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Pesticides Use, Practice and Its Effect on Honeybee in Ethiopia: A Review

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Abstract
Honeybees play an essential economic role in the pollination of crops. Farmers were buying, storing, and use pesticides on cultivated plants with no or little consideration of the effect on honeybees. In Ethiopia, pesticide poisoning of honeybees has increased from time to time, and beekeepers also lose their colonies due to unwise use and improper practice of pesticides. Ethiopia has developed a legal framework on pesticide registration, distribution, and use. But regulations are not strictly implemented by the farmers, and it needs enforcement. Farmers use pesticides on crops with no or little consideration on the effect of honeybees, and the use of pesticides harmful to pollination service, behavior, communication, forage resource, poisoning, and contaminated hive products. Effective communication between beekeepers and crop growers while spraying is required to minimize the impact of pesticides on honeybees. Research should focus on the effects of pesticide use on honeybees and the means of reducing its impact.
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1. Introduction

Pesticide refers to a wide range of compounds including insecticides, herbicides, fungicides, rodenticides, molluscicides and plant growth regulators. Pesticides use as crop pesticides in the agricultural sector were introduced in Ethiopia with the development of commercial farms in the beginning 1960s (EPA, 2004; Mengistie, 2016). Following the introduction, use of chemical pesticides was applied as integrated package projects including the Chilalo Agricultural Development Unit (CADU), Wolaita Agricultural Development Unit (WADU), Minimum Package Project (MPP) under the Extension and Project Implementation Department (EPID) by the Ministry of Agriculture (Tadesse 2016). Ethiopia imports diverse types of pesticide with the amount expected bout 3346.32 metric tons annually (Gizachew, 2011).

Agrochemical poisoning, lack of equipment, pest and predators are found to be the top three challenges for the beekeeping industry and about three-quarters of beekeepers lost their colonies due to sprayed agrochemicals (Mengistu and Beyene, 2014). Improper use of pesticides in crop production is a source of socio-economic conflict among farmers. In Ethiopia, the poisoning of honeybees by application of pesticides has increased from time to time, and some beekeepers were also lost all their colonies due to agrochemical applications (Kerealem et al., 2009). Insecticides and herbicides had been reported as significant causes of the death of the colonies and absconding (Melaku et al., 2008; Desalegn, 2014; Melisie et al., 2016; Krystyna et al., 2017; Guesh et al., 2018). Improper use of insecticide leads to the honeybee death (Chauzat et al., 2006: MOWR, 2007) and decline of honeybee products and crop yield are among the significant constraints of beekeeping sector (Melisie et al., 2015).

The Ministry of Agriculture (MoA) at the federal level and agricultural bureau at regional states are agencies responsible for regulating, implementing, and monitoring pesticide policies, pesticide registration, importation, distribution, and use. Because of policy framework plays a vital role in the implementation of any regulation (Gysen et al., 2006). In order to govern pesticide use by farmers, the Ethiopian government has formulated new pesticide legislation which is Pesticide Registration and Control Proclamation No. 674/2010.

Extensive use of pesticides on crop results in decrease the pollination service of honeybees (Chauzat et al., 2006). Smallholder farmers use pesticides as technology inputs, to produce subsistence and commercial crops of different varieties and honeybees' have an immense contribution to agricultural crop pollination (Klein et al., 2007; Winfree et al., 2007; Rader et al., 2009). However, the impacts of pesticides on honeybee production are likely to be aggravated by the limited knowledge among users on toxicological and chemical properties of these substances and the fact that labels on pesticide containers were in a language that cannot be understood. Therefore, the objective of this paper is to review pesticide use, practice, their effect on honeybees', the effect of honeybees' pollination service on agriculture crops and farmer's knowledge, attitude and perceptions regarding the impact of pesticides use on honeybees' in Ethiopia.

