

Survey on people's attitudes and constraints of rooftop gardening in Dhulikhel

Constraints of
rooftop
gardening

89

Sandesh Thapa, Rakshya Bhandari and Anjal Nainabasti
Gokuleshwor Agriculture and Animal Science College, Tribhuvan University, Nepal

Received 6 April 2020
Revised 19 April 2020
Accepted 24 April 2020

Abstract

Purpose – The purpose of this study was to observe the people's response regarding rooftop farming in one of the rapidly developing area of Kavrepalanchok district, Dhulikhel, as rooftop farming is aimed in solving food security problem in urban area by providing quality materials for nutritional requirements.

Design/methodology/approach – The research design of this study was random sampling survey with replacement techniques as respondents without concrete roof were not selected for the study. This study was aimed at recording the people's response in one of the most accessible way, which would be easy for interpretation and analysis.

Findings – The major finding was that all of the respondents found rooftop farming beneficial but not all could practice it because of many constraints associated with rooftop farming. Most of them have fear of roof damage, so they are not adopting it. However, the respondents who are practicing rooftop farming find it difficult to manage because of lack of proper knowledge. Planting materials include plastic bags, crates, polythene and many other non-recyclable components.

Originality/value – To the best of the authors' knowledge, this research is the first ever conducted in their country. Surveys related to rooftop gardening have not been done in the authors' country till date. This is one of the present needs to improve the urban farming status, thus survey on rooftop farming and solving its constraints is necessary.

Keywords Carbon sequestration, Damages roof, Planting material, Random sampling survey

Paper type Case study

1. Introduction

Rooftop farming includes the concepts of process and change, economy and means that derive the most benefit from the least effort and energy, correctness that acknowledges the interrelationship of environmental literacy that begins at home and forms the basis for a wider understanding of environmental issues worldwide, and a goal that stresses an elaboration of environmental values that are connected to change an integration of human

© Sandesh Thapa, Rakshya Bhandari and Anjal Nainabasti. Published in *Ecofeminism and Climate Change*. Published by Emerald Publishing Limited. This article is published under the Creative Commons Attribution (CC BY 4.0) licence. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this licence may be seen at <http://creativecommons.org/licenses/by/4.0/legalcode>

We would like to express our deep gratitude toward the respondents of Dhulikhel municipality for providing their valuable time and helping us in our research. We would also like to acknowledge Janak Adhikari, Dinesh prasad jamkatel and Anup Ghimire for supporting us throughout the preparation of manuscript.

Conflict of interest: None.



Ecofeminism and Climate Change
Vol. 1 No. 2, 2020
pp. 89-96
Emerald Publishing Limited
p-ISSN: 2633-4062
e-ISSN: 2633-4070
DOI 10.1108/EFCC-04-2020-0008

with natural processes at a fundamental level (Hough, 2002). At present context, the issues related to urban welfare and sustainability of cities can be overcome by Rooftop gardening (Hough, 2002; Kneafsey *et al.*, 2008). Urban agriculture is often taken as an opportunity to improve nutrition and food security in urban areas (UNDP, 1996). Simply, rooftop farming is the praxis of growing food on the rooftop of buildings. This helps to bring nature closer to humans. It facilitates a diverse group of people that seeks farming not only as a source of food availability but also as a means to improve existing social problems such as unemployment. It is believed that around 200 million urban people provide food for the market and 800 million urban people are engaged in urban agriculture in one way or another (UNDP, 1996; FAO, 2001).

Plants help in stimulating environmental awareness through human interaction, which is possible only when the process is visible (Hough, 2002). Urban farming connects urban people to the soil, plants and animals, and helps to create a more pleasant physical environment, that is visible (Hall, 1996). It teaches city people to love nature (Lawson, 2005) and integrate knowledge, skills and commitment toward environmental protection and balance development with conservation (Hall, 1996). The focus on rooftop gardening also decreased the urban waste as kitchen waste is mainly degradable and is used as compost and unrecycled plastic waste can be used as a planting material for short span of time. The main objective of the study is to assess urban rooftop farming from an economic point of view; our study on this topic is for recording people's attitude toward rooftop gardening in Dhulikhel area.

2. Methodology

2.1 Study area

Dhulikhel, headquarter of Kavrepalanchok is a hilly district that falls in province no. 3 (Bagmati state) of country Nepal touching Tatopani Naka (Sindhupalchok), a Tibetan border. For our study, we selected ward no. 7 of Dhulikhel municipality randomly as the rate of urbanization is in height and also to access people's responses regarding usage of least available resources. The local government has also given training to local people about rooftop farming. Those who were trained, they are doing accordingly and growing food on their roof. Although most of the people are busy in their business, the roof of their buildings is packed with green vegetables, ornamental flowers and other plants (Table 1).

