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A Detailed Survey on Awareness, Knowledge and Practice of Pesticides Used Against Various Vegetables, Fruits and Cereal Crops Grown in and Around Udaipur Region of South Rajasthan, India

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ABSTRACT:
The present study was designed to have an insight into the different crops grown, gain information about the different pesticides used, the various practices adopted for the storage, application, and disposal of pesticides, and to know the awareness status of the farmers of in and around Udaipur region regarding the harmful effects of pesticides. An explicit and detailed questionnaire was prepared and formal interviews and field observations were used to gather information on farmers' knowledge of pesticides and safety practices. The survey was conducted between February, 2021 to September, 2021. The survey questionnaire was developed to document the information regarding types of crops grown, pesticides used, their dosage and application pattern, and associated hazards. Data were collected through face-to-face interviews and getting a questionnaire filled by 304 farmers. The target of the study was explained to these respondents and the questionnaire was duly signed to seek their consent in order to ensure their cooperation, which was very important for the study. It was evident from the survey that 59% of respondents had ensured safe storage and 31% stored them in open fields, 59.44% of respondents placed the empty containers in the trash; 11.24% discarded them in the field and 25.30% burnt them at the farm itself, 87.56% respondents ensured that they washed hands properly with soap after using pesticides; 33.31% ensured the use of face mask and 72.54% respondents were aware of pesticide associated risk and contamination and 27.46% didn't have many ideas about it. The results reveal that the most commonly used pesticides were 2,4-D, profenofos, phorate, atrazine, endosulfan, chlorpyrifos, dimethoate, glyphosate, etc. some of these pesticides are under restricted use and belong to the highly toxic group as classified by World Health Organization. Summing up the results obtained, it is suggested that proper monitoring of pesticides along with awareness amongst the farmers of the Udaipur region is needed to minimize the dangerous effect of pesticides on humans and the environment as 27.46% of respondents which could be either farm owners or

farm laborers are unaware about the pesticide associated risks. However, the remaining 72.54% were not fully aware of the proper usage of pesticides of the proper all pesticides. Furthermore, it is suggested that in addition to extensive awareness drive, alternatives to chemical control of pests like integrated pest management, use of biopesticides, etc., should be developed, disseminated, and reinforced.

Keywords: Environment, Endosulfan, 2,4-D, Safety practices, Pesticide.

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INTRODUCTION

Agriculture is the backbone of the Indian economy. According to the Ministry of Statistics and Programme Implementation, Government of India, the Gross Value Added (GVA) at current prices for agriculture and allied sector is estimated at 36.17 lakh crore Indian rupees in 2020- 21 which accounts for 20.19% of total India's GVA (NSO-MOPSI, 2021). As per government records, 58% of India’s population and 70% of Rajasthan’s population depends on 1agriculture (Census of India, 2011). Agriculture in Indian states is largely dependent on chemicals including pesticides and their usage has a huge impact on human and animal health, biodiversity, and the environment. India shares only 1% of the global pesticide use but it ranks 12th in the world and 3rd in Asia Although agriculture is the second- largest sector in the world it is one of the most dangerous occupations as the agricultural workers and farmers are particularly at high risk of pesticide exposure (ILO, 2010; Hashemi, Hosseini, & Hashemi, 2021).

Pesticide Issues: Indiscriminate use of pesticides has led to many problems like adverse effects on parasites, predators, and pollinators, toxic residues causing health hazards, the resurgence of the treated population of pests, development of resistance in insects to insecticides, environmental population, etc. (Lal, 2001). The severe losses in agriculture due to pests necessitate the use of pesticides to protect our crops against the attack of several pests and moreover they also help to increase the yield, and productivity andto improve the quality of the crops (Fernndez-Alba & Garca-Reyes, 2008; Verger & Boobis, 2013). Despite the fact that pesticides have aided us in meeting the ever-increasing food demands of a growing population, these poisonous chemicals have hurt us and the environment to a significant amount.

In India, about 63% of the total pesticides are utilized in the agricultural sector, while the remaining 37% are used in the non-agricultural sector (Annual Report, 2005). Pesticide side effects vary depending on the type of pesticide used, but long-term exposure to any pesticide causes carcinogenic and immunotoxic consequences in addition to neurotoxicity. Pesticides negative impacts on animal behaviour, morphological and biochemical lesions, and pesticide metabolic pathways have all been researched in aquatic settings and diverse species (Dikshith, 1991). Many pesticides also act as endocrine disruptors. They mimic or destroy the natural hormones in the body and their long-term, low-dose exposure is responsible for many dreaded conditions like immunosuppression, hormone disruption, diminished intelligence, reproductive abnormalities, and cancer (Crisp et al, 1998; Hurley, 1998; Brouwner et al, 1999).

Pesticides Regulation: Pesticides are regulated in India under the Insecticides Act, 1968 (Government of India, 1968), and the Insecticide Rules, 1971(Government of India, 1971). The Central Insecticide Board (CIB) advises the Ministry of Agriculture and

Farmers' Welfare on pesticide safety (SCA, 2016). Its mandate includes reviewing matters relating to (a) the risk to human beings or animals involved in the use of insecticides and the safety measures necessary to prevent such risk, and (b) the manufacture, sale, storage, transport, and distribution of insecticides with a view to ensuring safety for human beings or animals (Government of India, 1968).

As per the Department of Chemicals & Petro-Chemicals, Ministry of Chemicals & Fertilizers, India, pesticide production in the country during 2020-2021 stood at 2,55,090 metric tons which were about 33% more than the production in the year 2019-20. According to the total consumption of technical grade pesticide in India was 62,193 metric tons and in Rajasthan, it was 2,330 metric tons in the year 2020-21 as reported by the Directorate of Plant Protection, Quarantine and Storage, Department of Agriculture, Cooperation and Farmers Welfare, Ministry of Agriculture and Farmers Welfare, Government of India. Thus, the production of pesticides is rising continuously and there is substantial consumption in India and Rajasthan.

