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Research Article

Social and Environmental Concerns Witnessed by Nearby Inhabitants of Flower Farms in Central Ethiopia

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ABSTRACT

Ethiopia became the fifth largest non-EU flower exporter to the EU market and the second-largest exporter from Africa. Fertilizers and pesticides used extensively in the industry have been linked to negative environmental and health impacts. The cross-sectional study was conducted to assess social and environmental concerns witnessed by nearby inhabitants of flower farms from April 8 to June 02/2019 using questionnaires, focus group discussion (FGD), and field visits. The data was analysed using Statistical Package for Social Sciences (SPSS) software version 16. This study revealed that 161(26.79%), 317 (52.75%), and 25(4.16%) of sample HHs reported that flower farms are disposing of their flower residue by burning in their compound, by disposing of in the open field, and by burying in their compound, respectively. Also, the result showed that 216(36%) buy or receive empty chemical bags and containers which they use it to fetch and store water (69.91%), for house shade (7.87%), to make and store traditional liquor (14.35%), and for sale (7.41%), respectively. FGD participants perceived the decrease in volume and quality of groundwater, a decrease in productivity, land degradation, and increased emerging diseases. In addition, they reported abuse of employee rights, displacement of farmers from fertile land, death of cattle and fish, loss of acceptance for their agricultural and fish products. In general, it was reported that there are a poor waste management and unsustainable activities by the flower farms. The government should closely monitor these farms and undergo a holistic study to quantify environmental and local inhabitant's opportunity costs of flower farming activity.

Keywords: Flower farm; Waste management; Environmental pollution; Pesticides; Fertilizer; Human health

INTRODUCTION

Ethiopia started to enter the flower export market in the mid- 1990s at the time when the EU market was much more demand-driven, and as a result, increasingly stringent standards and regulations had been instituted. In less than a decade, the country became the fifth largest non-EU flower exporter to the EU market and the second-largest exporter from Africa, surpassing all early exporter countries except Kenya [1,2]. Ethiopia generated over 178 million USD from flower exports. Although the contribution of the sector to GDP growth is undeniable, many scholars are doubtful about the long term impacts of this sector on the environment and welfare of the rural families, in areas where flower farms are developed [2].

Due to the rapid growth of the floriculture industry, many have become concerned about the potential adverse environmental impacts of flower farms. Fertilizers and pesticides used extensively in the industry have been linked to negative environmental and health impacts [3-5].

Pesticides (which include herbicides, insecticides, fungicides, and more) can contaminate organisms, soil, water, turf, and other vegetation [5]. The adverse effect of pesticide use includes degrading water and soil quality, the effect on non-targeted lives like soil organisms, aquatic life, human beings, insects, cattle, etc, air pollution, and increase of pesticide resistance by targeted pests [3,6]. According to[7] between 2007 and 2014, flower farms in Ethiopia have imported 96 types of insecticides and nematicides and 105 types of fungicides. Most growers rank pesticides second on their list of expenditures, next to international (air) transport costs [8].

On other hand, fertilizers are used in many different forms of agriculture to increase the level of crop production by adding nutrients to the soil that benefit the growth of plants. However, they are often harmful to the environment [3]. The residue of these fertilizers can cause water pollution, eutrophication of freshwaters, and increased nitrate concentrations in ground and surface waters [5]. The long-term use of inorganic fertilizers can also be detrimental

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to the soil because it can kill nitrogen-fixing bacteria and other beneficial organisms [9]. As a result, more fertilizers are applied each year to make up for the loss of natural microorganisms and micro-nutrients [3,5].

Many studies were performed focusing on occupational health, employee's rights, water pollution, soil pollution, waste management, and so on. However, there are none or a few who collected data from the surrounding residents who can give better testimony regarding the health impacts, the local inhabitants' benefit, the solid waste management practice, and social complaints of flower farming industries. It is important to collect data from a different source to generate reliable data. The local inhabitants are the mosaic of the industry employee, the farmers, and other residents; they can be taken as surveillance camera or watchdog that is following what is happening inside the compound as well as the surrounding environment. Therefore, in this study, the social and environmental concerns witnessed by nearby inhabitants of flower farms were tried to be assessed.

