# Health Risk of Conventional Farmers: A Case Study of Tamil Nadu, India

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**Abstract**

***Purpose***: *To investigate,Occupational health risk of farmers exposed to agrochemicals and pesticides in their agricultural activities of Tamil Nadu, India.*

***Method and Methodology***: *Descriptive and empirical analysis was done to justify the objectives. Purposive non random sampling method was used to find the sample elements and the study area. Primary data was collected June to July 2024. Sample size was 128 based on the usages of agrochemicals and pesticide during their agricultural activities. Linear Probability model and Chi Square test was used.*

***Findings***: *From the field survey, it's clearly understood that the farmers are using pesticides and agrochemicals and aware about its existing health risk. Hundred percent of respondents pointed out that a pesticide spray is done just before harvesting in case of Grapes for to maintain its yield, colour and quality. There was an inverse relationship of adopting self-preventive measures against the number of times / risk exposures from agrochemicals and pesticides. One unit of increase in age increases the unfavourable opinion on the preference for conventional farming by 0.01475 units. The positive coefficient of 0.7832 arrived for the variable on the number of members in the family indicates that every one unit of member increase in the number of members in the family increases the preference for farming of traditional by 0.7832 units. Similarly, in the case of the variable on the number of earning members, the negative slope coefficient of -0.4541 implies that every one unit of increase in the number of earning members in the family reduces the preference farming activity. It indicates that better healthy peasants in the study area. The tangible self-health issues are cared immediately by both Indian medicines and Allopathic Medicines.*

***Conclusion***: *Certainly Farmers in the study area were in the aura of economic returns on investment, who thought of farming as an economic activity. One side Simply profit motivators and other side of the coin caring their health and others. To conclude that,Present and future generation must have (Bio-empathy) the ability to see things from nature's point view; to understand, respect, and learn from its pattern for their own health status and their soil's health status.*

**Keywords: Health Risk, Health Status, Health Expenditure, Conventional Farming**

## Introduction

Health is an important factor impact on poverty reduction strategy. Good health of an individual can increase his/her productivity which in turn leads their household income. The present approach of the government to care the health of any individual has been to extend preventive and curative public health with a large burden on public expenditure and the outreach to poor in rural areas is often limited. Because the supply timing of public healthcare system and the distance of public multispecialty healthcare supply are the prime reason for access in hard times for people who suffered in health issues from rural areas. The other sides of rural India, traditional methods of farming were by default 'organic', with hardly any use of chemical inputs. However, concerns about ensuring food security for a large population led to the Green Revolution in the 1960s, which resulted in an increase in the use of chemical inputs to improve crop yields, leading to the some deteteorition effects on soil and producer, consumer health that developed countries had already experienced, experiencing and will experienced if the usage of agrochemicals and pesticides persist in cultivation.

The two main issues facing the world's abnormally growing population are environmental preservation and food security. The most vital resource needed to survive is food. It provides nutrients and energy for the body's growth, maintenance, repair, and production. It has never been easy to produce enough food to meet the demands of the entire world's population, even with the dedicated supply of laborforce by farmers in any part of the world to feed their country. The prime reason is each and every farmer facing challenges given by more than 10,000 different kinds of insects and 30,000 different kinds of weeds which were seriously reduce the crop productivity (Dhaliwal et al.). The use of HYV seeds, better irrigation systems, and the application of composts and pesticides, is the appropriate supervision strategy for crop damage caused by pests. But, the other sides of using pesticides are alerted in India during second plan period itself. In Kerala, more than 100 people died after eating wheat flour contaminated with parathion in 1958, marking the first recorded case of pesticide-related injury in India (Karunakaran). Scientific research studies found that long-term effects of pesticides among farmers and common population include cancers of the mind, bones, and stomach, lymphomas, leukemia, soft tissue sarcomas, damage to the peripheral and central nervous systems, birth defects, reproductive issues, immune system disruption, and mortality (Tomer et al.). In 2023, two farmers, Gunasekharan (42) from Kappamadai area in Gudalar passed away at Government Medical College Hospital, Theni on October 1. A few days later, on October 8 another farmer, Pandian, (54) of Vettukadu in Theni also died in hospital. The two farmers were admitted to hospital after they sprayed an insecticide, 'Sapper' in their fields, following which they vomited, complained of giddiness and fainted. They died within a few days of hospitalization. Hence, this study was done by the following research question: What are the health problems of agricultural workers experiences as a result of occupational exposure to pesticides in Tamil Nadu specifically in Cumbumtaluk in Theni district?.