Agricultural Context Udaipur: Udaipur district is located in the southern part of the state of Rajasthan (24.5854°N, 73.7125°E) in the western part of India with a population of0.75 million. The area is a unique landscape situated in the hills of the world's oldest Aravalli Mountain range (Ali & Ikbal, 2015). According to 2011 census data, the total population of the Udaipur district is about 30.68 lacs of which 80.17% population reside in rural areas and only 19.83% population live in urban areas. The literacy rate is 61.8% which is lower than the state average (66.1%). The scheduled caste (SC) and Scheduled Tribe (ST) population of the district is 6.1% and 49.7% respectively of the total population of the district (Census of India, 2011). The livelihood of these tribal populations depends on domestic animals, agriculture, forest products, etc. (Tanwar, Vaishnava, & Sharma, 2008). The economy of the Udaipur district is mainly dependent on agriculture as 61.7% of workers in the district are either cultivators or agricultural laborers (Census of India, 2011). In the Udaipur district, the percentage of cultivators, agricultural laborers, workers in the household industry, and other workers (category of workers) are 39.5, 22.2, 2.5, and 35.9 percent respectively (Census of India, 2011).

Research Aims: The fate and impact of pesticide application in Udaipur region remain unknown in the public and farmers eyes. Thus, farmers' perception of pesticide practices and, their level of awareness of adverse effects on the environment and human health need to be determined (Rajeswari, Sharma, & Balachandran, 2021). For this purpose, farmers of Udaipur were questioned about their pesticide knowledge, practices, safety, and resources by conducting a survey. This study was set out to analyze the beliefs, perceptions, and awareness in relation to pesticide use among the farmers of in and around Udaipur region. Research Area selected Udaipur due to the hilly zone, small agricultural land, and specific crops like wheat, sorghum, maize, etc, cultivated in the Udaipur region.

METHODS

Area of Study: The farmers having fields near and around the Udaipur region were surveyed during the study. The main areas included Mali Colony, Manvakheda, Choti Nokha, Badi Nokha, Dangiyo ka Mohalla, Sisarma, Kalarohi, Shobhagpura, Bedla, Badi, Iswal, Shivpuri (Chirwa), Eklingpura and Karakala.

Survey Questionnaire and Response Generation: Data were collected through face-to-face interviews and getting the questionnaire filled by 304 farmers (owners of land and farm laborers, and family members) on the paper. The survey questionnaire was documented and analyzed to develop information regarding attitude and knowledge of the farmers towards types of crops grown, pesticides used, their dosage and application pattern, disposal, and harms. The respondents were contacted first time during the study period. The target of the study was explained to these respondents and the questionnaire was duly signed to seek their ethical consent in order to ensure their cooperation, which was very important for the study. The study was carried out by conducting the survey and responses recorded by the research survey team on the paper from February 2021 to September 2021. Formal interviews and field observations were used to gather information on farmers and this was part of the survey data collection knowledge of pesticides and safety practices.

Structure of the Questionnaire: A detailed questionnaire was prepared or a random survey to generate response data from farmers about their knowledge of pesticides and safety practices. The questionnaire was divided into three major sections: The first section was general information which included details like name, age, educational qualifications, duration of farming, members involved in farming, major crops grown, etc. The second section consisted of pesticide and crop information which dealt with the different pesticides used their trade/common names, dosage, and application schedule. The third section included information regarding pesticide storage, disposal, and application practices adopted by the farmers. Sections one and two had open-ended questions whereas section three consisted of closed-ended questions in the form of multiple choices.

Response outcome and Statistical Analysis: Three hundred and four responses (questionnaires) received, were found to be complete. Maximum respondents were at the age of 40-50 (31.58%) (Table 1), and the response was a hundred percent. The data obtained from all completed questionnaires were compiled in a spreadsheet. The data were analyzed using descriptive and inferential statistics such as mean, percentages, and frequencies to draw meaningful inferences. All analyses were carried out using MS Excel.

RESULTS

Commonly grown Crops

Wheat, maize, bajra, jowar, soybean, mustard, brinjal, chili, cauliflower, cabbage, tomato, bitter gourd and okra were the most significant crops growing in the region examined and researched, according to the survey.

General Characteristics of Farmers:

Age Group: The distribution of respondents according to the age group is shown in Table 1. The overall average age of the respondent farmers was 49.86 ± 12.80 years old (mean ± SD), the youngest farmer was 18 years old and the eldest was 83 years old. Splitting the farmers' age into groups it was found that the majority of the farmers were in the age group of 40-50 years (31.58%) and the minimum was above the age 70 years (4.61%). The second-highest number was in the group 50-60 years of age (24.34%), followed by the age group 30-40 years (19.41 147%), then the 60-70 years group and the 18-30 years of age group (7.57%). It was evident that about 17.10% of the respondents were above the age of 60 years (Figure 1).