2. Impact pesticides use to honeybees

Globally concerning the amount applied and the extent of use of pesticides are the second group of human-made

chemicals after the fertilizers (AAAS, 2013). It results in declining the population of honeybee and other pollinators throughout the world (Lebuhn et al., 2013), and toxic to honeybees even at very low doses (Johnson et al., 2010; Krupke et al., 2012; Simon-Delso et al., 2014; Williamson et al., 2014; Chakrabarti et al., 2015). Improper pesticides use also harms the natural environments; harmful and beneficial organisms were kill leading, climate change, pest resistance, and biodegradation (Ajayi, 2005). The population dynamics of the honeybee has been affected and declined by different factors; the use of organo-synthetic pesticides is considered to be among the critical elements (Van der Sluijs et al., 2013).

Agrochemical poisoning is the primary challenge for the beekeeping sector, and on average farmers lost more than two colonies per year in West Gojjam Zone, Ethiopia (Mengistu and Beyene, 2014). This indicates that the use of different chemicals to agricultural crops is high affects the economy of beekeepers. Honeybees are expos to different types of artificial chemical substances. Due to the deficiency in the number of genes encoding detoxification enzymes, honeybees are extremely sensitive than other insects to pesticides (Claudianos et al., 2006) and the extent of colonies damaged in confirmed honeybee poisoning occurrences varied between 10-90% (Pistorius et al., 2009). This is because the exposure is not uniform for honeybees and the extent of particular effects is varied.

In line with the beginning of agriculture modernization, honey bees, and beekeepers are suffering from the unnecessary usage of pesticides every year in the agriculture sector (Maini et al., 2010). Use of pesticides for crop pests, weeds, tsetse fly, mosquitoes and household pests control brings in to focus the real possibility of damaging the delicate equilibrium in the colony, kill the honeybees and their food source (Kerealem et al., 2009; vanEngelsdorp and Meixner, 2010; Allsopp et al., 2014; Desalegn, 2014; Mengistu and Beyene, 2014; Melisie et al., 2016; Askale et al., 2017), decrease hive production (Kerealem et al., 2009; Erik, 2013; Mengistu and Beyene, 2014; Melisie et al., 2016 ; Guesh et al., 2018), contaminated pollen (Pistorius et al., 2015) and it also affects the cognitive, behavior, and physiological functions of honeybees (Desneux et al., 2007; Belzunces et al., 2012; Eiri and Nieh, 2012). In addition to the poisoning; pesticides use ranking the first among the factors constraining beekeeping in Adami Tullu district Ethiopia (Melisie et al., 2016). Both honeybees and beekeepers are suffered more prominently due to practices used in agricultural development (Porrini et al., 2003; Maini et al., 2010; Mullin et al., 2010). According to Mengistu and Beyene (2014), it is reported that massive deaths of bees at the hive entrance (75.5%) and dead broods (14.5%) were among the significant signs noticed through pesticides sprayed on different crops. Other reports also indicate that if honeybees are poisoned by pesticides they display disorientation, aggressiveness, and incapability to enter the hive (Bortolotti et al., 2009).

Through the application of pesticide death, absconding and dwindling of honeybee colonies was occurring and subsequent financial loss was estimated to a total of about 819291.4 US$ at selected districts of Amhara Region, Ethiopia (Desalegn, 2014). Scientific study also documented that; the use of different pesticides could lead to a significant reduction of foraging activity (Gill et al., 2012; Henry et al., 2012; Schneider et al., 2012; Feltham et al., 2014), brood production (Alburaki et al., 2017), and orientation, dance communication, and return flight of honeybees (Fischer et al., 2014; Williamson et al., 2014). Even also pesticide, more specifically, the neonicotinoids have a capacity to disease resistance capacity of honeybees (Di Prisco et al., 2013; Brandt et al., 2016). In this case, it is possible to review that, use of pesticides has a potential to reducing the honeybee population, affects their nectar and pollen collection behavior and flight intensity as a result production and productivity received from honeybees is decrease.