2.2 Research design and data collection

A random sampling survey was conducted using replacing techniques as the respondents without a concrete roof in the house were not selected for the interview. Also, a key informant survey was conducted to access the response regarding the management of the

Table 1.
Features of the study
area

Features	Description	References
Ecological zone	Mid hills	Climate data (2012)
Area	54.62 km ²	Wikipedia (2020)
Altitude	1,550 masl	Climate data (2012)
Average temperature	16.7°C	Climate data (2012)
Precipitation (rainfall)	1,711 mm	Wikipedia (2020)
Population	33,981	CBS (2015)
Average family size	4.5	CBS (2015)
Literacy rate	75.26%	CBS (2015)

rooftop garden. Survey was conducted during 23rd of February to 12th of March. Most of the respondents were aware of the rooftop garden but not all were practicing. Thus questionnaire was prepared in a way which suits both the rooftop practitioner and non-rooftop practitioner. Data collection includes face-to-face interview as it is more transparent than any other survey.

2.3 Statistical analysis

Descriptive and inferential statistics (chi-square) analysis was done using IBM Statistical Package for Social Sciences (SPSS v.20). Calculations include frequency, mean, standard error and chi-square test. Microsoft Excel 2013 was used for data entry and preparation of graphs and charts.

3. Result and discussion

3.1 Socio-economic characteristics

A total of 51 respondents were reported where most of the respondents were females (54.9%) and males (45.1%). Among the respondents, Newars (76.5%) were found to be more than other ethnic groups followed by Brahmin (7.8%), Chhetri (7.8%), Janajatis (5.9) and Dalit (2%). Survey finding shows that most of the respondents had secondary to higher secondary education followed by primary education (Table 2). The finding shows that more males were found to be head of the family and to make a decision in the family concerning females because Nepal has patriarchy social system (Tavva and Martini, 2014). The majority of respondents were businessmen followed by farming. The finding shows that land ownership was reported higher in males (51%). The details of socio-economic characteristics are presented in Table 2 and the chi-square association of gender and caste with other components is as shown in Figure 1. According to CBS (2015), literacy rate of Dhulikhel was 75.7%, but in our findings all of the respondents are literate. The main reason for the literacy rate to be 100% is the study area being on a small frame and also the time gap of research on population census is about 5 years. The average family size of 4.39 was reported in the study area which is similar to the findings of CBS (2015) of family size 4.5.

3.2 People's response toward rooftop farming

Among the respondents, 74.5% of them have rooftop farms while 25.5% does not have rooftop farms. All the respondents give a positive response to the benefit of rooftop farming i.e. 100%. Most of the knowledge obtained by the respondents was from television (76.5%) followed by television and internet (16%) and internet (7.5%). The present finding on accessing information was similar to the findings of Kharel (2018) as 90.2% of respondents of valley area used television for gathering information.

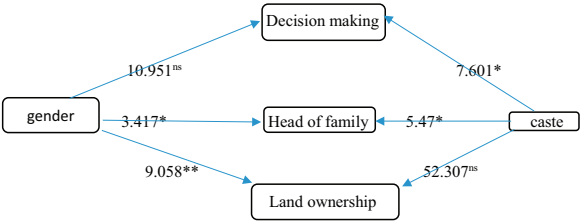
3.3 Constraint of rooftop farming

During the survey, 25.5% of the respondents did not have rooftop farming though they have access to it. Thereof, the need to know for not establishing rooftop gardens and the constraints associated with them was of utmost importance. Majority of the respondents were unable to start rooftop farming because of lack of space and knowledge (27.4%), because of lack of technical knowledge (33.3%), no time to maintain the garden (7.8%), damaged roof (17.7%), damaged roof and lack of knowledge (2%) and damaged roof and no time to maintain the garden (11.8%). A cross-tabulation result from rooftop farmers and non-rooftop farmers' response is as shown in Figure 2. Constraint regarding rooftop gardening has been reported by Kumar *et al.* (2019) in Pokhara but the findings of