Due to variations in the duration and intensity of exposure, the toxicity of the pesticides, the field mixes or cocktails used, the geographic and meteorological features of the agricultural areas where pesticides are applied, and other factors, assessing the risk of pesticides' effects on human health is not a simple or particularly accurate process (Damalas and Eleftherohorinos). A lot of the discussion in the long-running pesticide controversy is fruitless black-and-white schematizing. People who advocate for pesticides may be called profit-seeking polluters, while individuals who express worries about pesticides are likely to be labeled as uninformed idealists with unrealistic phobias. The conflicting results in the current literature will probably fuel continued discussions over limiting or outlawing pesticides, with each side arguing that their position has been validated. From the understanding of the possible impacts of pesticides on human health and the environment has been aided by the numerous researches that have been published in the literature. It goes without saying that the more informed about the advantages and disadvantages of using pesticides, them ore effectively can address their harmful effects (Damalas et al.).

A group of researcher done an articles review and analyzed the corpus of work that had been published between January 2016 and March 2018 using a non-systematic methodology. The researchers looked for publications that showed farmers were exposed to pesticides at work while performing normal agricultural duties in online electronic databases (such as PubMed, Science Direct, Web of Science, and other online sources). The authors state that studies have demonstrated the presence of pesticide residues and metabolites in human blood and urine. Additionally, the scientists classified the data based on the kind of health risk that farmers encounter from pesticide exposure. 41% of high-risk ailments for farmers were neurological disorders, followed by cancer (13%), other health issues (14%), poisoning (8%), respiratory problems (7%), genotoxicity (6%), reproductive disruption (6%) and chronic renal diseases (5%) (Dhananjayan and Ravichandran).

Another group of researcher's evaluation was availed, which were also collected the articles between January 2015 and October 2018. Articles were taken from the LILACS, SciELO, and PubMed databases by researchers. Thirty five articles were taken which were representing different parts of

the world or can say from different countries. The review's included articles revealed a number of ways that agricultural workers' health may be harmed by prolonged exposure to pesticides while performing their jobs. Hematological changes, respiratory problems, endocrine disruption, neurotoxicity, infertility, an most serious of all an elevated risk of certain cancers are among the ailments linked to pesticide exposure (de-Assis et al.). In addition the usage of pesticide in farming activities may generate its negative externality too which is intangible in reality. Hence, it is significant to study the implication of using pesticide on human health specifically the targeted population are farmers.

**Review of Literature**

The purpose of a pesticide is to kill, repel, or mitigate a pest. Pesticides are composed of chemical and biological substances used industrially. Pesticides are classified on the basis of various criteria such as toxicity (Hazardous effects), pest organism they kill and pesticide function, chemical composition, mode of entry, mode of action, how or when they work, formulations and sources of origin. Farmers and the persons who are coming in contact with pesticides are unaware about types of pesticides and their hazardous effects. With the thorough knowledge of classification of pesticides, its gross use, exposure and toxicity can be minimized by using it judicially (Akashe et al.).

(Setboonsarng and Lavado) did an Investigation of Health Expenditure among Organic and Conventional Farmers in Thailand. A survey was conducted on organic and conventional rice-farming households in North and Northeast Thailand in 2006. The results show that health expenditure of conventional farmers is 56% higher than organic farmers. Catastrophic health expenditure is also significantly higher for conventional farmers than organic farmers. (Rupera) reported that, Anand Agriculture University, Gujarat warned consumers to look before they cook any vegetables. A Survey conducted at AAU's laboratory in Anand, Surat, Vadodara, Padra, Nadiad and Bharuch had revealed that cabbage, Lady's finger and cauliflower were more exposed to pesticide contamination in the state. (Jallow et al.) enlightens the symptoms of the farm workers from Kuwait. The most frequently reported symptoms were headaches (82%), skin irritation (58%), nausea (49%), itchy eyes (79%), dizziness (41%), fatigue (50%), and coughing (22%). Other symptoms reported by respondents were poor vision, stomach ache, excessive sweating, shortness of breath, and vomiting.