Table 1: Age of the Farmers/respondents for

Age group	No. of respondents (n= 304)	Percentage (%)
18-30	23	07.57
30-40	59	19.41
40-50	96	31.58
50-60	74	24.34
60-70	38	12.50
70 above	14	04.61

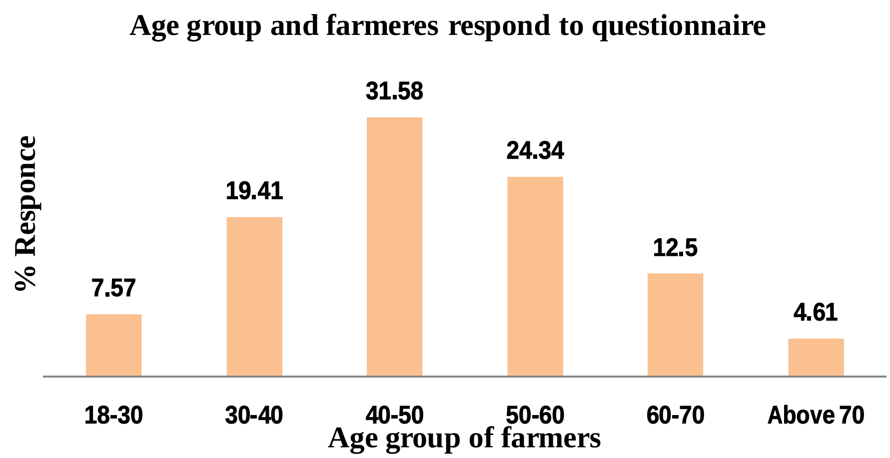

Figure 1: Age group of farmers and percentage of farmers respond to questionnaire.

Education Level: The educational level of the respondent farmers is shown in Table 2. Out of 304 respondents, about one-fourth is 78 (25.7%) were illiterate; 201 (66.1%) had school education and only 25 (8.2%) had education beyond school. Out of 201 respondents attaining school education, 67 (33.3%) had primary level education i.e., up to class 5 which accounted for 22.1% of the total; 48 (23.9%) accounting for 15.8% of the total had education up to middle school (class 6 to 9); 51 (25.4%) or 16.8% of the total had done secondary (class 10) and 35 (17.4%) had completed senior secondary which was 11.5% of the total respondents. Only 25 farmers had attained college education, of which 68% or 17 farmers (5.6% of total) were undergraduates and 32% or 8 farmers (2.6% of total) were postgraduates (Figure 2).

Table 2: Education level of the Farmers/respondents

Education level	No. of respondents (n=304)	Percentage (%)
Illiterate	78	25.70
Primary School (upto class 5)	67	22.10
Middle School (class 6 to 9)	48	15.80
Secondary (up to class 10)	51	16.80
Senior Secondary (up to class 12)	35	11.50
Undergraduate	17	05.60
Postgraduate	08	02.60

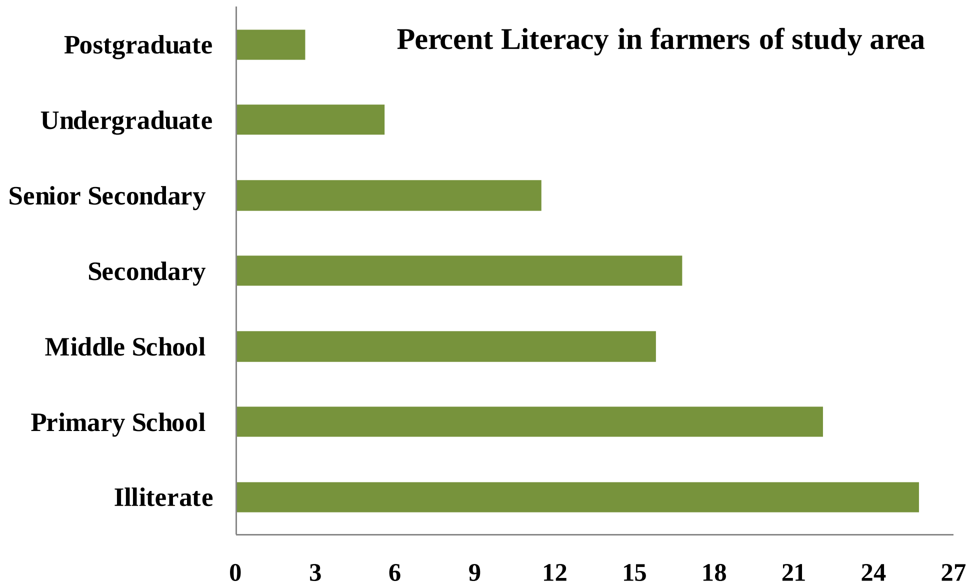

Figure 2: Education level and percent literacy in farmers of study area.

Pesticide storage, disposal, and application practices adopted by the farmers: A separate questionnaire was prepared for knowing the various practices adopted by the farmers regarding pesticide storage, disposal, and application while using and applying the pesticides (Table 3). Responses for five major questions about pesticide storage and disposal were collected. 55 respondents refused to answer these questions therefore; responses from 249 respondents were collected and scored.

Pesticide storage after purchase: Out of 249 farmers, 59% had ensured safe storage, and 31%stored them in open fields. Unsafe storage, storage in the refrigerator, and storage in an open shed were done only by one or two respondents. None of them had a separate facility solely entitled for the chemicals. No respondent stored them in the living area or in an animal shed (Figure 3).

Disposal of empty pesticide containers: 59.0% of respondents placed the empty containers in the trash; 11.2% discarded them in the field and 25.3% burnt them at the farm itself. No resale and reuse of containers as well as burying or crushing them in soil were recorded (Figure 3).

Safety measures used by applicants: 87.6% of respondents ensured that they washed hands properly with soap after using pesticides; 33.3% ensured the use of face mask while applying pesticides and about 10% used hand gloves during application (Figure 3).

Disposal of old pesticide stocks: Out of 249 respondents, 138 (55.4%) claimed that they buy only the required amount of pesticides to avoid the problem of disposal; 74 (29.7%) of them reported disposing of their sewage; 22 (8.8%) disposed of them in the field and only a very small number 8 (3.2%) returned them back to the retailer (Figure 3).