Table 2.
Socio-economic
characteristics of the
study area

<i>Gender (%)</i>		
Male		45.1
Female		54.9
<i>Ethnicity (%)</i>		
Newar		76.5
Brahmin		7.8
Chhetri		7.8
Janajati		5.9
Dalit		2
<i>Education (%)</i>		
Primary		23.5
Secondary		56.9
University		19.6
<i>Age groups (%)</i>		
Below 25		19.6
25-35		29.41
36-50		41.17
51-51+		9.8
<i>Family head (%)</i>		
Male		74.5
Female		25.5
<i>Land ownership (%)</i>		
Male		51
Female		49
<i>Occupation (%)</i>		
Farming		15.7
Business		52.9
Service		13.7
Teacher		6
Other		11.7
Average family size (mn ± SE)		4.39 ± 0.283
Source: Field survey		

Figure 1.
The chi-square
association of gender
and caste concerning
the decision-making,
head of the family
and land ownership



Notes: *Standardized coefficient (alpha) is significant at the 0.05 level; **standardized coefficient (alpha) is significant at the 0.01 level; Ns = non-significant

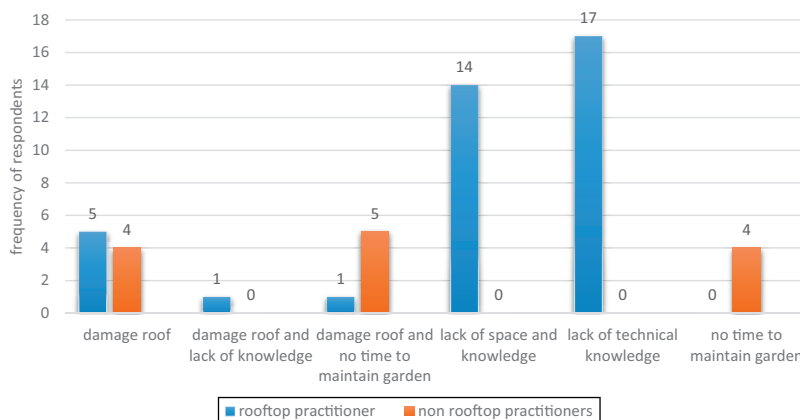


Figure 2.
Constraints of rooftop
farming

obstacles between practitioners and non-practitioners are quite different, though identical type of constraint has been reported in the study. The challenges of rooftop farming are also common in developed countries such as USA and Canada as a proper policy and legal framework has not been implemented (Sanyé-Mengual, 2015). For the commencement of rooftop gardening as urban farming, lack of technical knowledge (Specht and Sanyé-Mengual, 2017) is one of the serious problems because of which most of the respondents do practice rooftop gardening but cannot maintain it and some of them want to start rooftop gardening but are unaware about the initial procedure (Walters and Midden, 2018).

3.4 Planting material and plant diversity in the study area

Most of the respondents used poly bags, waste bags, cans, bottles and fish crates as planting material for the rooftop followed by respondents having no idea about the planting materials. The details of the use of planting materials in the study area have been presented in Figure 3. In rooftop farming, according to the survey, respondents grow most of the vegetables (62%), followed by medicinal plants (21%), ornamentals (10%) and spices (7%). The diversity of all plants was found to be grown by respondents in the study area. However, fruit trees were found lacking. The reason for not planting a fruit tree is because of

