Characterizing the agroecological transition levels of regenerative, organic and conventional farming of Kathmandu Valley

Prashanta Raut[1*], Santosh Shrestha[1], Monika Thapa[1], Alina Poudel[2], Pragati Dahal[3] and Rojina Gauchan[2]

[1]Agricultural Technology Center Pvt. Ltd., Lalitpur, Nepal
[2]Himalayan College of Agricultural Sciences and Technology (HICAST), Purbanchal University, Kathmandu, Nepal
[3]University of Idaho, Moscow
*Corresponding author: rautprasant@gmail.com

Abstract

Agriculture policies addressing organic farming are disproportionately centered towards promoting organic farming as enterprises that produce exportable, high value product that can fetch premium price. This is often reflected in the perception of people, who regard organic farming as means to earn dollars, rather than an approach that ensures the sustainability of our farming system. This has resulted in the deviation of organic farming from its original philosophical grounds and the underlying intuition of environmental conservation. Emerging concepts of agroecology seek to address this challenge by promoting organic farming as a science, practice and movement that incorporates economic, social as well as the environmental dimensions of agriculture. Farming systems are slowly starting to transform in Nepal, in the recent times, resulting in the adoption of various alternative practices, systems and approaches of farming. In absence of proper tools to assess the phases and pathways of transition, it was difficult to assess the sustainability of farming system in the past. However, criteria and tools for measuring the transition are being developed in the past few years, allowing practitioners of organic farming to gauge their agroecological performance and make informed decision regarding selection of the right pathways for transition.

A study was conducted in the suburbs of Kathmandu Valley (Kathmandu, Lalitpur and Bhaktapur districts) of Bagmati Province, Nepal. Out of 217 screened vegetable farms, for our preliminary study, 30 farms were selected proportionally from each district using stratified random sampling. Questionnaire was designed to collect necessary information on the agroecological characteristics of farms. The level of transition of the production systems was assessed using the 10 elements of agroecology. The ten elements are broken down into 34 indices with descriptive scales and five levels of transition represented by scores from 0 to 4. The final scores are then converted into a transition percentage for each element. The CAET aggregated score (agroecological transition level) is the average of all ten elements.

Our results show that farms of Kathmandu Valley collectively, performed below average in terms of agroecological transition with average scores for most of the elements below 50%. Conventional farms scored below 50% in all 10 elements. Organic and Regenerative farms performed better than Conventional farms in all 10 elements. However more pronounced difference was observed in terms of diversity, responsible governance, circular solidarity economy, recycling; and culture and food traditions. Organic farms surpassed Regenerative farms in all other elements except responsible governance. The only element in which Regenerative farms performed better than Organic farms was 'Responsible Governance'. The results were useful in identifying the bottlenecks in agroecological transition pathways and figure out the areas that need improvements and transformation and evaluation of agriculture projects and interventions at local level.

Introduction

Organic farming is the system of crop and livestock production without using chemical pesticides, fertilizers, antibiotics, Plant growth regulators (PGRs) and Genetically modified organism (GMOs) (Seufert et al., 2017; Puech et al., 2014; USDA, 1980). However, the concept of organic farming is much broader and majorly emphasizes on environmental protection, animal welfare, food quality and health along with sustainable use of resources during production of crops and livestock (Stolze & Lampkin, 2009).

In response to the complex challenges facing the agriculture sector of the country, farming systems are slowly starting to transform in Nepal, in the recent times, resulting in the adoption of various alternative practices, systems and approaches of farming. The farming system in the suburbs of Kathmandu Valley, for instance, is characterized by various categories of farms at various levels of agroecological transition. In absence of proper tools to assess the phases and pathways of transition, it was difficult to assess the sustainability of farming system in the past. However, criteria and tools for measuring the transition are being developed in the past few years, allowing practitioners of organic farming to gauge their agroecological performance and make informed decision regarding selection of the right pathways for transition.