METHODS AND MATERIALS

Study areas

This study assessed the environmental and social consequences inhabitants living around five flower farms (Farm 1, Farm 2, Farm 3, Farm 4, and Farm 5) in Central Ethiopia. The flower farms' location was depicted in Figure 1. Farm 1 and Farm 2 are found in the Southwest Shewa zone (Woliso Woreda and Bacho Woreda, respectively). Farm 3 and Farm 4 are found in the West Shewa zone (Walmera Woreda). And, Farm 5 is located in the East Shewa zone, Adami Tulu Jido Kombolcha Woreda. These flower farms were purposely selected for this study based on the intensity of the social complain as per the local Environment, Forest, and climate change authority recommendation (Figure 1).

Study design and period

The cross-sectional study was conducted to assess social and environmental consequences observed by nearby inhabitants living within a 2 km radius of flower farms from April 8 to June 02/2019 using questionnaires, focus group discussion(FGD), and field visit.

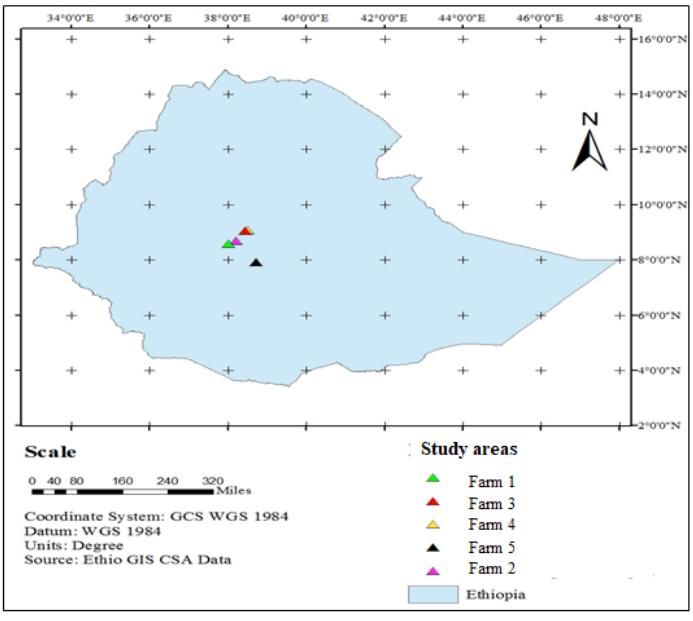

Figure 1: Study areas.

Sample size determination

The sample size was determined using a Cochran's formula [10] at a 95% confidence interval and 4 margin of error. Systematic random sampling techniques were employed to determine the number of samples per study site. A total of 601 sample size was determined which is allocated to the flower farms based on the land surface area the flower farms have occupied.

$$n_0 = \frac{(Z^2 pq)}{e^2}$$ Equation 1

Whereas: n_0 is sample size

e is the desired level of precision (i.e. the margin of error)

p is the (estimated) proportion of the population which has the attribute in question,

q is 1-p

z-value is found in Z table

$$n_0 = \frac{1.96^2 * 0.5 * 0.5}{0.04^2} = 601$$

Sampling technique

It is not appropriate to use the whole residents of a kebele to determine study subjects for this specific study. Therefore, we have set a benchmark indicating a 2 km distance from the flower farm in four directions using GPS and collected data from those living in the specified distance. The sample size per flower farm was determined based on the assumption of "The land area the flower farms are using is proportional to the number of residents affecting." Based on our reconnaissance survey by field visit and Google earth, we have used 47.5% of the Farm 5 land area to calculate the sample size taking into consideration that the firms have bounded the lake Ziway and agricultural land partially. And for the rest cut flower farms we used the area of their farmland as it is. Accordingly, the data were collected from 53, 53, 53, 53, and 389 inhabitants in a 2km radius of Farm 1, Farm 2, Farm 3, Farm 4, and Farm 5, respectively. Individual households that participated in the study were selected randomly. If the selected housing units were not serving as a home; the next housing number was directly selected. Only one person was interviewed from each household selected randomly. The selected households were informed about the purpose of the study before filling the questionnaire.

Data collection process

Data was collected by urban health extension professionals and experts from concerned Woreda Environment, Forest, and climate change Authority who has taken detail orientation on data collection tool. Data were collected using a questionnaire and checklist which were prepared in the English language and translated to Afan Oromo. Data was gathered from randomly selected individuals of inhabitants around flower farms by questionnaire and four Focus group (FGD) discussion having 15 members in which farmers, residents, and concerned experts have participated. The FGDs aimed at stimulating a debate on the Social grievance of the flower farm industries and to identify the existing main social and environmental problems of flower farms and their possible solutions.