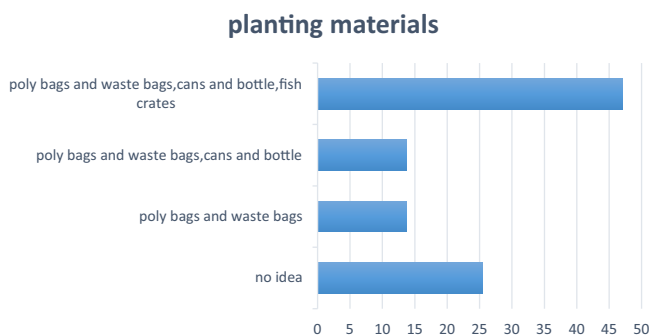


Figure 3.
Planting materials
used for rooftop
farming

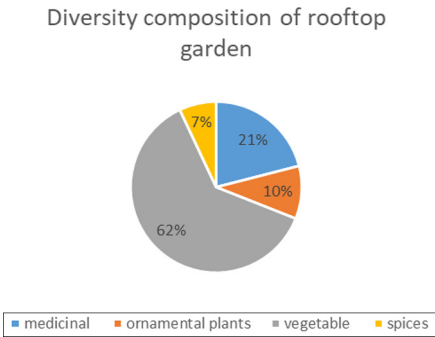
its heavyweight and is not friendly to the roof situation of most of the houses. The diversity combination of plants reported in the study area has been entailed in [Figure 4](#). Lack of planting materials and true varieties is a serious problem in rooftop gardening ([Kumar et al., 2019](#)). Thus the availability of planting materials and true varieties of plants should be distributed as gardening encompasses low areas so a high yield should be gained from it. Planting materials such as plastic pipes, recycled pallets filled with compost, polystyrene panels and floating tanks are used for growing lettuce, black cabbage, chicory, tomato, aubergine, chili pepper, melon and watermelon in rooftop gardens in Bologna, Italy ([Sanyé-Mengual et al., 2015](#)). Despite modern management of rooftop farms in hydroponics, our study has found that people used household materials such as plastic bags, cans and bottles ([Buehler and Junge, 2016](#)). As rooftop farming is being maintained by people in an urban area who have maintained their home gardens earlier due to which plant composition is similar to that of home gardens. A similar type of composition in a home garden has also been reported by [Khanal et al. \(2019\)](#).

3.5 Impact of rooftop gardening on the environment

As the study area is one of the urban areas of Kavre district and also the headquarters, so the mobility of people and transportation is high. There might be some environmental disorders reported, so the respondents were interviewed regarding their views of the aid of rooftop farming on the environment. Most of the respondents were unfamiliar with carbon sequestration by plants. However, their response regarding impact was limited to gaining organic and fresh vegetables and required nutritional elements from the garden. Also, they believe that rooftop farming is helpful in climate change as it has increased the plant density in the study area. Though, they were unaware of the aid of rooftop gardening in carbon sequestration, they do have a positive response regarding the aid of rooftop farming in climate change. Among the surveyed interviewers, 31.37% of the interviewers got information about the aid of rooftop farming on climate changes through television, 29.41% through the internet and 39.21% by newspapers and public discussion. The role of a rooftop garden in carbon sequestration has been explained by [Safayet et al. \(2017\)](#), [Grard et al. \(2018\)](#) and [Kumar et al. \(2019\)](#).

In today's context, rooftop farming is gaining importance mostly in urban areas for paving green environment and supporting the climate change and reducing rain water runoff. The cooling effect of rooftop garden has multiple benefits from nutritional supply to healthy living. A study in Tokyo revealed that temperature was reduced by 0.11-0.84 C if half of the roof was covered by garden ([Yuen and Hien, 2005](#)). Thus rooftop farming is not only beneficial from nutritional point of view but also from way of living.

Figure 4.
Diversity
composition of
species observed in
the study



4. Conclusion

Rooftop gardening is regarded as a part of urban farming with potential to solve food security problems. In the study area, all of the respondents found rooftop farming beneficial though some obstacles are hindering the respondents to commence rooftop farming. Television was found to be the main source of people's knowledge of rooftop gardening. Urban waste such as plastic bags, polythene sheets, fish carats, bottles, cans and jars were found to be used for planting and household vegetable waste was used as compost. Constraints of rooftop farming were encountered in the study area. People's perception regarding damage of roof, lack of knowledge and busy in their daily schedule was reported, thus necessary plans have to be adopted to encourage people for rooftop gardening.

Urban farming possesses a good environmental impact because of carbon sequestration and also acts as a coolant for houses because a portion of the roof is covered by soil and plants. However, regarding rooftop farming, necessary plans and policies should be formulated by the government as much of the respondents do have rooftop farms but good agricultural practices are lacking. And also the low-quality planting material is a great threat to rooftop farming in the study area.