Further, (Kori et al.) identified that the farm workers in sagar, Madhya Pradesh-India, were had the adverse health effects in farm workers including tingling (32.3%), muscle pain (51.6%), headache (56.5%), skin disease (19%), blurred vision (35.5%), tremor (23%), stress (24.2%), depression (15.3%), anxiety (44.7%), altered taste (21.4%), altered smell (31.4%), sleep disorder (39.5%), dizziness (66.1%), memory problems (29.4%), trouble in walking (8%), and cardiac problems (16.9%). The research articles pertinent to various geographical area of farmers of country Nepal published over the years depicted that the high use of chemicals is detrimental to farmers', consumers', and ultimately environmental health (Atreya et al.; Bhandari et al.).

So, one of the most hazardous pollutants for the environment is pesticides because of its detrimental effects on ecosystems and human health. In humans in particular, there is a higher risk of mutagenesis, cancer, and other negative outcomes (Pathak et al.). The effects on ecosystems, and potential remediation strategies, and confirm the negative effects of pesticide exposure on human health. Pesticide exposure occurs both directly through domestic, agricultural, and occupational activities (Sapbamrer et al.) and indirectly through contaminated food, water, soil, and air (Macfarlane et al.). These several types of exposure influence the level of pesticide toxicity (Anderson and Meade). It's also claimed that a sharp increase in the use of pesticides with long half-lives harms local aquatic ecosystems and builds up in the bacteria, plants, and animals that dwell there (Dhuldhaj et al.). Increased use of pesticides had a detrimental impact on health and the environment.

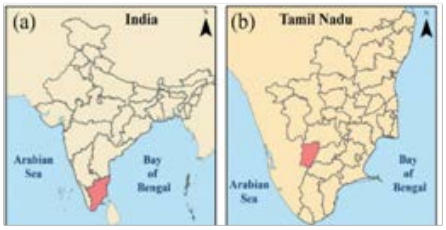
**Methodology**

The data used for this research fact was both primary and secondary data. The secondary data was collected from the statistical hand book of India, and

Tamil Nadu. The primary data was collected from the field by using interview schedule. The tools of analysis used were simple tabulation, percentage analysis, linear probability model, logit model and Chi-Square test.

**Consumption of Agrochemical and Pesticide in the Study Area**

In India per hectare use of total fertilizer nutrients ($N+P_2O_5+K_2O$) marginally up from 141 kg in 2021-22 to 141.2 kg in 2022-23. Ninety two percentages of the fertilizers was used by 13 states of India which are as follows: Uttar Pradesh had the largest share (17.6%), followed by Maharashtra (9.5%), Madhya Pradesh (9.4%), Karnataka (6.9%), Punjab (6.3%), Rajasthan and Gujarat (6.1% each), Andhra Pradesh (5.9%), Telangana (5.7%), Bihar (5.5%), West Bengal (5.4%), Haryana (4.5%) and Tamil Nadu (3.5%). The least used state and by rank thirteenth was Tamil Nadu in Southern India next to Kerala.




**Source:** National Informatics Centre

Minister M R K Panneerselvam presented the Agriculture Budget in the Tamil Nadu Legislative Assembly on 22nd February 2024 for the financial year 2024-2025, which focuses on sustainable practices, GI tags for 10 agricultural products and other highlights like giving subsidy for the installation of automated irrigation systems, promoting the precise application of water directly to the plant's root zone as needed. Odaipatti village seedless grapes from Theni district is the one among the ten Geographical Indication (GI) tag to be obtained for agricultural products. Chemical-free agricultural practices for the wellbeing of society, a new scheme called the 'Chief Minister's Mannuyir Kaathu Mannuyir Kaappom Scheme (CM MK MKS) to protect soil fertility with 22 components to be implemented at an outlay of Rs 206 crore in 2024-25.

**Table 1 Consumption of Pesticides in Tamilnadu**

| Years | Consumptions (MTs) |
|---|---|
| 2011-12 | 1968 |
| 2012-13 | 1766 |
| 2013-14 | 2142 |
| 2014-15 | 2096 |
| 2015-16 | 2096 |
| 2016-17 | 2092 |
| 2017-18 | 1929 |
| 2018-19 | 1901 |
| 2019-20 | 2225 |
| 2020-21 | 1834 |
| 2021-22 | 1851 |
| 2022-23 | 1952 |
| CAGR | 0.089% |

The average consumption of Pesticide in Tamil Nadu from 2011 to 2023 is 1987.7 Metric tonnes. The minimum consumption was 1766 metric tonne in 2012-2013 and the maximum consumption was 2225 MT in 2019-2020 which was Covid 19 period. There is poor correlation between the period and the pesticide consumption in Tamil Nadu. There is a negative correlation between the pesticide consumption and years. It means that the consumption of pesticide in Tamil Nadu is reduced over the period from 2011 to 2023. The linear regression relationship between the pesticide consumption as dependent with respect to time variable (over the year) resulted that -5.839 MT consumption was reduced when a year passes from 2011 to 2023. Table 2 depicts that , among the districts in the state Tamil Nadu, the study area Theni consumed 0.6 percentage of Dust (MTs) of Tamil Nadu's consumption and 2.4 percentage of pesticide was consumed as Liquid (Lts) during 2022.