Disposal of unused leftover (mixed or diluted) pesticides: It was found that 47.8% of respondents disposed of the mixed/diluted/leftover mix into the dump yard; 14.9% disposed of them in the field; 27.3% ensure that they mix only the required amount; 4.0% applied the leftover mix on other crops and 5.6% disposed of it in the field itself (Figure 3).

Whether aware of pesticide-associated risk and contamination: Out of the total of 304 respondents, 295 responded to this question. 72.5% that is 218 respondents were aware of pesticide associated risks and contamination and 27.5% didn't have many ideas about it. Out of the 55 respondents who didn't answer the other questions related to pesticide storage and disposal, 46 gave responses regarding pesticide-associated dangers, and 33 out of 46 were aware of the risk (Figure 3).

Table 3: Pesticide storage, disposal, and application practices adopted by the farmers

Criteria	Parameter	No. of responses	% (n= 249) (55 respondents refused to answer these)
Pesticide storage after purchase	a. Safe storage	147	59.04
	b. Unsafe storage	001	00.40
	c. Open shed just for pesticides	002	00.80
	d. Refrigerator with open items	001	00.40
	e. In the Open field	078	31.33
	f. Locked chemical store	000	00.00
	g. Living area	000	00.00
	h. Animal shed	000	00.00
	Both a and c	001	00.40
	Both a and e	019	07.63
Disposal of empty pesticide containers:	a. Discard in field	028	11.24
	b. Sold / reused	001	00.40
	c. Crushed / buried in the soil	003	01.20
	d. Place in trash	148	59.43
	e. Burn / incinerate on farm	063	25.30
	Both a and b	003	01.20
	Both a and d	003	01.20
Safety measures used by applicants	a. Use of face masks	008	03.21
	b. Use of hand gloves	011	04.42
	c. Proper hand wash with soap after application	153	61.45
	Both a and c	065	26.10
	Both a and b	010	04.02
	Both b and c	001	00.41
	All	001	00.41
Disposal of old pesticide stocks?	a. Return to retailer	008	03.21
	b. Dispose of in the field	022	08.84
	c. Buy only the required amount	138	55.42
	d. Dispose of sewage	074	29.72
Disposal of unused leftover (mixed or diluted) pesticides	a. Dispose of in the field	014	05.62
	b. Mix only the required amount	068	27.31
	c. Apply on other crops	010	04.02
	d. Dispose of sewage	037	14.86
	e. In the dump yard	119	47.79
Whether aware of pesticide associated risk and contamination	Yes	214	72.54
	No	081	27.46

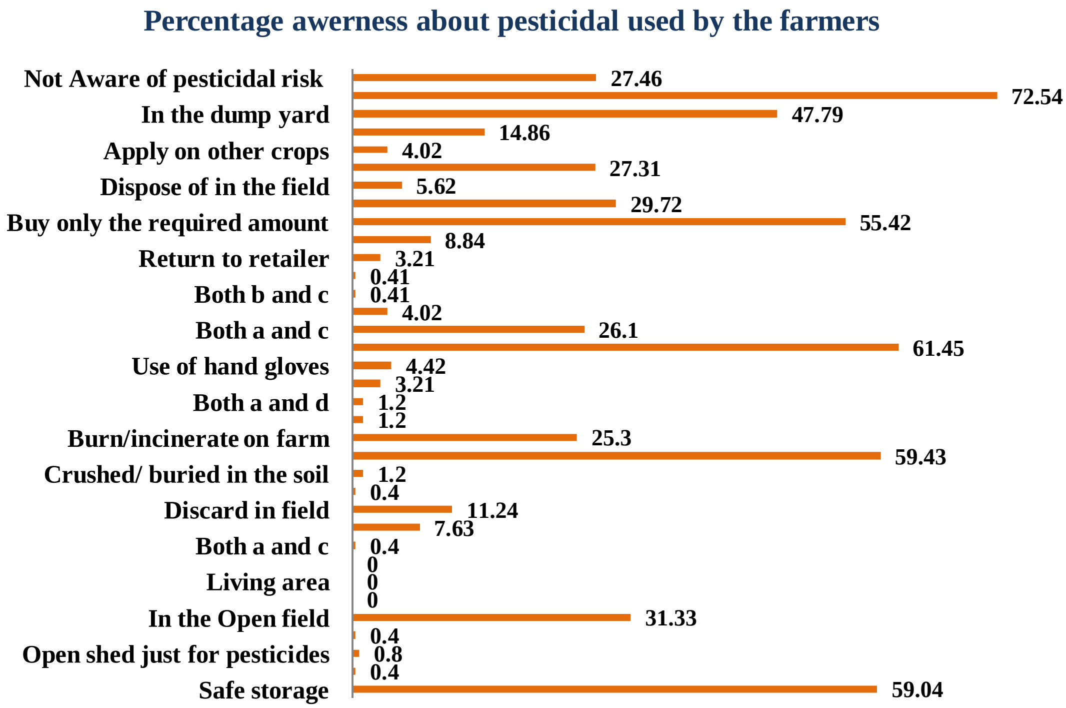

Figure 3: Pesticide storage, disposal, and application practices and percentage awareness between farmers.

Commonly used Agrochemicals in the Study Area

The details of the different pesticides used in the study area, their trade name, the active ingredient, WHO Toxicity Class/classification, mode of action, etc. are given in Table: 4. It was found that 59 different types of pesticides or their formulations were used by the respondents. These are available under various trade names in the market. The most commonly used pesticides were 2, 4-D (33.55%), profenofos (3.94%), phorate (2.63%), atrazine (3.28%), endosulfan (1.97%), chlorpyrifos (4.60%), dimethoate (4.23%), glyphosate (2.96%), etc.