Questions addressed in the FGDs were the following:

- What impacts and changes attributed to the flower farm existence the inhabitants perceived in their vicinity?

• What diseases and injuries associated with flower farms have you perceived it has occurring newly or increasing?

• What measures could be taken to reduce the possible negative impacts of flower farms?

Additionally, field visits were performed in the residential area, and pictures of important observations were included as supportive qualitative information.

Data quality control

To ensure the quality of data training of data collectors and supervisors were given for two consecutive days. The structured questionnaire was pretested on 5% of the sample size which is 31 households before actual data collection. The investigator and supervisors closely supervised the performance of the data collectors daily. The data was thoroughly cleaned before coding and entry to minimize the error encountered. Randomly selected households were cross-checked by the researcher against the filled questionnaires to verify the collected data.

RESULTS AND DISCUSSIONS

Socio-demographic characteristics of the respondents

A total of 601 households (HHs) were included in this study. Among households' study participants, 317(52.75%) were male and 284 (47.25%) were females. The majority of the study participants were found in the age range of 20-45 (77.7%). Regarding the occupational and educational status of respondents, 14(2.33%), 125(20.80%), 224(37.27%), 97(16.14%), of the respondents were government workers, private business, farmer, and unemployed, respectively and 147(24.46%), 217(36.11%), 136(22.63%), 52(8.65%), of the participant were reported as they had grade 9-12, grade 1-8, illiterate, can read and write, respectively. Four hundred ninety-eight (82.86%) respondents were lived in the area for more than 11 years. The results are presented in (Table 1)

Waste management gap of flower farms observed during the field visit

Liquid pesticide waste mainly consists of effluent and wastewater from flushing drip lines or cleaning spraying equipment and is diluted and disposed of in soak away pits, a practice that may not prevent chemical residues entering the environment [8]. Liquid waste that cannot be reused or recycled should be collected and kept in impermeable containers or solar evaporation ponds. The waste residue should be transported off-site for safe disposal at a local, council-approved waste disposal area [6]. During the field visit, we observed wastewater is discharged from the compound of some flower farms. As it was tried to illustrate in Figures 2a and 2b, this discharged wastewater is added to the nearby water body, drink up by cattle, or fetched by residents for uses (Figure 2a and b)

Flower farms empty chemical container use status

Another environmental concern in the flower farming is the unsafe management of pesticide containers [6,8]. To assess whether

Table 1: Socio-demographic characteristics of the respondents.

Characteristics		IA Farm 1		IA Farm 2		IA Farm 3		IA Farm 4		IA Farm 5		Total	
		Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Gender	Male	40	75.47	33	62.26	31	58.49	32	60.38	181	46.53	317	52.75
	Female	13	24.53	20	37.74	22	41.51	21	39.62	208	53.47	284	47.25
	Total	53	100	53	100	53	100	53	100	389	100	601	100
Age	20-35	9	16.98	21	39.62	15	28.3	20	37.74	189	48.59	254	42.26
	36-45	19	35.85	18	33.96	17	32.08	19	35.85	140	35.99	213	35.44
	>45	25	47.17	14	26.42	21	39.62	14	26.42	60	15.42	134	22.3
	Total	53	100	53	100	53	100	53	100	389	100	601	100
Educational status	First Degree	0	0	2	3.77	0	0	0	0	8	2.06	10	1.66
	10 + 3	0	0	0	0	0	0	0	0	40	10.28	40	6.66
	Grade 9 to 12	17	32.08	11	20.75	14	26.42	9	16.98	96	24.68	147	24.46
	Grade 1 to 8	18	33.96	11	20.75	20	37.74	15	28.3	153	39.33	217	36.11
	Illiterate	2	3.77	25	47.17	10	18.87	25	47.17	74	19.02	136	22.63
	Read and write	16	30.19	4	7.55	9	16.98	4	7.55	19	4.88	52	8.65
	Total	53	100	53	100	53	100	53	100	389	100	601	100
Type of job	Government	0	0	0	0	1	1.89	0	0	13	3.34	14	2.33
	Private business	2	3.77	7	13.21	0	0	3	5.66	113	29.05	125	20.8
	Farmer	46	86.79	43	81.13	31	58.49	28	52.83	76	19.54	224	37.27
	Unemployed	0	0	1	1.89	0	0	20	37.74	76	19.54	97	16.14
	Other	5	9.43	2	3.77	21	39.62	2	3.77	111	28.53	141	23.46
	Total	53	100	53	100	53	100	53	100	389	100	601	100
Residence duration in years	<5	0	0	0	0	0	0	3	5.66	8	2.06	11	1.83
	5 to 10	0	0	2	3.77	0	0	13	24.53	77	19.79	92	15.31
	11 to 20	7	13.21	10	18.87	2	3.77	7	13.21	104	26.74	130	21.63
	>20	46	86.79	41	77.36	51	96.23	30	56.6	200	51.41	368	61.23
	Total	53	100	53	100	53	100	53	100	389	100	601	100

