. 68.06 % of the respondents suggested encouraging farmers to grow organic crops through subsidies, technical support, etc. Now a day's organic farming is gaining more importance and they were getting a good return from growing organically grown crops. Ensure quality control measures for pesticides were suggested by respondents.

Conclusion

The run off agrochemicals and their effluents into river and lakes leads to pollution and also affecting the eco system. The over usage of pesticides leads to resistance in Helicoverpa & Spodoptera and also kills beneficial organisms and insects. We must use alternative methods in pest control including expanding biological agriculture, natural and natural enemies to combat pests, pest control mechanical activities, chemical pesticides with a lower degree of toxicity and timely use of pesticides in order to effectiveness of pesticides, so it's very important that Integrated Pest Management Centre, State Department of Agriculture, University of Agricultural Science and Environmental Pollution Board should make integrated and concrete

efforts to provide the required perception about environmental hazards caused by indiscriminate use of agro chemicals.

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