Table 4: Commonly used agrochemicals and their details

S.N.	Pesticide Used as Per Information Collected	Active Ingredient	Trade Name	WHO Toxicity Class (WHO 2009-10)	Classification By Main Group	Organic/ Inorganic Formulation	Mode of Action	Recommended For Use On Which Crop	Used On Which Crop By Farmers
1.	2,4-D amine salt 50%	2,4-D amine salt 50% SL	NOBIRU, Amine super	highly toxic	Phenoxy carboxylic group	organic	selective systemic post- emergence herbicide	Wheat, Spinach	Wheat, Tomato
2.	2,4-Diethyl ester 38% EC	2,4-dichloro-phenoxy acetic acid	Hit-44, Sackweed 38, Heera 44, Shooter, cutout, Finish -38 cloud 38	highly toxic	Phenoxy carboxylic group	organic	selective herbicide	Wheat, Sorghum, Maize, Sugarcane, Potato, Paddy	Pudina, Wheat, Cauliflower, Mustard, Spinach, Cucumber
3.	Agil	Propaquizafop 10% EC	Propaquizafop 10% EC	highly toxic	Aryloxyphenoxy propionates	organic	Post-emergence herbicides, systemic herbicide	Onion, Cotton, Sugarcane, Soybean, Black gram	Coriander, Soybean
4.	Aldrin	Chlorpyriphos 20% E.C.	Aldrin Tc	Modera tely Toxic	organophosphate	organic	Broad- spectrum	Agricultural food, feed crops	Rizka, Brinjal
5.	Amazer 5% G (Gravure)	Monomehypo 5% G	Amazer, Monomehypo	highly toxic	carbamate	organic	systemic herbicide with contact and stomach action	Rice	Ladyfinger
6.	Atranex	500 g/L atrazine SC	Atrazine 50% WP	Very toxic	Triazine class	organic	pre-emergence and post-emergence control	Maize, Sugarcane	Wheat
7.	Atrazine	(2-chloro-4-methylamino-6-isopropylamine-s-triazine) 41.9%	Atrazine 50%	moderately toxic	synthetic	organic	photosynthesis inhibitor	Maize (corn), Sugarcane	Garlic, Onion, Wheat, Barley, Maize, Ridged gourd, Bottle gourd
8.	Avan cerfungic ide	Azoxystrobin 8.3% + Mancozeb 66.7% WG	Avancer glow	moderately toxic	mancozebis dithiocarbamate	organic	systemic and contact,	Chili, Grape	Chili

							Azoxystrobin inhibits mitochondrial respiration		
9.	Cholropyriphos 20% EC	0,0-diethyl hydrogen phosphorothioate	Chlorpyrifos, Excel, Lethal, SAINIK	Moderately toxic	organophosphate	organic	broad- spectrum	Agricultural food, feed crops	Wheat
10.	Cloud -38	2,4-D Ethyl Ester 38% Ec	Cloud 38	highly toxic	Phenoxy carboxylic group	organic	selective systemic herbicide	Maize, Sorghum, Wheat	Wheat
11.	Collagen	chlorantraniliprole 18.50 % SC	Dupontcoragen, Cosko	less toxic	anthranilic diamide	organic	ryanodine receptor modulators	Rice, Cabbage, Cotton, Sugarcane, Tomato, Chili, Soybean, Brinjal, Pigeon pea, Black gram	Ladyfinger, Brinjal
12.	Dhanusan	50% w / wPhenthoate	Dhanusan	Moderately hazardous	organophosphate	organic	contact and stomach poison Insecticides	Cotton, Groundnut, Pulses, Paddy	Cauliflower
13.	Dhanzyme Gold	cytokinin, gibberellin, hydrolyzed protein complexes, enzymes amino acids	Dhanzyme Gold	Nontoxic	organic manure	organic	growth regulator	Paddy, Sugarcane, Vegetable crops, Soybean, Potato, Groundnut, Cotton	Chili
14.	Endosulfan	1,5,5a,6,9,9a hexahydro-6,9- methano-2,4,3-benzodioxathiepine 3-oxide	Beosit, Thiodan, Thiofor, Malix	highly toxic	Organochlorine	organic	affinity with the GABA	Cabbage, Potato	Gram
15.	Fenhit	Fenvalerate 20% EC	Fenhit, Pydrin, Tatafen	highly toxic	pyrethroid	organic	Nonsystemic with contact and stomach action. Sodium channel modulator	Cauliflower, Cotton, Brinjal, Okra	Cucumber
16.	FMC	chlorantraniliprole 18.50% SC	Dupont collagen	slightly Toxic	Anthranilic diamide	organic	act on ryanodine receptors	Tomato, Brinjal, Chilli	Wheat