Figure 2: Pictures showing the waste management gap of flower farms.

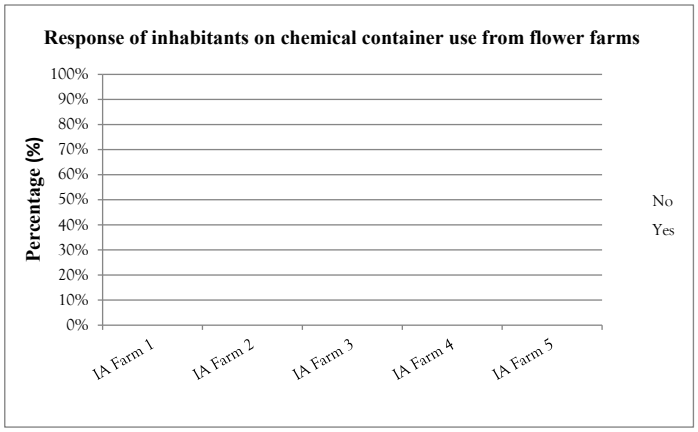

Figure 3: Response of inhabitants on chemical container use discharged from flower farms.

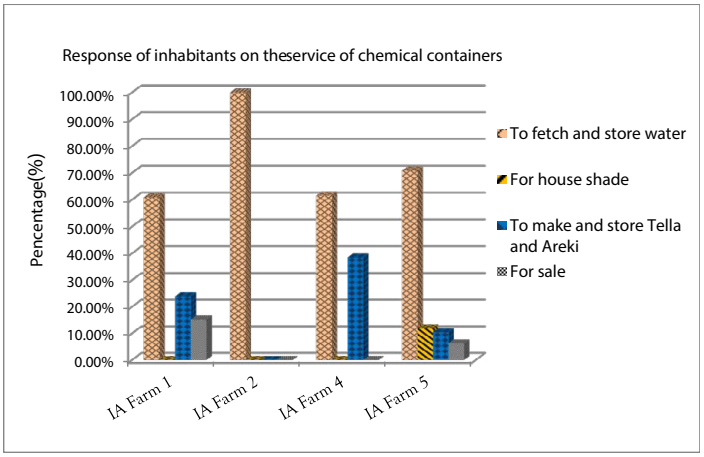

Figure 4: Response of inhabitants on the service of chemical containers.

they receive/buy chemical bag/containers from flower farms, residents living around flower farms were asked. The result showed that 46(86.79%), 13(24.53%), 13(24.53%), and 144(37.02%) of inhabitants around Farm 1, Farm 2, Farm 4, and Farm 5 receive/buy the chemical bags/containers, respectively. Whereas, residents around Farm 3 responded that they didn't receive/buy it all. Residents reported that they get the materials from guards and employees of the flower farms (Figure 3).

The local inhabitants were also asked for what purpose they use the chemical container they received/bought. Accordingly, 28(60.87%), 11(23.91%), and 7(15.22%) of respondents around Farm 1 use it to fetch and store water, to make and store Tella and Areki (Cultural Alcoholic drink in Ethiopia), and for sale, respectively. Whereas 13(100%) inhabitants around Farm 2, reported they use it to fetch and store water. Regarding inhabitants around Farm 4, 8(61.54%) and 5(38.46%) use it to fetch and store water, and to make and store Tella and Areki, respectively. While, 102(70.83%), 17(11.81%), and 15(10.42%) of inhabitants around Farm 5 use it to fetch and store water, for house shade, and to make and store Tella and Areki, respectively (Figure 4).