Cumbum valley grapes city of south India is very popular for Muscat Hamburg (panneerthiratchai) cultivation. It is noteworthy that the valley contributes

up to 85% of panneerthiratchai production in the country. Tamil Nadu's famous Cumbum Panneerthratchai, also known as Cumbum grapes, has received the Geographical Indication (GI) tag in April 2023. The 'Panneer' variety is chiefly associated with Cumbum Valley, where the cultivation area covers around 2,000 acres at 10 villages. The agro climate and the soil condition of the Cumbum region are very conducive to the cultivation of the Muscat variety. This variety is popular for its quick growth and early maturity, ensuring that the crop is available in the market almost throughout the year. Cumbum Valley is a testament to India's agricultural prowess. It's a beacon of successful grape farming. The valley's contribution to agriculture is significant. Moreover, it sets a standard for grape cultivation worldwide.

**Table 2 District wise Consumptions of Agrochemicals in Tamil Nadu 2022**

| S. No | Districts | Fertilizers | | | | Pesticides | |
|---|---|---|---|---|---|---|---|
| | | Nitrogen | Phosphatic | Pottasic | Total (NPK) | Dust (MTs) | Liquid (Lts) |
| 1 | Kancheepuram | 9592 | 3794 | 1060 | 14446 | 211 | 34735 |
| 2 | Thiruvallur | 23469 | 10680 | 3208 | 37357 | 853 | 5910 |
| 3 | Chengalpattu | 11714 | 4914 | 1584 | 18213 | 210 | 34733 |
| 4 | Cuddalore | 35562 | 15879 | 9316 | 60757 | 819 | 12450 |
| 5 | Viluppuram | 29213 | 10951 | 5444 | 45608 | 14 | 974 |
| 6 | Kallakuruchi | 25741 | 11840 | 7350 | 44931 | 13 | 970 |
| 7 | Vellore | 11852 | 4904 | 3023 | 19779 | 42 | 34356 |
| 8 | Ranipet | 14491 | 5528 | 1925 | 21944 | 40 | 34354 |
| 9 | Thirupathur | 13581 | 5830 | 2733 | 22143 | 40 | 34354 |
| 10 | Tiruvannamal | 40252 | 15437 | 6885 | 62574 | 29 | 26708 |
| 11 | Salem | 19895 | 11792 | 6442 | 38129 | 84 | 54128 |
| 12 | Namakkal | 10978 | 6484 | 4356 | 21818 | 101 | 13080 |
| 13 | Dharmapuri | 13928 | 6136 | 4086 | 24150 | 16 | 16925 |
| 14 | Krishnagiri | 18732 | 10650 | 2933 | 32315 | 16 | 16542 |
| 15 | Erode | 25187 | 12800 | 8070 | 46057 | 105 | 44388 |
| 16 | Coimbatore | 11761 | 8496 | 11294 | 31551 | 111 | 26550 |
| 17 | Tiruppur | 16789 | 9241 | 6606 | 32636 | 28 | 14919 |
| 18 | The Nilgiris | 5696 | 2612 | 3178 | 11485 | 28 | 6637 |
| 19 | Tiruchirappalli | 14391 | 5233 | 2722 | 22346 | 52 | 20195 |
| 20 | Karur | 5841 | 3050 | 1861 | 10752 | 3 | 315 |
| 21 | Perambalur | 12476 | 6626 | 2715 | 21818 | 30 | 4328 |
| 22 | Ariyalur | 9860 | 4158 | 1497 | 15515 | 50 | 74826 |
| 23 | Pudukkottai | 19405 | 6625 | 3509 | 29539 | 31 | 23691 |
| 24 | Thanjavur | 37487 | 10522 | 9146 | 57154 | 29 | 1761 |
| 25 | Nagapattinam | 11994 | 4268 | 2533 | 18796 | 37 | 594 |
| 26 | Mayiladuthurai | 7931 | 2253 | 1854 | 12038 | 33 | 593 |
| 27 | Thiruvarur | 25516 | 7423 | 4810 | 37749 | 43 | 3330 |
| 28 | Madurai | 17413 | 7566 | 3687 | 28666 | 59 | 44761 |
| 29 | Theni | 9077 | 4709 | 3341 | 17127 | 21 | 17387 |
| 30 | Dindigul | 19172 | 9963 | 4631 | 33766 | 23 | 29968 |
| 31 | Ramanathapuram | 12242 | 3573 | 594 | 16409 | 46 | 23954 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 32 | Virudhunagar | 10338 | 4227 | 1690 | 16254 | 22 | 13190 |
| 33 | Sivagangai | 9657 | 3253 | 1217 | 14127 | 16 | 13656 |
| 34 | Tirunelveli | 5222 | 1975 | 1488 | 8686 | 105 | 4545 |
| 35 | Tenkasi | 16849 | 6907 | 3570 | 27325 | 100 | 4543 |
| 36 | Thoothukudi | 21488 | 10890 | 7059 | 39437 | 59 | 8078 |
| 37 | Kanniyakumari | 6171 | 3386 | 3471 | 13028 | 44 | 9825 |
| | Total | 610963 | 264575 | 150888 | 1026425 | 3563 | 712253 |