17.	Forate	Phorate 10 % C.O.	Forate 10G, Zamindar	Extremely toxic	organophosphate		systemic insecticide inhibits cholinesterases	Corn, Potatoes, Cotton, Peanuts	Guava
18.	Hakama	Quizalofopethyl 5% EC	Hakama	Moderately toxic	Aryloxyphenoxy propionates herbicide	organic	selective herbicide	Soyabean, Cotton, Groundnut, Onion, Garlic, Black, Greengram, Vegetables, Coriander	Coriander
19.	Hamla-550	chlorpyriphos 50% EC + Cypermethrin 5% EC	Hamla-550, Gharda Hamla 550, Lethal super-505	highly toxic	combination of organophosphorus andsynthetic pyrethroid	organic	contact and stomach poison	Cotton, Paddy, Pulses, Vegetable, Fruits, Oilseeds	Wheat
20.	Heera 44	2-4-D Ethyl Ester 38% EC	Heera 44	low toxic	Phenoxy carboxylic group	organic	growth inhibitor	Sorghum, Maize, Wheat, Sugarcane	Wheat
21.	Hi- yield Atrazine	Atrazine 4.00%	Hi-yield Atrazine	moderately toxic	Triazine class	organic	Bind toplastoquinone -binding protein in photosystem II	Maiz, Sugarcane, Sorghum	Vegetable
22.	ImidaCloprid	Imidacloprid 17.8% SL	Admire, Dawn, Confidence 555	Moderately Toxic	Neonicotinoid	Inorganic	Neurotoxin	Cotton, Chili, Tomato, Brinjal, Mango, Sugarcane, Paddy, Okra	Wheat, Cauliflower, Mustard
23.	Index	Myclobutanil 10%WP	Index, Insyst, Matrix, Myclowin, Systhane, Cygnet, Boon	Moderately toxic	triazoles, monochlorobenzenes	organic	systemic fungicide	Tomato, Chili, Apple, Grape	Ladyfinger, Brinjal, Bitter gourd, Sponge gourd
24.	Intrepid	Chlorfenapyr 10% SC	Intrepid	moderately toxic	Class of pyrroles	organic	disrupting the production of	Cabbage, Chili	Chili

							ATP		
25.	Jumbo	Imidacloprid	JUMBO	low toxic	chloro-nicotine	Inorganic	stomach and contact	Cotton, Paddy, Chili, Citrus, Groundnut	Vegetable
26.	Khanjar	alkaloid and salt of fatty acid with a mixture of wild plant oil	Khanjar	Highly toxic	Sulphonyl urea	organic	neurotoxin	Cotton, Maize, Potato, Soybean	Cauliflower
27.	Krosin -Ag	streptomycin sulphate 90 + Tetracycline hydrochloride 10% SP	Krosin-Ag, Streptomycin, streptosac, K-Cycline, Strepto plus	less toxic	streptomycin	organic	Streptomycin sulfate is used to treat bacterial infections	Rice, Cotton, Potato, Citrus, Onion, Grape, Banana, Mango, Pomogranate, Brinjal, Apple, Tomato	Tomato
28.	Metro	Lambdacyhalothrin-4.9%CS	Metro	highly toxic	selective systemic herbicide	organic	selective systemic herbicide	Cotton, Paddy, Wheat, Soybean	Wheat
29.	Milquat	Paraquat dichloride 24% SL	JU Weedout, Weedout, Milquat, Ozone, Paratop, All clear	highly toxic	Viologen, a family of redox-active heterocycles of similar structure	organic	nonselective contact herbicide	Cotton, Tea, Potato, Rubber, Paddy, Wheat, Grapes	Wheat
30.	Milsuit	Imazethapyr 10% SL	Milsuit, Lockout, Imazakill, Supersuit, Eraser, Dhoomketu	less toxic	Imidazolinone	organic	inhibits the enzyme acetohydroxyacid synthase	Soybean, Groundnut	Soybean
31.	Monster	Monocrotophos 36%	Monster, Tata Mono	Extremely toxic	Organophosphorus insecticide	organic	contact and stomach poison	Paddy, Maize, Cotton, Mustard	Maize, Rizka

32.	Outright spray adjuvant	methyl oleate, nonionicsurfactants, ammonium sulphate	Outright 770	Highly toxic	Methyl oleate, nonionic surfactants and ammonium sulphate	organic	reduce evaporation foaming, spray drift andvolatilization	Wheat	Wheat
33.	Oxylife	2-chloro-1-(3- ethoxy-4 nitrophenoxy)-4-(trifluoromethyf) benzene. 22.3%	oxyfluferon 23.5 EC	least toxic	Glyphosate herbicide	organic	cause membrane disruption through lipid peroxidation	Rice, Tea, Onion, Potato, Groundnut, Cumin	Wheat
34.	Permit	Acetameprid 20% SP	Wapkil 20 SP	less toxic	neonicotinoid	organic	systemic translaminar action	Cumin, Citrus, Wheat, Mustard, Potato, Tea	Cauliflower
35.	Planofix	Alpha naphthyl acetic acid4.5% SL	Planofix	moderately toxic	auxin	organic	plant growth regulator	Tomato, Chili, Mango, Cotton, Grapes, Pineapple	Papaya
36.	Profenofos	Profenofos	Profenofos 50% EC	Moderately hazardous	organophosphate	organic	Neurotoxin	Maize, Cotton, Potato, Soybean	Cauliflower, Mustard, Spinach
37.	Profex super	Profenophos 40% + Cypermethrin 4% EC	Profex super	highly toxic	Cypermethrin is a synthetic pyrethroid, profenophos is an organophosphate	organic	it has strong contact, stomach, ovicidal action. It Inhibits acetylcholine esterase.	Maize, Potato, Soybean, Sugarbeet	Maize, all vegetables
38.	Rogor	Dimethoate 30% EC	FMC Rogor, TATATafgor	Highly toxic	organophosphate	organic	contact and through ingestion	Tomato, Onion, Cabbages Cauliflowers, Potato	Vegetable
39.	Runout-71	ammonium salt of glyphosate 71% S.G.	Runout-71, Bhasma-71, Excel Mera 71	moderately toxic	organophosphate	organic	Systemic insecticide	Wheat, Lentils, Pea, Millet, Sunflower, Corn	Maize, Ridged gourd, Bottle gourd

