Research Article **SRR (2022) 15:128**

Scientific Research and Reviews
(ISSN:2638-3500)

Beekeeping in the context of unsafe agrochemicals use: The case of Seka Chekorsa District of Jima Zone of Oromia, Ethiopia

Desta Abi

Adami Tulu Agricultural Research Center

ABSTRACT

During 2009/2010, study was carried out to assess agrochemicals use practice and its potential risk on honeybees and beekeeping activities in Seka Chekorsa district of Jimma zone of Oromia. A total of 240 farmer respondents from two rural peasant associations were interviewed using pretested partially structured questionnaires. Focus group discussion was held in the peasant associations for data collection. About 83.3 % of the study participants used different types of agrochemicals (insecticides, herbicides and fungicides) at different levels.50.8%, 22.2%, 13.3%, 7.9%, 3.8% and 2.1% of the respondents did use agrochemicals for fungal, insect, weed, quality product, others and other diseases in decreasing order of importance respectively. Majority of Farmers in the study area have practiced spray form of agrochemicals application as compared to other forms. Even though , there was variability, farmers apply agrochemicals mainly at flowering stage of nearly all cultivated crops. Most of the farmers apply agrochemicals during winter season following irrigation farming in the study area. The respondent farmers confirmed that agrochemicals had affected beekeeping activities in several ways. From the respondents view and field observation in the present study, it is evident to report that agrochemical are recklessly used and do have high risk to beekeeping activities and honeybees population in the study area.

Therefore, all stake takers should cooperate to mitigate agrochemicals use practice impact on honeybee population in the ecosystem. Frequent training has to be provided for both beekeepers and crop growers on the sustainable use of agrochemicals and approaches that will lessen potential harm that might be posed to honeybees due to misuse of agrochemicals. Further study is needed to examine actual impact of agrochemicals on beekeeping and honeybees using a rigorous research approach under laboratory and field conditions.

Keywords: Beekeeping, pesticides survey, honeybee colony, risk assessment.

***Correspondence to Author:**
Desta Abi
Adami Tulu Agricultural Research Center

How to cite this article:
Desta Abi.Beekeeping in the context of unsafe agrochemicals use: The case of Seka Chekorsa District of Jima Zone of Oromia, Ethiopia. Scientific Research and Reviews, 2022, 15:128.

eSciPub LLC, Houston, TX USA.
Website: http://escipub.com/

INTRODUCTION

For several decades now outbreak of pests and diseases of agricultural crops has led to excessive use of agrochemicals in developing countries. Agrochemicals use has been used protect pests and diseases of agricultural crops to boost production and ensure food security. In most countries the use of pesticides in agriculture is an accepted practice as it ensures a reliable yield of good quality produce (Sánchez-Bayo, 2011)[7].

However, the unchecked and misuse of agrochemicals has reportedly been brought about the loss of biodiversity (Douglas, 2019)[3]. This phenomena has been acknowledged to be extensive and even serious in developing countries as farming activities have always been characterized by low skill and improper use of agricultural technologies (Muhammad.A., 2017)[5]. Agrochemicals choice in the developing world is often older, broad-spectrum compounds belonging to the organophosphate, organchlorine and carbamate classes chemical families noted for their acute toxicity (S.K. Biswas, 2014)[6]. It could be from potential pesticide exposures from living near farm, in an agricultural spray area, near a pesticide factory, or other environmental exposures and consuming pesticide contaminated food (Bura, 2013)[2]. As a matter of fact, misuse of agrochemicals has been known to harm non-target organisms ranging from beneficial soil microorganisms to insects, plants, fishes, and birds in the ecosystem (S.K. Biswas, 2014)[6].

Although agricultural chemicals use in Ethiopia was historically low, increased trends of agricultural production has resulted in higher consumption of chemical pesticides (Asogwa, 2009) [1]. Recently, Ethiopia has been considered as having the largest accumulations of obsolete pesticides in the whole of Africa. It was estimated that there were 402 stores at 250 sites containing 1, 500 tones of obsolete pesticides (MOARD,2007). At this point in time ,therefore, it is important to assess the risk posed by the multitude of different pesticides that are used within the agricultural communities in Ethiopia. In the country, beekeepers in particular and farming community in general have poor awareness as to how agrochemicals has to be safely used to the non-targeted organisms in the agro ecosystem.