3. Pesticides use and pollination of honeybees

One-third of the total human food supply depended on animals and insects, including honeybees pollination (Klein et al., 2007; Said et al., 2015; Roubik et al., 2018). Farmers use different external inputs, including pesticides, to grow subsistence and commercial crops of different varieties for agricultural crop maximization. Honeybees are economically essential insect pollinators in all over the world (Amssalu et al., 2004; Allsopp et al., 2008; Le Conte and Navajas, 2008; Muli et al., 2014). Production of agriculture crops is increasing up to 50% through pollination is done by the honeybees (Klein et al., 2007). In Ethiopia, the economic contribution of biological pollination services in agriculture crops is estimated at about $ 815.2 million dollars (Alebachew, 2018).

The resent agricultural growth has led to increased pesticide use resulting in a significant reduction of honey bee population or death, (Klein et al., 2007; Tadesse and Asferachew, 2008; Brittain et al., 2009; Mullin et al., 2010; Potts et al., 2010; Henry et al., 2012; Whitehorn et al., 2012; Nakasu et al., 2014) and pollination service of honeybees (Chauzat et al., 2006; Stanley et al., 2015). A vital crop pollinator particularly honeybees contact these agrochemicals during their trips by flying through contaminated dust clouds, visiting treated plants during collecting nectar and pollen which contains pesticides. The decline of beneficial insects includes honeybees is a side effect of the practice of protecting crops against undesirable insects through pesticide use. Therefore, the unwise use of pesticides on agricultural crops does not only affects the honeybee directly through killing to them and indirectly reducing their food resource, but it also affects the production of crops through

declining the pollination efficiency of honeybees.

4. Pesticide residues in hive products

Hive products, mainly honey, may be contaminated from the environment, beekeeping practice, and pesticides. Pesticide residues in honey can happen when bees in search nectar and pollen, visit crops that have been treated with various agrochemicals for different reasons (Bogdanov et al., 2007). European Union set regulation 396/2005 EC limit at 10 µg per kg for substances for which no MRL had been established and since September 2008 also the European Commission has set new MRLs, which mostly is between 10 and 50 ng per g in honey (Blasco et al., 2011).

A scientific report indicates that 44.4% of the samples contained no detectable residues of the target pesticides (Eissa et al., 2014) and in another case the honey samples collected from Walmara District of Oromia Special Zone, Ethiopia was free of the organochlorine (there is no significant pesticide) residues and the honey in the study area is safe for consumption (Kebebe, 2019). In this case even though, the fact no pesticides were detected or not exceeded the admitted level but, it does not necessarily mean that farmers are not using pesticides. Because some time honeybees can make biological transformation/detoxification of toxic substances and extract through their feces to sustain their life.

Different scientific documents reported that pesticide residues(contamination) in honey, wax, bee brood, pollen, and bees in several countries (Chauzat et al., 2006; Martel et al., 2007; Frazier et al., 2008; Mullin et al., 2010; Wiest et al., 2011; Ostiguy and Eitzer, 2014; Porrini et al., 2016; Amulen et al., 2017; Valdovinos-Flores et al., 2017).

5. Colony collapse disorder

This problem has occurred worldwide, and it needs management is the priority to save pollinator insects. With regard to the ecological and economic value of pollinators, there is a call to take an instantaneous action to spot and rectify anthropogenic activities responsible for the decline in numbers of pollinators to uphold crop production and environmental conservation. Colony collapse disorder was caused by different factors; neonicotinoids insecticides and pesticides exposure is one among the factors for the occurrence (Cox-Foster et al., 2007; Blanchard et al., 2008; Higes et al., 2008; vanEngelsdorp et al., 2009; Alaux et al., 2010; Henry et al., 2012; Krupke et al., 2012; Whitehorn et al., 2012).