40.	Saaf fungicide	12% carbendazim + 63%WPmancozeb	Saaf fungicide	less toxic	mancozeb is dithiocarba mate and carbendazim is benzimidazole fungicide	organic	systemic and contact	Chili, Grape, Groundnut, Mango, Paddy, Potato, Tea	Chili
41.	Safex herbicide	Pendimethlin 30% EC	Safex, Hextar, Blaze, Stop	Highly toxic	Dinitroaniline class of herbicide	organic	prevent plant cell division and elongationin susceptiblespecies	Cotton, Paddy, Pigeon pea, Soybean, Wheat, Potato,	Wheat
42.	Saheb.505	Chlorpyriphos 50% Ec + Cypermethrin 50% Ec	Sahib Sarata- 505	Highly toxic	Chlorpyriphos + cypermethrine	organic	contact stomach poison	Cotton, Rice	Brinjal, Cauliflower
43.	Sandesh	Clodinafop propargyl 15%+ Metsulfuron methyl 1%WP	Sandesh	Moderately toxic	selective systemic post-emergence herbicide	organic	inhibition of amino acid and lipids production	Wheat	wheat
44.	Senior	2,4-D Amine salt 58% SL	Weedwin, Weedoff	highly toxic	Phenoxy carboxylic group	organic	kills the target weed by mimicking the plant growth hormone auxin	Cereals, Tea, Wheat, Rice, Maize, Millets	Wheat
45.	Shooter-50	Lambda Cs/Lambdacyhalothrin 5% EC & 4.9 C	Shooter 50 Insecticide, Cyhalothrin	highly toxic	pyrethroid insecticide	organic	stomach & Contact Insecticide	Cotton, Paddy, Groundnut, Okra, Brinjal, Cabbage, Cauliflower, Tomato	Cauliflower, Spinach, Coriander
46.	Strike	Hexaconazole 5% EC	Strike 20 EC	Moderately toxic	Conazoles	organic	stomach, contact, and fumigant	Cotton, Paddy,	Wheat
47.	Strom Plus (Pendimethalin-301)	Pendimethalin	Strom Plus, Stomp	Moderately toxic	dinitroaniline herbicides	organic	inhibits cell division and cell elongation	Cotton, Groundnut	Cotton, Brinjal, Garlic
48.	Sumo insecticide	carbofuran 3% GR	Sumo, Don-3G, Carbon	Extremely Toxic	carbamate	organic	Systemic insecticide	Potato, Corn, Soybeans	Colocasia, Rizka, Ginger

49.	Supergold	Thiamethoxam 30% FS	Supergold, Areva Super, Kaziro	least toxic	Neonicotinoid	organic	stomach and contact poison	Cotton, Sorghum, Okra, Maize, Wheat, Paddy, Sunflower, Chili, Soybean	Cauliflower, Spinach
50.	Super killer	cypermethrin 10%	Super killer	moderately toxic	Pyrethroid	organic	stomach and contactpoison	Paddy, Wheat, Potato, Cotton, Brinjal, Sugarcane	Cauliflower
51.	Taka	Diafenthiuron 47%+ Bifenthrin 9.4% SC	Takaf	moderately toxic	Diafenthiuron belongs to the thioureas group and Bifenthrin is a pyrethroid insecticide	organic	inhibits mitochondrial ATP synthase leading to paralysis of pest	Cotton, Chili	Cauliflower
52.	Tarka super 5% EC	Quizalofop ethyl 5% EC	Tarka super	Moderately toxic	Aryloxyphenoxy propionates herbicide	organic	systemic herbicide	Soybean, Onion, Black gram, Cotton, Groundnuts, Sponge gourd	Coriander
53.	Topaz	atrazine 50% WP	Topaz, Atragold, Atrazone	moderately toxic	Triazine class	organic	bind toplastoquinone-binding protein in photosystemII	Maize, Sugarcane, Sorghum	Vegetable
54.	Total Company	Sulfosulfuron 75%+ Metasulfuron methyl 5% WG	Total, satatsat, N Double mix	less toxic	sulfonyl urea herbicide	organic	systemic insecticide,amino acid biosynthesis inhibitor	Wheat	Wheat
55.	Traxx (Atrazine)	(2-chloro-4- ethylamino-6- isopropylamine-s triazine) 41.9%	Atrazine 50% WP	moderately toxic	Triazine class	organic	interfering with photosynthesis.	Maize	Maize
56.	Ujala pesticide	Buprofezin 25% SC	Ujala, Buproblast, Bupropower, Banzo	Moderately Toxic	Thiadiazinanes	organic	inhibitor of chitin synthesis	Cotton, Rice, Chili, Mango, Grape	Ladyfinger

57.	Ulala	Flonicamid 50% WG	Ulala	Moderately toxic	pyridine organic compound	organic	disrupts insect chordotonal organs	Rice, Cotton	Ladyfinger, Brinjal, Bittergourd, Sponge gourd
58.	Vesta herbicide	clodinafop- Propargyl 15% + Metsulfuron Methyl 1% WP	Vesta	moderately toxic	Metsulfuron methyl herbicide	organic	acetylcholine sterase inhibition	Wheat	Wheat
59.	Xplode	Emamectin Benzoate 5% SG	Xplode, Shuclaim, Proklin, Mectin	Moderately toxic	Derivative of abamectin	organic	works as chloride by channel activator binding GABA receptor	Cotton, Soybean, Brinjal, Chilli, Cauliflower, Grape, Ladyfinger, Blackgram, Chickpea, Green gram	Ladyfinger, Cowpea, Maize

DISCUSSION

This study focused on investigating the knowledge, practice and awareness of pesticides and their impact on farmers in the Udaipur region. The results show that farmers and other workers are exposed to some harmful pesticides. Many chemicals which have been banned nationally and globally are still being used. One such pesticide is endosulfan which was found to be used in the Udaipur region. Endosulfan, an organochlorine Class II pesticide, was banned by the Supreme Court of India in May, 2011, with the final stocks disposed of or exported by January 2017 (Government of India, 2019). According to the Department of Chemicals and Petrochemicals, no more endosulfan was produced domestically after the ban but it is still being used. An increase in the use of pesticides that have the same applications as endosulfan was also reported earlier (Government of India, 2018) including the WHO class II organophosphate insecticides profenofos, chlorpyriphos, and acephate. Similar pesticides are used in Udaipur. 2,4 - D was another toxic pesticide that was used by the local farmers. As obvious from Table: 4 many harmful and toxic chemicals are being used.