References

- Buehler, D. and Junge, R. (2016), "Global trends and current status of commercial urban rooftop farming", *Sustainability (Sustainability)*, Vol. 8 No. 11, doi: [10.3390/su8111108](https://doi.org/10.3390/su8111108).
- CBS (2015), "Population census in Nepal", *Ministry of Population and Environment*, Vol. 111 No. 3, pp. 51-57.
- Climate data (2012), "Dhulikhel climate: average temperature, weather by month", Dhulikhel weather averages – Climate-Data.org. available at: <https://en.climate-data.org/asia/nepal/central-development-region/dhulikhel-717780/> (accessed 2 April 2020).
- FAO (2001), "A briefing guide for the successful implementation of urban and peri-urban agriculture in developing countries and countries of transition introduction and acknowledgements", Available at: <http://internal.fao.org> (accessed 2 April 2020).
- Grard, B.J.P., Chenu, C., Manouchehri, N., Houot, S., Frascaria-Lacoste, N. and Aubry, C. (2018), "Rooftop farming on urban waste provides many ecosystem services", *Agronomy for Sustainable Development*, Vol. 38 No. 1, doi: [10.1007/s13593-017-0474-2](https://doi.org/10.1007/s13593-017-0474-2).
- Hall, D.J. (1996), *Community Gardens as an Urban Planning Issue*, The University Of British Columbia, Vancouver, [10.14288/1.0087131](https://doi.org/10.14288/1.0087131).
- Hough, M. (2002), "Cities and natural process".
- Khanal, S., Khanal, D. and Kunwar, B. (2019), "Assessing the structure and factors affecting agrobiodiversity of home garden at Katahari rural municipality, province 1, Nepal", *Journal of Agriculture and Environment*, Vol. 20, pp. 129-143, doi: [10.3126/aej.v20i0.25039](https://doi.org/10.3126/aej.v20i0.25039).
- Kharel, S. (2018), "Information and communication technology for the rural development in Nepal", *Tribhuvan University Journal*, Vol. 32 No. 2, pp. 177-190, doi: [10.3126/tuj.v32i2.24714](https://doi.org/10.3126/tuj.v32i2.24714).
- Kneafsey, M., Cox, R., Holloway, L., Dowler, E., Venn, L. and Tuomainen, H. (2008), *"Reconnecting consumers, producers and food: exploring alternatives"*, Berg.
- Kumar, J.R., Natasha, B., Suraj, K., Kumar, S.A. and Manahar, K. (2019), "Rooftop farming: an alternative to conventional farming for urban sustainability", *Malaysian Journal of Sustainable Agriculture*, Vol. 3 No. 1, pp. 39-43, doi: [10.26480/mjsa.01.2019.39.43](https://doi.org/10.26480/mjsa.01.2019.39.43).
- Lawson, L.J. (2005), *City Bountiful: A Century of Community Gardening in America*, University of CA Press, CA.

- Safayet, M., Arefin, M.F. and Hasan, M.M.U. (2017), "Present practice and future prospect of rooftop farming in Dhaka city: a step towards urban sustainability", *Journal of Urban Management*, Vol. 6 No. 2, pp. 56-65, doi: [10.1016/j.jum.2017.12.001](https://doi.org/10.1016/j.jum.2017.12.001).
- Sanyé-Mengual, E. (2015), "Sustainability assessment of urban rooftop farming using an interdisciplinary approach", Doctoral thesis, September, p. 325. doi: [10.1007/s13398-014-0173-7.2](https://doi.org/10.1007/s13398-014-0173-7.2).
- Sanyé-Mengual, E., Orsini, F., Oliver-Solà, J., Rieradevall, J., Montero, J.L., Gianquinto, G. (2015), "Techniques and crops for efficient rooftop gardens in Bologna, Italy", *Agron Sustain Dev.*, Vol. 35 No. 4, pp. 1477-88, doi: [10.1007/s13593-015-0331-0](https://doi.org/10.1007/s13593-015-0331-0).
- Specht, K. and Sanyé-Mengual, E. (2017), "Risks in urban rooftop agriculture: assessing stakeholders' perceptions to ensure efficient policymaking", *Environmental Science and Policy*, Vol. 69, pp. 13-21, doi: [10.1016/j.envsci.2016.12.001](https://doi.org/10.1016/j.envsci.2016.12.001).
- Tavva, S. and Martini, M. (2014), "Indian journal of gender studies", February 2013. doi: [10.1177/0971521512465939](https://doi.org/10.1177/0971521512465939).
- UNDP (1996), "URBAN AGRICULTURE food, jobs and sustainable cities", United Nations Development Programme.
- Walters, S.A. and Midden, K.S. (2018), "Sustainability of urban agriculture: vegetable production on green roofs", *Agriculture (Agriculture)*, Vol. 8 No. 11, pp. 1–16, doi: [10.3390/agriculture8110168](https://doi.org/10.3390/agriculture8110168).
- Wikipedia (2020) "Dhulikhel – Wikipedia", Available at: <https://en.wikipedia.org/wiki/Dhulikhel> (accessed 2 April 2020).
- Yuen, B. and Hien, W.N. (2005), "Resident perceptions and expectations of rooftop gardens in Singapore", *Landscape and Urban Planning*, Vol. 73 No. 4, pp. 263-276, doi: [10.1016/j.landurbplan.2004.08.001](https://doi.org/10.1016/j.landurbplan.2004.08.001).

Corresponding author

Sandesh Thapa can be contacted at: sand.thapa.2056@gmail.com

For instructions on how to order reprints of this article, please visit our website:

www.emeraldgroupublishing.com/licensing/reprints.htm

Or contact us for further details: permissions@emeraldinsight.com