6. Use of pesticide to agricultural crops

The application of pesticides is increasing in less developed countries to maximize crop production (Atreya, 2007) and dramatically in Ethiopia (Nigatu et al., 2016). Research indicates that producers used pesticides for different purposes including for weed control, insect pest control, fungi/molds/rust control, rodent control, and veterinary uses (Kalayou and Amare, 2015). In the agriculture sector pesticides have played a vital role in increasing crop production and without pesticide applications, crops would produce significantly lower yields due to factors insect damage, weed infestations and plant diseases (Ortelli et al., 2006). But considering its positive impact in agricultural crop production, the use of pesticides still has negative impacts on pollinators and other non-target organisms. Recent agricultural growth and development in Ethiopia resulted in higher demand and use of pesticides.

Formally, government extension programs encourage the use of pesticides, arguing that farmers have no alternative for its application as an extension package (MoA, 2013; Mengistie et al., 2014; Damte and Tabor, 2015). Pesticide use designs of smallholder farmers are more complicated compared with large-scale farmers, as they are usually resource-poor as well as risk-averse. A report indicates that due to high exposure and unsafe application techniques of pesticide, smallholders experience more pesticide health risks than larger-scale farmers (Ngowi et al., 2007; Williamson et al., 2008). Application of pesticide requires training; apply safety rules, proper time and techniques for both the farmers and habitat around include the more sensitive honeybees.

7. Type pesticides use

Various types of pesticides, insecticides, and herbicides were applied without consideration of the damage on honeybee colonies. The study indicates that except coffee and Enset (*Ensete ventricosum*) growers, those cereal and vegetable growers mainly used pesticides at a different level for production (Tilahun and Hussen, 2014). It is estimated that about 541,467 liters of pesticides are aerially sprayed at 514,923.6 hectares of land to control crop pests in the regions of Ethiopia, with the highest beekeeping potential, namely Oromia, Amhara, and Tigray (Sintayehu and Tibebu, 2016).

Table 1, Pesticides types used in Ethiopia

Type according to priority	References	The place where they apply
DDT (55.2%), Malathion (44.8%) and 2-4 D (21.6%)	Tilahun and Hussen, 2014	Gedeo and Borena Zones, Ethiopia
2-4-D (97%), Malathion (76%) Actalic (methyl parathion) (24%)	Mengistu and Beyene, 2014	Gojjam Zone, Ethiopia
Malathion 50%, phenetratite 50% Ethiothoate 40%, Agrothoate 40%, Diazion60% EC, Dimethoate40%EC, Ethiolathion 50% EC or Malathion, Karate 5EC, and herbicides like 2,4-D Amine, Zura, Diazion60% EC, Agro- Thoate40%, Etho-Thoate40%, Hepta clore, Phenetratite50%, Daconil, Diasnol, Primagram, Roundup, Agroset, Glycell and Terminator	Desalegn, 2014	Selected Districts of Amhara Region, Ethiopia
Chlorpyrifos dissolving in water, mixed Chlorpyrifos and Malathion, Malathion, mixed Chlorpyrifos and 2 4 D and 2,4 D alone	Shemsu, 2016	Bule Hora District, Ethiopia
Profenofos, Endosulfan, Diazinon, Malathion, Lambda-cyhalothrin, Deltamethrin, Dimethoate and DDT	Melisie et al., 2016	Adami Tullu district of Ethiopia
Aldrin, α-BHC, β-BHC, γ-BHC, Lindane, α-chlorodan, γ-hlorodan, 4,4'DDD, 4,4'DDE, 4,4'DDT, Dieldrine, α-Endosulfan, β-Endosulfan, Endosulfan sulfate, Endrine, Endrine	Eyobel et al., 2017	West Shewa Zone, Oromia Region, Ethiopia
Aldehyde, Endrine Ketone, Heptachlor, Heptachlor Exo-epoxide, and Methoxychlor.	Guesh et al., 2018	Selected zones of Tigray Region, Northern Ethiopia
Agro- 2,4-D amine 720g/l A.E, Malathione *(Ethiolation 50% EC),* Karate (*Karate 5% EC),* Dimothoate (*Ethiothoate 40%EC), Ridomil, Mancozeb,* Dursban (*Dursban 48% EC),*Fenithrothion *(Ethiotrothion 50% EC), and* Diazinon *(Ethiozinon 60% Ec.*		
Thiamethoxam, Imidacloprid, Deltamethrin, Abamectin, Spinosad Fosetyl Aluminium, Boscalid, Metalaxyl, Chlorothalonil, Carbendazim, Propamocarb, Hydrochloride, Iprodione, Profenofos, Mancozeb, Lambdacyhalthrin, Endosulfan, Dimethoate, DDT, Metalaxyl, Chlorpyrifos, Triadimefon, Mancozeb +Metalaxyl, and Cymoxanil +Copperoxichloride	Negatu et al., 2016	In selected large scale (closed greenhouses and open farms) and small-scale irrigated farms, Ethiopia