**Source:** Statistical Hand Book of Tamil Nadu 2021-22

## Findings and Discussions

In Cumbum taluk, sample farmers were cultivating Grapes were selected and analyzed in this paper. The researcher found that farmers have potential market with significant income growth and employment diversity. The socio demographic profile of Cumbam depicts that quality of education, high exposure, good potential for income, high expenditure on health and mostly potential age group of young farmer's base. Farmers have the strategy of returns on investment,which thought of farming as a business were willing to spend more to earn more.

**Table 3 Socio Demographic Status of Sample Farmers from Cumbum-Theni district 2024**

| S. No. | Personal Details | N (128) | % |
|---|---|---|---|
| 1 | **Age** | | |
| | 20-30 | 10 | 7.8 |
| | 31-40 | 46 | 35.9 |
| | 41-50 | 36 | 28.1 |
| | 51-60 | 19 | 14.8 |
| | Above 60 | 17 | 13.4 |
| 2 | **Educational Qualification** | | |
| | Primary school | 59 | 46.09 |
| | Middle school | 19 | 14.85 |
| | High school | 50 | 39.06 |
| 3 | **Type of Family** | | |
| | Joint Family | 31 | 30.5 |
| | Nuclear Family | 89 | 69.5 |
| 4 | **Numbers of Members in the Family** | | |
| | Below 4 | 72 | 56.3 |
| | Above 4 | 56 | 43.7 |
| 5 | **Living Place** | | |
| | Own House | 104 | 81.25 |
| | Rental House | 24 | 18.75 |
| 6 | **Type of House** | | |
| | Concrete House | 46 | 35.9 |
| | Tiled House | 26 | 20.3 |
| | Hutcha / Thatched House | 56 | 43.8 |
| 7 | **Toilet Facility** | | |
| | Yes | 45 | 33.6 |
| | No | 83 | 66.4 |
| 8 | **Electricity Supply** | | |
| | Yes | 117 | 91.2 |
| | No | 11 | 8.8 |
| 9 | **Water Supply to House** | | |
| | Bore well | 70 | 55.2 |
| | Govt. Pipe Water | 55 | 43.2 |
| | Others | 3 | 1.6 |

**Source:** Field data

Table 3 says about the socio demographic status of the respondents. 100 percentages of respondents in Cumbum taluk, sample farmers were cultivating Grapes. The researcher found that farmers have major percentage of potential labor force with available facilities like water supply, electricity, own house.

From the table four it shows that, only 37.5% of the people in the age of 35-50 are very much interested in knowing the causes of conventional farming and 28.13% of the people in the age group of 18-34 are very interested in causes of conventional farming whereas 34.38% of the people of age 51 and above are very interested about it. Totally 25 percentage of sample respondents were highly interested to know the risk of conventional farming. Out of interviewed 128 respondents 50 percentages of respondents are not interested to know about the health risk of conventional farming. From the field survey analysis, it's clearly understood that the farmers are not interested to listen the tangible negative effect

and negative externality of conventional farming and its health risk existing for the farmers in study area. But, farmers are still using the conventional method in their farming activities.