Good pesticide management practices could help to minimize the risks of pesticide poisoning and pollution of the environment. Some of the good management practices to consider when working with pesticide are: follow pesticide label directions, use protective devices, avoid spills, disposal of pesticide wastes and containers properly, elimination of unnecessary application and use of proper pesticide storage (Goka, 2016)[4].

It is unfortunate that there are very limited studies that address this subject in the country.

Therefore, the present study was conducted to assess agrochemicals use practice and its potential impacts on honeybees and beekeeping in Seka Chekorsa district of Jimma zone, Oromia, Ethiopia.

Study sites

The study was conducted in Seka Chekorsa district of Jimma zone of oromia, Ethiopia.

Study Population and Methods of data collection

The Source of population included beekeeping farmers in **the study** district. Two rural kebeles were purposively selected per the district. These study rural kebeles were selected based on the information received from the agricultural experts in agricultural and rural office for the study. A study was conducted using self administered questionnaires. Respondents were selected randomly from those Kebeles and the intended data was collected accordingly.

The questionnaire was developed by referring different literatures and modified according to the objectives of the study. The questionnaire has got different parts which enabled to collect information on pesticide practice, pesticide knowledge and perception and pesticide use and effects on beekeeping. Prior to data

collection, the questionnaire was pre-tested on some farmers in the study area who were not included for actual data collection. It was, therefore, checked for its clarity and some corrections.

For further validation of the data for this research, a focus group discussion was arranged at each rural kebeles from where data was collected in which model beekeepers, development agents and district level livestock experts were involved.

Data analysis and treatment

Frequency and percentage were used to describe beekeeping practices and pesticide utilization related factors. Results were presented using tables.

RESULTS AND DISCUSSION

It was explored that farmers practiced different methods of agrochemicals application at each sample districts (Table 1).In this manner, 84.6% , 10.4% and 5% of the sampled farmers apply agrochemicals in the form of spray, dusting and fumigation respectively. Looking in the decreasing order of importance the respondents had used spray ,dust and fumigation forms of agrochemicals application.

The other factor described in this study was distribution of growth stage of the crop on which agrochemicals were applied in the study district (table 1).Accordingly, 86.4%, 9.%, 0% and 4.1% of the farmers applied agrochemicals at 'vegetative', 'vegetative& flowering', 'seed setting' and 'any stage' of growth of the cultivated crops respectively.

According to the result of this survey majority (46.6%) of the respondents apply agrochemicals during winter and about 20% of the respondents apply the chemicals during summer.13.8% of the respondents apply agrochemicals both in winter and summer and 10% of the respondents apply during autumn. Not much but like 4.2% of the respondents apply during spring and the rest 7.9% apply at any season.

Table 1: Stage of crop and methods of agrochemicals application in the study districts

Agrochemicals use practice in Seka Chekorsa district			
		(n)	(%)
Method of agrochemicals application	Spraying	203	84.6
	Fumigation	25	10.4
	Dusting	12	5
Stage of crop at agrochemicals application	Vegetative	207	86.3
	Vegetative and flowering	23	9.6
	Seed setting	0	0.00
	Any stage	10	4.1

Description of the crops grown in the district and attractiveness to bees

The major crops grown in the study areas were barley (2.08%) , Tomato (3.75%) , Onion (8.75%) , Potato (5%), Mango (9.58%) , Avocado (10%) , coffee tree(15.42%), orange (11.67%) , Lime (5.83%) , Papaya (7.08%) , Banana (12.50%) and Zeyituna (8.33%).In the current investigation, barley (0%) has been identified to be non-attractive to honeybees. On the other hand, tomato (4.58%), onion (9.17%), potato (3.75%), avocado (15.83%), papaya (15.83%) and coffee (15%) were identified to be attractive to honeybees

Table 2:Type of agrochemicals applied on different crops

Major crops grown	Proportion		Proportion (attractive to bees)		Proportion (non-attractive to bees)	
	n	%	n	%	n	%

barley	5	2.08	0	0	240	100.00
tomato	9	3.75	11	4.58	229	95.42
onion	21	8.75	22	9.17	218	90.83
potato	12	5.00	9	3.75	231	96.25
mango	23	9.58	24	10.00	216	90.00
avocado	24	10.00	31	15.83	209	87.08
Papaya	17	7.08	38	15.83	202	84.17
orange	28	11.67	16	6.67	224	93.33
Lime	14	5.83	8	3.33	232	96.67
zeytun	20	8.33	18	7.50	222	92.50
banana	30	12.50	20	8.33	220	91.67
coffee tree	37	15.42	36	15.00	204	85.00