8. Pesticides using practices

In Ethiopia, several shops are selling pesticides, and farmers have easy access to pesticides (Mengistie et al., 2017). Farmers use the improper storage of pesticides at home (Ngowi, 2002; Ajayi and Akinnifesi, 2007). Some farmers mix two pesticides before application and this helps farmers to save their time, labor and they have considered it have higher efficacy in pests and disease control (Kalayou and Amare, 2015; Negatu et al., 2016; Mengistie et al., 2017). However, it is scientifically not recommended and does not label instructions to cover mixtures of two or more pesticides. Interactions between insecticides, fungicides and water mineral content may more toxic, risky, less efficient, neutralized or resistant of pesticides against fungal pathogens and insect mortality (Ngowi et al., 2007). Hence, an unspecified container of mixing of insecticide and fungicide are common practices with the vegetable farmers (Mengistie et al., 2017). Farmers purchase pesticides without having proper knowledge, storing, safe handling, safe use, and disposing of. As a result, this may be hazardous to beneficial pollinators, including honeybees.

9. Legislation and monitoring systems

Policy plays a vital role in the implementation of any regulatory developed by the governments. Due to its importance and applicability Ethiopia has established policies and legal instruments towards production, use of pesticides, and also accepted and ratified different international conventions and agreements. Formally it developed in written form the constitution as proclamation No.1/1995, in which under article 43, in which it stated people's right to a clean and healthy environment and proper compensation provisions (FDRE, 1995). In addition to this, the environmental policy of Ethiopia has also illustrated that prevention of pollution while sector environmental policies relating to soil husbandry and sustainable agriculture emphasize on the use of biological and cultural pest control approaches and safeguarding of environmental health by adequately regulating

agricultural chemicals in the country (Ethiopian-EPA, 1997).

Currently, the country was developed proclamation which is Pesticide Registration and Control Proclamation No. 674/2010 with the aim of laying down a scheme of control that would minimize the adverse effects that pesticide use might cause to humans, animals, and the environment. It also composes the need to enact comprehensive legislation to regulate the manufacture, formulation, import, export storage, distribution sale, use and disposal of pesticides (FDRE, 2010). But, it is understandable that only designing the policy possibly addresses pesticide problems and accomplishes the objectives unless the participants along the chain are enforceable (FOA, 2003; Brodesser et al., 2006; Mengistie, 2016). In Ethiopia, the role played by the actors in pesticide governance is weak, enforcement all level along the production includes at the federal, regional and grass-root or district level is fundamental and the formulation of pesticide policy by the state is not sufficient by itself unless it is enforceable (Mengistie, 2016). Enforcement of realistic pesticide policy is the most important component of monitoring the invaluable tool for verification of the conditions of exposure and the occurrence of risk in the field. Even if there are legislation (European Union) and proclamations (Ethiopia), but there is no official guide for performing monitoring studies for honeybees or other pollinating insects and monitoring studies were recommended (Alix and Garrido, 2015; Mengistie et al. 201,7).