The researchers have tried to make field visits in the vicinity around flower farms to check if empty chemical containers are haphazardly disposed of in the immediate environment. As depicted in Figure 5(a) empty chemical bags were disposed of haphazardly which further enter into the water body or eaten by castles grazing around the compound. Among empty chemical containers, we had a chance to take pictures of residents fetching water with Jerry Cans from which chemical was emptied (Figure 5 a and b)

Figure 5: **(a)** Picture showing an empty chemical bag is haphazardly disposed of in the immediate environment.
(b) Picture showing a person fetching water with Jerry cans from which chemical was emptied.

Social complaint concerning flower farms

In this survey, we have tried to identify how many of the inhabitants around the flower farms raised complain regarding the flower farm problems in their vicinity. Accordingly, 50(94.34%), 41(77.36%), 33(62.26%), 312(80.21%), and 27(50.94%) of inhabitants have reported they had raised a complaint on Farm 1, Farm 2, Farm 4, Farm 5, and Farm 3, respectively. And 2(3.78%), 5(9.43%),5(9.43%), 32(8.23%), and 13(24.53%) of inhabitants have reported they have no complaint about Farm 1, Farm 2, Farm 4, Farm 5, and Farm 3, respectively. Whereas, the rest 1(1.89%), 7(13.21%), 15(28.30%), 45(11.57%), and 13(24.53%), reported that they have no idea about the issue, respectively (Figure 6).

The respondents were asked for the cause of complaint in their vicinity. Accordingly, Inhabitants around flower farms reported high flood from the greenhouse (Farm 1; Farm 2) unfair

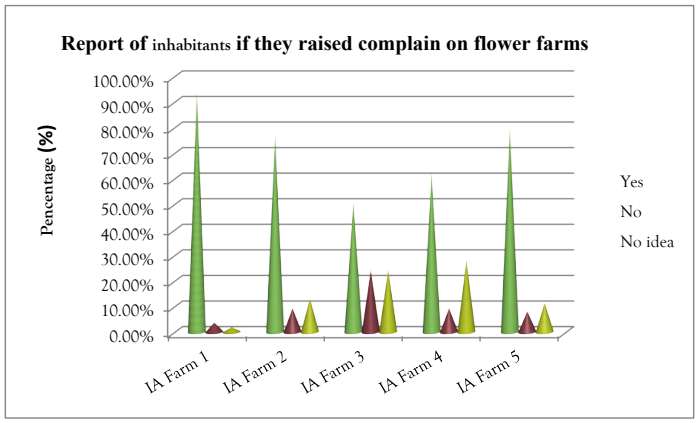

Figure 6: Report of inhabitants if they had risen to complain about flower farms.

compensation (Farm 1; Farm 2), unwillingness to implement its promises (CSR) (Farm 1; Farm 2), uncontrolled water abstraction (Farm 1; Farm 3), unfair wage (Farm 1), chemical contamination of nearby farmland and grazing lands by flood and wind (Farm 1; Farm 2; Farm 4; Farm 5), loss of local vegetables and fish acceptability on the market (Farm 1; Farm 2), loss farmland (Farm 4) decrease of crop yield (Farm 3; Farm 4) and water pollution (Farm 3; Farm 5). Furthermore, occupational injury, abuse of employee rights, health problems, death of cattle and fish, funeral area demolishment, chemical odour problem, reduced drinking water resource due to contamination were listed by inhabitants around Farm 5. This result is in agreement with the findings of [2,5,8,11,12].

Benefits the residents reported that they get from flower farms

Corporate Social Responsibility (CSR) is considered to be a vital part of any contemporary business strategy. Hence, focusing on CSR can provide companies with both operational efficiency as well as image benefits. People are becoming more aware of the social and environmental effects of their consuming habits, hence it is projected that innovative and responsible companies will continue to do well in the future, as their actions affect the purchasing behavior of customers [13]. This study has tried to assess what the local inhabitants have benefited from the flower farms.