Status of pesticide use in the study areas

In this study, 90.42% of the respondent beekeepers were using agrochemicals in their localities. This result has been found to be higher than results of Desalegn Begna, (2015) who has reported that 54% of his respondents used pesticides and among which about 61% of the pesticides used by the farmers were identified as herbicides, 21% insecticides and 18% both types at western Amhara.

Our study has also verified that 73.3%, 10% and 16.67% of the sampled respondents were using pesticides to protect the crops from pests, herbicides to control weeds and chemicals (DDT) as anti malaria respectively (Table 3). Furthermore, the result has revealed that 97.92%, 0.83%, 0.42% and 0.83% of the respondents were applying the chemicals as liquid spray, granules, dust spray and as a wettable powder respectively (Table 3). This agrees with the findings of Desalegn Begna (2015) who reported 85.03% (124/147) farmers apply in liquid (emulsified), 8.84%(13/147) in powder and 4.6% (8/174) both in liquid and powder forms in western Amhara. In general, majority of the respondents (91.7%) were using these agrochemicals for fruits followed by legumes (3.75%) and cereals (2.50%). However, very small numbers of respondents were also found to use these agrochemicals for Chat and pulses.

Table 3. Status and reason for agrochemical application by the respondents

Description	Response	Frequency	%
Do you use agrochemical in your locality	Yes	217	90.42
	No	23	9.58
you apply the chemical	Crop pest control	176	73.33
	Weed control	24	10.00
	Malaria control	40	16.67

Chemical formulations	As liquid spray	235	97.92
	As dust spray	2	0.83
	Granules	1	0.42
	Wettable powder	2	0.83
or what type of crop do you use those agro chemicals?	Fruit	220	91.67
	Leguminous crop	9	3.75
	Cereal	6	2.50
	Pulses	1	0.42
	chat	4	1.67

Majority of the respondents apply the chemicals at the early morning (64.58%) of the day and about 14.58% the respondents apply the chemicals during bees" active foraging time including late morning, 12.50% apply chemicals in middle of the day, 4.58% of the respondents apply chemicals in the early afternoon. Only few respondents (3.75%) were applying the chemicals at the late afternoon (Table 4). According to the results reported by Desalegn Begna (2015) though 64.4% of the users" at wesern Amhara prefer 6:00-9:00am as appropriate spray time, applications times are fixed by Knapsack renters and forced to spray at convenient time of knapsack renters.

Table 4. Time of the day when respondents were applying chemicals on their crops

Time of application	Frequency	%
Early morning	155	64.58
Late morning	35	14.58
Middle of the day	30	12.50
Early afternoon	11	4.58
Late afternoon	9	3.75

Awareness of farmers on the effects of agrochemicals

Most of interviewed beekeepers (56.2%) have found dead bees around the farm after the application of agrochemicals. As it is indicated in the Table 5, with regard to awareness of the beekeepers on agrochemicals effect on honeybees, 86.9% of the respondents clarified that they had got this notion from extension agents (63.5%), from their own experience or personal observation (20.8%) and lessons from collogues (9.7%). This result agree with Desalegn Begna, 2015 who reported that 69% of the beekeepers have got an extension services and are already aware of when and how to properly use pesticides without producing effects on the environment and honeybees. Marta Zelalem, 2013 aloso reported 85% of the total respondents at mecha districts of western Amhara are awared about the effects of agrochemicals.