10. Mitigation schemes for the impact of pesticides on honeybee

The majority of beekeepers do not use any control measures for chemical poisoning to honeybees (Mengistu and Beyene, 2014). The application of pesticides was also affecting honeybee production by decreasing the number of workers bee through poisoning and is considered a conflict between beekeepers and crop producers. To minimize the risk of honeybee poisonings or unacceptable weakening of a colony, the registration procedures of plant protection products (PPPs) take this issue into account and integrated agricultural crop production with apiculture is critical. Only a few farmers protected their honeybees colonies from insecticide poisoning either by keeping beehives far away from the insecticide sprayed area or by closing the entrance of the hive and giving supplementary feeds during spraying (Melisie et al., 2016). Even if it is difficult to completely prevent the effect of chemicals on honeybees, their effect can be reduce by strengthening integrated pest management programs, using insecticides of relatively low toxicity and residual effect for bees and other pollinating insects, not applying insecticides toxic to bees when crops are flowering, use proper methods application (Askale et al., 2017). Another scientific report also suggested that beekeepers and crop producers should be aware of the location of honeybee hive before the pesticide application (Cardoza et al., 2012; Tomé et al., 2012; Williamson and Wright, 2013), Positive communication between beekeepers and crop growers while spraying (Guesh et al., 2018). Under Ethiopia's agricultural situation to minimize the risk of pesticide use, there is a need for timely advice and use of educational programs to beneficiaries, chemicals applicators, and beekeepers on how to reduce poisoning by proper selection and application in insecticides. In addition to this, it is also important to avoid spraying pesticides to agricultural crops during blooming stage. Beekeeping management techniques (like moving bees out of hazardous areas, supplementary feeding and various protective measures) that will reduce the harmful effect of exposure to insecticides should be developed and practiced (Kerealem et al., 2009).

Honeybees' pollination plays an essential role to improve yields and better quality of different crops (Berenbaum, 2007; Klein et al., 2007; Winfree et al., 2007; Rader et al., 2009; Devkota et al., 2016). Because of the essential ecological and economic value of honeybees, there is a need to monitor and maintain pesticides application. And also to make the beekeeping sector sustainable, it is better to have an agreement between the crop producer and beekeepers on the implementation of those agrochemicals and use integrated pest management. The government should also be focused on formulating appropriate policies on the proper use of agrochemicals and accountability regarding the application (Kerealem et al., 2009).

11. Perception of farmers on the impact of pesticides on honeybees

The issue of knowledge, attitudes, and practices about pesticide usage and related health problems among irrigation farmers in Ethiopia has been left neglected (Gesesew et al., 2016). Majority of farmers use pesticides without full understanding of the impact on human health, honeybees and the environment (Mathews, 2008; Melisie et al., 2016; Sintayehu and Tibebu, 2016), farmers have having lack of appropriate knowledge on safe handling and use of pesticides (Ngowi, 2003; Ibitayo, 2006; Ngowi et al., 2007; Nalwanga et al., 2011; Tilahun and Hussen, 2014), use inappropriate practices (Mekonnen and Agonafir, 2002), farmers are not fully aware of the amount of agrochemical recommended (Mengistu and Beyene, 2014). The majority of farmers were not receiving pesticide-related training (Negatu et al. 2016). In another case around 63.2% of farmers usually followed the instructions/labels written on the containers of the pesticides (Gesesew et al., 2016). Farmers can use the pesticides effectively if they have the required knowledge, skill and experience (Brodesser et al., 2006; FOA 2008).