Accordingly, 27(50.94%), 10(18.87%), 10(18.87%) inhabitants around Farm 1 have confirmed that they get a job opportunity, drinking water, and school, respectively. Whereas, 23(43.40%) and 25(47.17%) inhabitants around Farm 2 has confirmed that they got job opportunity and water supply, respectively. Similarly, 23(43.40%) of inhabitants around Farm 4 have confirmed that they get the job opportunity. While, 30(56.60%) responded that they get nothing from the flower farm, respectively. On another hand, 209(53.73%) and 117(30.08%) inhabitants around Farm 5 have reported that they have got job opportunities, and school, respectively. Also, inhabitants around Farm 3 were asked to list the benefit the get as a resident of the vicinity. Accordingly, 19(35.85%) have confirmed that they got job opportunities. The result is presented in (Figure 7).

It is undeniable that cut flower production is now a major part of the Ethiopian economy and has shown considerable potential for Ethiopia in terms of creating employment opportunities and foreign exchange earnings which can be further enhanced by applying the right production technology and provision of support for diversification of marketing outlet destinations [14].

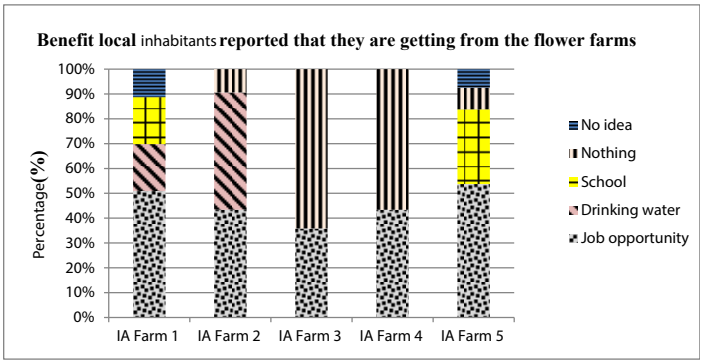

Figure 7: Benefit local inhabitants reported that they are getting from the flower farms.

Horticulture export gross earning is growing from 660 thousand USD in 2004/05 to 265.71 million USD at the end of 2011/12 and from this, the floriculture gross earning is 212.56 Million US dollar. The contribution of horticulture export to the overall GDP is also increasing from 0.10% in 2004/05 to 12% in 2011/12 [14]. Therefore, the pros and cons of the industry should be well balanced to be sustainable.

Local Inhabitant's degree of satisfaction about the flower farm activity

In Ethiopia, hearing at public need is very rare due to various reasons. A developmental project should ensure the benefit of the local community besides its national role. Hence this study has tried to measure the satisfaction level of the inhabitants around the flower farms to the flower farm industry in their vicinity.

Accordingly, residents around Farm 1 were asked about their satisfaction level, 1(1.89%), 9(16.98%), 16(30.19%), and 27(50.94%) of HHs were responded that they were "very satisfied", "Moderately satisfied", "Slightly satisfied" and "Not at all satisfied", respectively. Whereas, 9(16.98%), 9(16.98%), 10(18.87%), and 25(47.17%) of HHs around Farm 2 were responded that they were "very satisfied", "Moderately satisfied", "Slightly satisfied" and "Not at all satisfied", respectively. Similarly, 2(3.78%), 5(9.43%), and 46(86.79%) of HHs around Farm 4 were responded that they were "Moderately satisfied", "Slightly satisfied" and "Not at all satisfied", respectively. Among HHs around Farm 5, 2(0.51%), 9(2.31%), 162(41.65%), and 215(55.27%) responded that they were "very satisfied", "Moderately satisfied", "Slightly satisfied" and "Not at all satisfied", respectively. Likewise, 4(7.55%), 20(37.74%), and 29(54.72%) of HHs around Farm 3 were responded that they were "Moderately satisfied", "Slightly satisfied" and "Not at all satisfied", respectively (Figure 8).

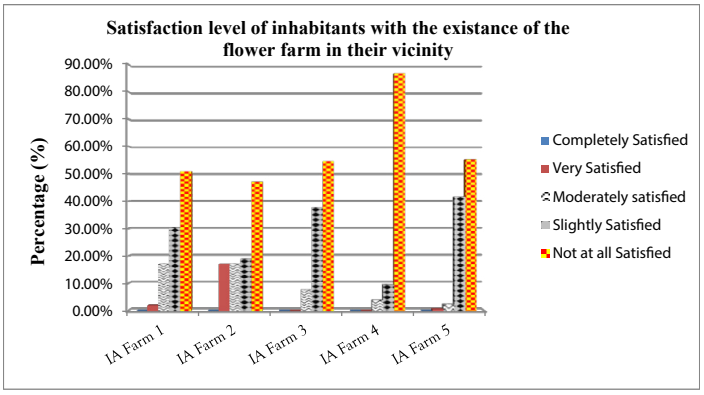

Figure 8: Satisfaction level of inhabitants with the existence of the flower farm in their vicinity.