**Table 4 Age wise Category - Are you Interested in Knowing about Causes of Conventional Farming?**

| Question for Finding the Respondents | Category of Reply | Age Category | | | Total |
|---|---|---|---|---|---|
| | | Age 18-34 Years | Age 35-50 Years | Age 51 Years & above | |
| Are you interested in knowing about causes of conventional farming? | Very interested | 9 (28.13) | 12 (37.50) | 11 (34.38) | 32 (100) |
| | Somewhat interested | 11 (34.38) | 9 (28.13) | 12 (37.50) | 32 (100) |
| | Not at all interested | 24 (37.50) | 26 (40.63) | 14 (21.88) | 64 (100) |
| **Total** | | 44 (34.38) | 47 (36.72) | 37 (28.90) | 128 (100) |

**Source:** Field data

**Table 5 Respondents by Knowledge about Health Risk of Conventional Farming**

| S. No. | Knowledge about Health Risk of Conventional Farming | Number of Respondents (Street-wise) | | | Total | Percentage |
|---|---|---|---|---|---|---|
| | | Village 1 | Village 2 | Village 3 | | |
| 1. | Aware | 24 | 21 | 34 | 79 | 83.67 |
| 2. | Unaware | 17 | 12 | 20 | 49 | 16.33 |
| | Total | 100 | 100 | 100 | 128 | 100.00 |

**Source:** Field Data

The field study results regarding knowledge about the health risk of conventional farming, shows that 83.67 percent are aware of the health risk due to conventional farming and only 16.33 percent are unaware of the health risk under the conventional farming method.

**Table 6 Sources of Awareness about Health Risk of Conventional Farming**

| S. No | Awareness | Respondents Total | % |
|---|---|---|---|
| 1. | By Advertisement | 21 | 16.40 |
| 2. | Government officials from Agricultural Department | 61 | 47.65 |
| 3. | Friends | 20 | 15.60 |
| 4. | Relatives | 26 | 20.30 |
| | Total | 128 | 100.00 |

**Source:** Field Data

Table six provides the sources of awareness about the conventional farming. The field study information regarding awareness and knowledge about conventional farming and its challenges was learned by 47.65 percent of the sample respondents from the government officials of agricultural departments, who visits in regular intervals, and 15.60 percent through friends, 16.40 percent through advertisement, 20.30 percent through relatives. The table shows the significant role of the agricultural field officers in making the people aware about the pest management and using pesticide.

**Table 7 Practice of Respondents toward Pesticides use in Cumbum Grapes**

| Explanatory Variables | Categories | N | % |
|---|---|---|---|
| Working Experience with Pesticide | Less than 3 Years | 12 | 9.4 |
| | 3 to 5 years | 86 | 67.2 |
| | More than 5 years | 30 | 23.4 |
| Understanding the labeled instructions | Yes | 116 | 90.6 |
| | No | 12 | 9.4 |
| Who Sprays the Pesticide | Own Labour | 43 | 37.5 |
| | Hired Labour | 85 | 66.4 |
| Types of Spraying Equipment | Backpack | 67 | 52.3 |
| | Handhold | 61 | 47.7 |
| Condition of Equipment | Good | 118 | 92.2 |
| | Not good | 10 | 7.8 |
| Weather condition during pesticide spraying | Humid and Cold | 128 | 100 |
| | Dry and Hot | - | - |

| | | | |
|---|---|---|---|
| Frequency of application in a year | 2 times per annum | 118 | 92.2 |
| | 3 times per annum | 10 | 7.8 |
| Overall Pesticide using practice by respondents | Good | 118 | 92.2 |
| | Poor | 10 | 7.8 |

**Source:** Field Data

The table seven reveals about the practice of sample farmers towards pesticide usage. 90.6 percentages of respondents were using the pesticide for their grapes farm more than three years, who were also understood the instructions in the label of pesticide. 66.4 percentages of farmers were hiring the service for spraying pesticide while the remaining farmers were using their own man power. Backpack and handhold spraying equipment's were used equally by the respondents. The conditions of the equipment were good for 92.2 percentages. The applications of pesticide was early in the morning or in the evening otherwise during humid and cold time said by all respondents. 92.2 percentages of respondents replied that pesticide was applied two times per annum. In summary of the behavior of farmers towards the usage of pesticide was good. 7.8 percentages of respondents were not practicing the usage of pesticide as per the instructions in label, leaflet, and agricultural officers.