12. Time of pesticides use

The study indicates that all of the farmers apply agrochemicals on barley, wheat, millet, and onion before blooming (Mengistu and Beyene, 2014). In addition to this the majority of the respondents apply the chemicals on mango (92.9%), orange (97.2%), potato (81%) and maize (81%) at blooming and liquid spray at the morning and at the middle of the day (Desalegn, 2014; Mengistu and Beyene, 2014; Melisie et al., 2016; Guesh et al., 2018). This man that they at the time when the honeybees were more visited time the flowering plants to collect nectar and pollen, as a result, they poison themselves or contaminate all the resources found the hive. Even if the majority of farmers apply pesticides ones per agricultural crop growing season but some farmers use twice and three times. On the other hand, according to Shemsu (2016), an assessment conducted in Bule Hora Districts of Ethiopia majority of farmers use pesticides four times per year. It's possible to conclude that as the frequency of pesticide application is increasing its impact including honey yield minimization, killing flowering plants, pollination service, population, absconding, forging behavior and others will be increasing. As a result, it may bring social conflict among farmers, economic and even ecological impact.

13. Trends of pesticide use

The trend of chemical utilization, including usage by smallholders, has been increasing (Ngowi et al., 2007; Gizachew, 2011; Mengistu and Beyene, 2014; Mengistie, 2016). This is due to the expansion of agriculture packages to increase plant productivity nation-wide and accessibility of the various pesticides in a market. According to MoA (2011), indicates that 2973 tonnes of pesticides in between 1996-1998, 3670 metric tonnes between 1999-2001, 5079 tonnes between 2002-2004, 8302 tonnes between 2005-2006 and in between 2006 - 2011 in which a total of 27,268.73 metric tonnes of pesticide were imported to Ethiopia. But this data is only including the pesticides imported legally this is because of pesticide importing process into Ethiopia is not well-controlled (Mengistie, 2016). In recent years, population increase led to a rise in demand for crops and cereals that increased with price incentives.

Conclusions

Honey bees (*Apis mellifera L.)* play an important ecological and economic role in the pollination service of crops. But recent global declining on pollinators, including honeybees' has reported owing to several factors includes unwise use and practice of pesticides.

Both beekeepers and non-beekeepers farmers buying, storing, and use pesticides on cultivated crops with no or little consideration on the effect of honeybees. The use of pesticides was affecting the bees directly through poisoning, death, flight, behavior, communication, and indirectly through destroying the honeybees' forage; it results in poor quality and quantity of hive products. The use of pesticides affected both to the honeybee colonies and beekeepers, and contaminating of hive product absconding the honeybees and creates socio-economic conflict among community members.

Farmers used pesticides during the flower or blooming stage, and this is at a time which field bee actively collected nectar and pollen; as a result, it damages the bees. Farmers used pesticides for different purposes with no or little consideration on its impact on the environment, pollinators including honeybees. Farmers also apply pesticides up to four times per production session; the frequency of use also increases its impact on the honeybees. Considering saving their time, labor and its higher efficacy farmers practice mixing of two pesticides before the application and which is scientifically illegal and adheres to substantial risk on honeybees and beekeepers also. Following the need to improve agricultural crop production, the lack and use of pesticides application are having been increased from time to time.

Honeybee productivity is affected by the indiscriminate use of agrochemicals, lack of knowledge, pests and predators accordingly. It needs urgent action from the federal and regional governments to formulate policy, design legislation, and enforcing for its implementation concerning the supply, transportation, storage, appropriateness, and application of harmful pesticides.

Research should focus on the effects of pesticide use on honeybees and means of minimizing their results as well as on the development of non-chemical methods of insect control is very vital. In order to make the apiculture sector is sustainable, it is better to create an agreement between the crop producer and beekeepers on the use of the insecticide and use integrated pest management, covering or moving the hive to the poising free area, follow proper application practice is very vital. The regional governments should provide insecticide-open sanctuaries and crop zones where bees can be isolated from insecticides' effect. The government should also be focused on formulating appropriate policies on the proper use of pesticides and monitoring its implementation.

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