The respondents were asked to report diseases and injuries they have perceived it was occurring newly or increasing due to flower farms in their vicinity. Consequently, the inhabitants residing around the flower farms reported Eye irritation (Farm 1; Farm 5), Asthma (Farm 1; Farm 2; Farm 5), Bad smell (Farm 1; Farm 4), cough (Farm 1; Farm 2; Farm 5), skin lesion (Farm 1; Farm 5), lung disease (Farm 2), and Malaria (Farm 1; Farm 2). Exclusively, weight loss, headache, miscarriage, disability and death, shortness of breath, diarrhoea, convulsion, wounding of hands, and other body were reported by inhabitants living around Farm 5 flower farms.

Kinds of literature also indicate similar results. UWEA (2006) mention in its research in Ugandan floriculture industries the neighbouring communities of flower farms complain of a smell when spraying is going on at the farm as the pesticides applied in the greenhouses travels an average distance of 1,500 miles [6,16].

It is well known that Pesticides can cause many types of harmful effects. It can cause acute effects such as nerve, skin, and eye irritation and damage, headaches, dizziness, nausea, fatigue, vomiting, abdominal pain, and systemic poisoning. Major acute effects can cause respiratory problems, nervous system disorders, and aggravation of pre-existing conditions such as asthma [17]. It can also cause chronic effects like brain cancer, breast cancer, leukaemia, non-Hodgkin lymphoma, Mutagenic effects, Teratogenic effect, prostate cancer, liver damage, reproductive disorder, damage to hormone-producing glands, neurotoxicity, Alzheimer disease, Parkinson disease, Multiple chemical sensitivity [5,18].

Findings from Focus Groups Discussions

During April 2019 four focus group discussions were prepared and organized to generate a discussion on the social and environmental problems of flower farms. The discussions revealed the existence of significant complaints in the community regarding the flower farm industry. These complaints traverse a wide range of issues and aspects related to the flower farms. Participants in the focus group discussions referred to environmental, wellbeing, financial, and personal issues.

A common dominator of the views expressed by all focus group participants regarding perceived flower farms negative impact is the decreased volume and quality of groundwater, a decrease of productivity, land degradation, increased emerging diseases, abuse of employee right, displacement of farmers from fertile land, death of cattle and fish, loss of acceptance for their agricultural and fish product. Participants reported perceived changes in their environment attributed to flower farms such as a change in colour and odour of water body, spring has terminated, decreased water table, bad smell, decreased groundwater yield, and decrease in fish production. The key words most commonly brought up across all four focus groups included water, health problems, occupational injury, abuse of employee rights, farmland, cattle death, productivity, and fertility.

CONCLUSIONS AND RECOMMENDATIONS

In this study it was tried to show the social and environmental issues such as waste management, empty chemical bag/container misuse, and social grievance of the farm, residents benefit from the farm, and inhabitant's degree of satisfaction around flower farms. Accordingly, the main issues reported were high flood from the greenhouse, unfair compensation, uncontrolled water abstraction, unfair wage for the employee, chemical contamination of nearby farmland and grazing lands by flood and wind, loss of local vegetables and fish acceptability on the market, loss farmland, decrease of crop yield, water pollution, occupational injury, abuse of employee rights, health problems, death of cattle and fish, and chemical odour problem.

In general, it was reported that there is a poor waste management and unsustainable activities by the flower farms. As a reason, high social grievance and dissatisfaction are broadly manifested by inhabitants around flower farms. Every developmental activity has its own negative impact which ranges from low to high, reversible to irreversible and short-term to long-term. The cost-benefit analysis of such a sector should be well examined and recognized. The fact that this study has tried to hear from the community, the government should strongly and closely monitor these farms if the firms are acting according to the management plan. Also, detail and holistic study is still highly required to quantify environmental and social opportunity costs of flower farming activity.

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