**Table 8 Attitude towards Pesticide usage in Cumbum Grapes Farms**

| S. No | Explanatory variables | Frequency | | Percentage | |
|---|---|---|---|---|---|
| | | Yes | No | Yes | No |
| 1 | Can you understand the information written on the pesticide packages? | 82 | 46 | 64.06 | 35.9 |
| 2 | Are you wearing protective equipment during spraying | 92 | 36 | 71.87 | 28.8 |
| 3 | Have you ever spilled pesticide on your body? | 40 | 88 | 31.25 | 68.75 |
| 4 | Do you spray against the wind | 32 | 96 | 25 | 75.0 |
| 5 | Do you enter into the pesticide sprayed farmland immediately? | 16 | 112 | 12.5 | 87.5 |

**Source:** Field Data

Table eight depicts that 64.06 percentage of farmers understand the information in the packages of pesticide, 71.87 percentage of respondents wearing protective equipment during spraying, 68.75 percentage of farmers were not spill the pesticide on their bodies while spraying, 75 percentage of respondents responded that they are not spray against the wind and 87.5 percentage of respondents told that they are not entering into the field immediate after spray.

**Table 9 Acute Health Symptoms of Respondents during and after Pesticide Spraying/ Applying in Farms**

| S. No | Outcome Variable | Yes | % | No | % |
|---|---|---|---|---|---|
| 1 | Coughing | 34 | 26.56 | 94 | 73.43 |
| 2 | Headaches | 28 | 21.87 | 100 | 78.12 |
| 3 | vomiting | 14 | 10.94 | 114 | 89.06 |
| 4 | Skin irritation | 26 | 20.31 | 102 | 79.68 |
| 5 | Abdominal Pain | 12 | 9.4 | 116 | 90.62 |

**Source:** Field Data

Table nine shows that 73.43 percentages of respondents were not have coughing, 78. 12 percentage of sample respondents not have head ache, 89.06 percentage of respondents not have vomiting, 79.68 percentage of respondents were not suffering with skin irritation and 90.62 percentage of respondents were not have abdominal pain during or applying the pesticide in farming specifically grapes garden.

**Place of Treatment Obtained**

The details regarding the place of healthcare or treatment obtained by the respondents are provided in the table ten.

The analysis regarding treatment obtained of 128 sample respondents 53.13 percent were took the treatment in public concern, 46.87 percent were access the treatment in private concern. The study reveals that most of the sample respondents were accessing public sector health services. From the study it is inferred that the public health sector scheme has really given an impetus to the sample respondents to access that in their necessary times.

**Table 10 Distribution showing Health Sector for Healthcare Obtained**

| S. No. | Treatment Obtained | Number of Respondents (Village-wise) | | | Total | Percentage |
|---|---|---|---|---|---|---|
| | | Village 1 | Village 2 | Village 3 | | |
| 1. | Public Health Sector | 30 (44.11) | 27 (39.71) | 11 (16.18) | 68 (100.00) | 53.13 |
| 2. | Private Health Sector | 14 (23.33) | 20 (33.33) | 26 (43.33) | 60 (100.00) | 46.87 |
| | Total | 44 (34.37) | 47 (36.72) | 37 (29.00) | 128 (100.00) | 100 |

**Source:** Field Data

## Testing of Hypotheses

### Hypothesis 1

An attempt was made to find out whether there is any significant relationship between knowledge about conventional farming and health risk (exposure to pesticide). For this the following hypothesis has been formulated. The knowledge about conventional farming and awareness about health risk (awareness about exposure to pesticides) are not associated.

**Table 11 Chi-Square Results For Testing Hypothesis**

| Hypothesis | Calculated Value | Tabulated Value | Decision |
|---|---|---|---|
| Knowledge about conventional farming and awareness about Health Risk (awareness about exposure to pesticides) | 2.832 | 5.991 | Accept the Null Hypothesis |

**Source:** Manipulated by the researcher

The table eleven value of $\chi 2$ for 2 degrees of freedom at 5% level of significance is 5.991. The calculated value of $\chi 2$ is less than table value. The result accepts that the hypothesis and it can be concluded that the knowledge about the conventional farming and awareness about health risk (awareness about exposure to pesticides) are not associated.

### Hypothesis 2

An attempt was made to find out the association between the conventional farming and (self-rated) health status. For this the following hypothesis has been formulated. There is no association between involvement in conventional farming and (self-rated) health status.