Table 5. Awareness of farmers and their observation on the effect of agrochemicals on bees

Response	Frequency	%

Description			
Did you find dead bees after you apply the chemical?	Yes	142	59.17
	no	98	40.83
Are you aware of agrochemicals effect on honeybees	Yes	171	71.25
	no	69	28.75
Who and how do you get the concept	personal observation	28	11.67
	Awareness from extension	201	83.75
	Lesson from colloquies	10	4.17
	Both (1+2)	2	0.83

Beekeepers and crop/fruit farmers‟ cooperation

From the total sample respondents about 39.5% of them use anti mala chemical sprays and

42.27 % have observed the effect of anti-malaria after the application which expressed as colony dwindling, loss of honey production and failure to perform a natural reproductive swarming (Table 6). To control poisoning of honeybees by chemicals, beekeepers take different measures like closing the hive entrance during application (29%), covering the honeybee colonies with coarse close (4%). However majority of the beekeepers (93.2%) did not use any control measures againist chemical poisoning. The result is agree with Marta Zelalem, 2013 who reported beekeepers at mecha district have experienced to control poisoning of honey bees by chemicals, nearly of respondents by moving the colonies away from the application area (21.2%), by covering the honey bee colonies with coarse close (9.1%), by closing the hive entrance during application (6%), adjust time of chemical application (3.4%) and do not use any control measures for chemical poisoning (61.1%).

About 93.3% of the beekeepers involved in this survey also described that agrochemical users did not announce the beekeeper before application. Moreover, 94.8% of the agrochemical user farmers especially the non-beekeepers had no willingness to use cultural pest control mechanisms like the application of IPM which were less promoted by the extension service (Table 6). The survey result agreed with the findings of Marta Zelalem (2013) who reported that none of the agrochemical users announce before they apply the chemical in Mecha district. In this regard, Desalegn Begna (2015) pointed out that the effects of pesticides due to none beekeepers indiscriminate uses and the jealously actions are showing absences of governing policy that put in place forcing measures so that the criminals can be penalized.

Table 6. Beekeepers and crop grower‟s cooperation and measures taken to protect bee colonies

Description	Response	Frequency	%
Do agrochemical users announce the beekeeper before application	Yes	12	5.00
	No	228	95.00
Measures taken to protect bee colonies from agrochemicals	covering with course cloth	5	2.08
	closing the hive entrance	10	4.17

	No any option	225	93.75
Willingness of farmers to use cultural pest control mechanisms	Yes	20	8.33
	no	220	91.67

Number of colonies lost due to agrochemicals

According to the result of current study 60.2% of the total respondent lost colonies due to the agrochemicals sprayed on different crops. This is slightly lower than the findings of Marta Zelalem (2013) who reported that 70.8% of the total respondent lost colonies due to the agrochemicals sprayed on different crops at Mecha district of western Amhara Region. The respondents were also pointed out the major signs observed on honeybees due to chemical poisoning like worker bee death at hive entrance (72.8%), massive death (17.7%), dead brood (5.8) and aggressiveness (3.7%). According to the survey result, the mean number of colonies lost due to agrochemicals was 3.78±0.378, 2.36 ±0.217 and 1.43 for traditional, movable frame and intermediate hives respectively. The estimated amount of honey from lost colonies is shown in Table 7. As a result of this, from the interviewed beekeepers alone a total an estimated price of 834,910 ETB were being lost from unwise use of agrochemicals. Desalegn Begna (2015) reported financial loss incurred due to the dead, absconded and dwindled honeybee colonies in western Amhara was estimated to about 819291.4 USD. Therefore, this increased and substantial loss of local honeybees necessiates the importance of protecting bees from pesticides in the study area (Desalegn Begna, 2015).

Table 7. Number of colonies lost and honey lost with an estimated price due to agrochemical applications

	N	No of colonies lost			Honey lost in kg			Estimated price		
		mean	SE	sum	mean	SE	sum	mean	SE	sum
Traditional	187	3.78	0.378	707	29.99	3.501	5579	2941.77	349.04	547170
Intermediate	7	1.43		10	15.88	4.27	127	780	195.96	7800
Movable frame	81	2.36	0.217	191	39.22	5.556	3277	3217.7	331.38	279940

Poisonous plants

About 67.7% of the interviewed beekeepers reported the existence of poisonous plants in the study area (Table 8). Accordingly the major reason for the existence of poisoned honey was resulted from the nectar and or pollen of the source plant (92.1%). Among the respondents 4.1% claimed that they didn"t know the reason for honey poisoning. Thirteen plant species: Kulkual (*Euphorobia spps*), kalkalda *(Euphorbia spp.*), kinche (*Parthenium hysterophorus*), Bahirsuf *(Helianthus annuus)*, kinchib *(Euphorbia tirucalli)*, Digita (*unidentified*) and Mech (*Guizotia scarab)* Eret (*Aloea spps*), Chiret (Agave *spps*), Nim *(Azadirachata indica),* ye wof kolo (*Lanthana camara*) and saligna (*Acacia saligna*) belonging to 8 different families (*Asteraceae, Agavaceae, Aloeaceae, Euphorobiaceae, Poaceae, Meliaceae, Fabaceae and Verbanaceae*) were the major poisonous plants reported in the area (Table 8). Nuru (2002) reported some poisonous bee

plants from Northern regions of Ethiopia that include the families *Ranuculaceae, Solanaceae, Acanthacae, Euphorbiaceae* and *Phytolacaceae.*