Rawal, Sharma, and Upadhyay (2011) stated that the pesticide imidacloprid 200SL was used primarily to control whitefly superfamily. Dimethoate 30EC and Triazophos 40EC are also used by farmers to control whiteflies in the okra crop. Mencozebis used by farmers to control leaf spots on Cercospora leaves, while SAAF (Mencozeb+ Carbendazim) is used at very low levels.

Storage of the pesticides in open fields by 31% of respondents, disposal of empty containers in trash/open fields by 70.68%, and disposal of old stocks in fields and sewage by 38.56% of respondents pose a threat to non-target animals, humans, and the environment as well. This shows that still, the majority of the farmers do not understand the gravity of the harmful effects that pesticides have on health and the environment. Farmers use pesticides without a full understanding of the impact on human health and the environment (Ngowi, 2003). While for instance, it is doubtful whether farmers follow the recommended application rate of pesticides. They also lack the appropriate knowledge on safe handling and use of pesticides as reported in another study (Ngowi, Mbise, Ijani, London, & Ajayi, 2007).

A cross-sectional study was done in Puducherry to analyze the awareness of application pattern of consumable pesticides, safety parameters, etc. 76% of workers were showing awareness towards pesticides from the training of the government agriculture department. (Mohanty et al, 2013). A similar study was done in southern India, a total of 171 farmers was selected to study the knowledge towards pesticide among them 61% of farmers have better knowledge toward pesticide and skin problems, neurological disturbance also reported from the study (Sai et al, 2019). A study for Pesticideconsumption patterns and farmers' perceptions towards pesticides was reported in the alwar district of Rajasthan where 49.8% responded were showing the hazardous effect of pesticides on health, 78.2% of workers showed basic knowledge and awareness towards pesticides (Yadav & Dutta, 2019).

Pesticides are considered a quick and easy solution for controlling agricultural pests and therefore they are used often at very high levels with a frequent and unscientific pattern of application (Al-Zyoud, 2014; Atreya, 2007; Devi, 2010; Shetty, Hiremath, & Sreeja, 2010). The complete dependency, extensive and massive use of pesticides in modern agriculture caused their widespread diffusion to all environmental compartments including a wide range of organisms up to humans (Abang, Kouame, Abang, Hannah, &Fotso, 2013).There is overwhelming evidence that some of these chemicals do pose potential risks to the ecosystem in general and human beings in particular (Jeyaratnam, 1990; Forget, 1993; Devi, 2010). Exposure to pesticides is increasingly linked to human health effects, like cancer, immune suppression, asthma, diabetes, reproductive abnormalities, nervous system disorders (Hanke & Jurewicz, 2004; Frazier, 2007; Weichenthal, Moase, & Chan, 2010; Amanullah & Hari, 2011; Lee et al, 2006; Jayashree & Singhi., 2011). They also affect wildlife, birds, beneficial soil microorganisms, plant yields (Tanabe, Kumar, Kannan, &Subramanian, 1998; Espin, Martinez-Lopez, Gomez- Ramirez, Maria-Mojica, & Garcia-Fernandez, 2010; Glover-Amengor & Tetteh, 2008); can also cause phytotoxicity (Fishel, 2011), undesirable residue accumulation in food crops (Caldas et al, 2011) and contribute to ozone depletion (Giri, 1998). The Standing Committee on Agriculture, in a report to the LokSabha (the lower house of India's Parliament), has acknowledged that excessive use of pesticides has led to high levels of pesticide residues in food and animal feed, accumulation of dangerous persistent organic pollutants, possible increased rates of cancer, increased input costs of agriculture and farmers suffering a wide variety of adverse health effects from occupational exposure to pesticides (SCA, 2016). The implementation of IPM reduces the diverse effect of pesticides from farmers because farmers have to lack the knowledge to use the pesticides so the proper implementation of IPM minimizes the deleterious effect of pesticides (Mancini, Jiggins, & O'Malley, 2009). Pesticide management training and practices are also useful for awareness of pesticides, use, and methods of pesticide application (Hashemi, Hosseini, & Damalas, 2009). It was observed that despite the efforts of various extension agencies in educating the farmers about the right use of pesticides, farmers are still using non-recommended insecticides at higher doses.

CONCLUSION

The result presented here displays a lack of awareness amongst farmers of the Udaipur region towards pesticides. The results presented here display a lack of awareness amongst farmers of the Udaipur region towards pesticide usage and a lack of appropriate knowledge on the safe handling and use of pesticides. There is strong evidence in Udaipur that there are serious human health problems that need to be addressed in connection with pesticide misuse and further research is needed on the link between pesticide use and health status.

As it is known that pesticide use comes at a significant cost at a significant it is required. Our approach to the use of pesticides should be pragmatic. In other words, all activities concerning pesticides should be based on scientific judgment, not on commercial considerations. Launch of educational and training programs for farmers, public awareness creation, and enforcement of laws concerning the use of pesticides to improve safety and awareness of pesticides are of vital importance. A multi effort from different professional groups, different sectors of the government, and non-governmental organizations is highly recommended. Alternatives to chemical control of pests like integrated pest management and use of biopesticides etc. should be applied and developed, disseminated, and reinforced.

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CONFLICT OF INTERESTS

Authors do not have any clash of interests.

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