**Table 12 Chi-Square Result For Hypothesi**

| Hypothesis | Calculated Value | Tabulated Value | Decision |
|---|---|---|---|
| Involvement in conventional farming and (self-rated) health status | 2.1352 | 5.991 | Accept the Null Hypothesis |

**Source:** Manipulated by the researcher

The calculated value of $\chi 2$ is much lower than the table value and hence the null hypothesis framed is accepted. Thus it can be concluded that there is no association in involvement in conventional farming and (self-rated) health status.

### Linear Probability Model Approach

The regression model is as follows:

$$Y_i = \beta_1 + \beta_2 X_i + u_i \quad (1)$$

where $X_i$ = age, sex, level of education, occupation, no of members in family, no of earning members in family, income etc… on Y = 1 if the farmers has health problems like head ache, coughing, skin irritation after using pesticide and 0 if it does not has any health issues. The above model looks like a typical linear regression model. Here, the regressand is binary, or dichotomous, it is called a linear probability model. The result is presented in table thirteen.

In the case of the quantitative variables, the slope coefficient of 0.01475 on the variable on age indicates that every one unit of increase in age increases the unfavourable opinion on the preference for conventional farming by 0.01475 units. In the case of sex, the positive coefficient of 0.05872 indicates that the female head of the family have more preference for traditional or organic farming than their counterparts. In the case of the level of education of the respondents, every one

year of increase in the level of education increases the favorable opinion on the preference for organic farming. The negative slope coefficients estimated as -0.6487 for the variable on occupation indicates that the respondents are who have a better occupation are not interested in farming or agriculture than the respondents who have not engaged in any poor occupation. The positive coefficient of 0.7832 arrived for the variable on the number of members in the family indicates that every one unit of member increase in the number of members in the family increases the preference for farming of traditional by 0.7832 units. Similarly, in the case of the variable on the number of earning members, the negative slope coefficient of -0.4541 implies that every one unit of increase in the number of earning members in the family reduces the preference farming activity.

**Table 13 Determinants of Health Risk of Pesticide Exposure: A LPM Model**

| | Variable | Coefficient | Std. Error |
|---|---|---|---|
| | Constant | 0.07823* | 0.00156 |
| 1 | Age | 0.01475* | 0.00487 |
| 2 | Level of Education | 0.02419* | 0.00647 |
| 3 | Occupation | -0.6487* | 0.09352 |
| 4 | Number of members in the family | 0.832* | 0.1432 |
| 5 | No. of Earning Members | -0.4541* | 0.008342 |
| 6 | Income | -1.7823* | 0.04137 |
| 7 | Sufficiency of Own labour | 0.032158* | 0.00321 |
| 8 | Labour hired | -0.1832* | 0.02566 |
| 9 | Type of irrigation facilities available | -0.03821* | 0.04134 |
| 10 | Quality of land | -0.07431* | 0.0556 |
| 11 | Spent from pocket for health problems | 0.1253* | 0.05321 |
| 12 | Distance to health centre place | 0.01286* | 0.05891 |
| | R square | 0.9247 | 0.9247 |

**Source:** Manipulated by researcher

*Significant at 0.05 level of probability

The positive value of the variable on the sufficiency of own labour indicates higher theutilisation own labour is the risk of exposure exist. The positive coefficients of distance to health centre place indicates that the preference for Organic farming. The goodness of fit of the model is 92 percent. It means that the above explanatory variables indicate that variables were explained 92 percent about the health issues due to exposure to conventional farming.

## Conclusion

People are living beyond their means both in terms of finance sense and environment sense. The farmers in the study area are well equipped with knowledge of risk due to pesticide mismanagement by the government officials which resultant is health status of sample farmers were good. In reality, 2023 two farmers were died in the study area due to exposure of pesticide as per the medical report in the same study area Theni district. The registered pesticides if used as per Label and Leaf lets do not pose any harm to human beings, animals, and environment and living organisms other than pests. Further, with the objective of educating, orienting and training of farming community about the judicious use of pesticides and their use as per the directions given in the label and leaf lets, then there is no evident in the loss of human capital, loss of bio-diversity, unpredictable weather patterns and natural disasters. Now and then, Central and State Governments through their field agencies must ensure that farmers are provided a right knowledge/ information about there commended pesticide usage. The last but not the least, the present and future generation must have (Bio-empathy) the ability to see things from nature's point view; to understand, respect, and learn from its pattern for their own health status and their soil's health status.

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