Table 8. Presence of poisoned honey and their possible reasons of its existence

description	response	frequency	%
Have you faced poisoned honey?	Yes	210	87.50
	no	30	12.50
Reasons for poisoned honey	Source plant	204	85.00
	Times of storage	4	1.67
	Container	13	5.42
	I don"t Know the reason	19	7.92

CONCLUSION AND RECOMMENDATION

The increase in pesticide use has gave rise to concerns about potential adverse effects on environment and biodiversity, particularly in countries where regulations are not strictly implemented and farmers' knowledge of safe handling procedures is often inadequate. This paper assessed the potential health effects pesticide use on honeybee colonies and beekeeping activities in East Shoa and West Arsi zones of Oromia, Ethiopia.

In the areas, most of the farmers extensively apply variety of agrochemicals. The use practice of agrochemicals by the farmers in the study area was found to be reckless and can potentially affect honeybee population and beekeeping activities in general. Even though it is with an inconsistent distribution, in the zones, agrochemicals are applied at all seasons of the year to control agricultural crop pests and diseases in the study area. Farmers in the study area opted to apply agrochemicals mainly during the morning and afternoon times of the day where honeybees are usually expected to be active at field activities and foraging. As a result, agrochemicals are supposed to having considerable effects in killing honeybees and affecting beekeeping activities in general.

In conclusion, the study availed balanced information on the side effects of pesticides on honeybees and their products that is leading to developing strategies, policy and practices towards mitigating the risks.

Mitigating damage of pesticide use to honeybees is the responsibility of all parties involved and requires concerted effort to minimize the risk. Hence, based on this study the below are presented as possible recommendations, which are aimed at minimizing the ill effects of pesticides on honeybees and their products. Farmers and beekeepers need to be educated on how to use label instructions and put into practice safety measures like not to spray on blooming crops, to keep bee colony away from the farm receiving pesticides, adjust the application time to late evening etc .Regulatory body that oversees the total supply, transportation, storage, appropriateness etc of pesticides at all levels should be in place.

Conventional way of pest management known should be encouraged to protect bees and the environment; and to ensure the products are natural.

Comprehensive research into the effects of pesticides on honeybees and their products decline to which this study targeted to contribute is important. As it is clear, proper application of pesticide can minimize, environmental and public health impacts being caused by

inappropriate utilization of pesticides. Well planned training is needed on the safe use of pest management and less risk to bees in the study area. This study highlighted the need for further study and monitoring of the of different pesticides on honeybees in different aspects. Key to effecting change in response to pesticide contaminations is community based programs that replace toxic pesticides with alternative non-chemical practices and products.

References

[1]. Asogwa, E. a. (2009). Problems associated with pesticide usage and application in Nigerian cocoa production: A review. *Afr. J. Agr. Res.* , 675-683.

[2]. Bura, A. R. (2013). The Impact of Pesticides on Honey Bees and Hence on. *Animal Science and Biotechnologies* .

[3]. Douglas, B. (2019). Pesticides and pollinators: A socioecological synthesis. *Science of the Total Environment* , 012–1027.

[4]. Goka, F. S.-B. (2016). Impacts of Pesticides on Honey Bees. *ResearchGate* .

[5]. Muhammad.A., S. A. (2017). A review: risk assessment of pesticides on honey bee and pollination of agriculture crops in Pakistan. *Asian J Agri & Biol.* , 140-150.

[6]. S.K. Biswas, S. R. (2014). A Review on Impact of Agrochemicals on Human Health and. *Plant Environment Development* , 31-35,.

[7]. Sánchez-Bayo, F. (2011). Impacts of Agricultural Pesticides on Terrestrial Ecosystems. *Ecological Impacts of Toxic Chemicals* , 63-87.