Tool for Agroecological Performance Evaluation (TAPE) is one such tool developed by FAO in 2019. TAPE can be used for the characterization of agroecological transition of the farms based on the 10 elements of agroecology (FAO, 2018). The analytical framework attempts to provide a diagnostic of agricultural performance across multiple aspects in order to move beyond typical productivity measurements (e.g., yield/ha) and better depict the advantages and tradeoffs of various agricultural systems (FAO, 2019). In this study TAPE was used as a tool to characterize the agroecological transition of the farming systems in Kathmandu Valley. For the purpose of our study, we define production oriented farms with extensive use of chemical fertilizer and pesticides as 'Conventional Farms'; farms adopting principles of soil conservation and judicious use of chemical inputs as 'Regenerative farms' and those using no chemical inputs as 'Organic farms'.

Materials and Methods

Study Site

Our study site included the suburbs of Kathmandu Valley (Kathmandu, Lalitpur and Bhaktapur districts) of Bagmati Province, Nepal.

Sampling Technique and sample size

Out of 217 (AKC, 2021). screened vegetable farms, for our preliminary study, 30 farms were selected proportionally from each district using stratified random sampling. Out of the 30 farms, 12 were located in Kathmandu district, 9 each in Lalitpur and Bhaktapur districts.

Data collection

Step 1 of TAPE(FAO, 2019), Characterization of the Agroecological Transition (CAET), assesses the level of transition of the production systems using the 10 elements of agroecology(FAO, 2018b). The ten elements are broken down into 34 indices with descriptive scales and five levels of transition represented by scores from 0 to 4. The final scores are then converted into a transition percentage for each element. The CAET aggregated score (agroecological transition level) is the average of all ten elements.

Data analysis

Data were imported on Microsoft excel and the score of each indices were summed and the total was then standardized to scale of 0-100% which represent the total score of the given element of agroecology as prescribed in TAPE. Likewise, score was calculated for all 10 elements for given three types of transition (i.e., conventional, regenerative and organic).

Results and Discussions

Characterization of Agroecological Transition in Kathmandu Valley

Our results show that farms of Kathmandu Valley collectively, performed below average in terms of agroecological transition with average scores for most of the elements below 50%. Average score for the elements "Efficiency" and "Co-creation and Sharing of Knowledge" were maximum at 52.3% and 50.0% respectively. Except these two elements, the surveyed farms scored below 50 in other 8 elements. The average score for element "Synergies" was lowest at 23.8%.

Farmers spend a huge portion of their expenses on expensive inputs like: hybrid seeds, fertilizers, pesticides and plant growth regulators. The consumption of chemical fertilizer has rapidly increased after the reintroduction of chemical fertilizer subsidy program by Government of Nepal (GoN) in 2008/2009 (Pandey et al., 2017). The country also witnesses an increasing usage of chemical pesticides. Reportedly, 25% of Terai area, 9% of mid-hill area, and 7% of mountain area in Nepal use chemical pesticides for farming, and their use is increasing (Nyaupane, 2021). Such pesticides application are reported to be higher than the threshold in vegetables and commercial crops. Further, due to irregular supply of these inputs, farmers often suffer from shortages during the critical periods and sometimes are forced to pay higher price. All these factors contribute to the vulnerability of the farming systems and exposure to the market risks, which also justifies the lower score on 'Resilience' we obtained for our farms in this study.

Agroecological Performances of Organic, Regenerative and Conventional farms

When the scores were analyzed after segregating the farms into conventional, regenerative and organic; it was observed that Organic farms scored above 50% in 7 out of 10 elements. Scores were lowest for the elements "Synergies" and "Recycling" both at 37.5% for Organic farms. Organic farms performed best in terms of "Efficiency" by scoring 67.2%, the maximum across all elements. Regenerative farms scored above 50% in 5 elements and below 50% in other 5. However, Conventional farms scored below 50% in all 10 elements.

Organic and Regenerative farms performed better than Conventional farms in all 10 elements. However more pronounced difference was observed in terms of diversity, responsible governance, circular solidarity economy, recycling; and culture and food traditions. Organic farms surpassed Regenerative farms in all other elements except responsible governance. The only element in which Regenerative farms performed better than Organic farms was Responsible Governance. Results from this study suggest that Organic farms are the most efficient among the three types of farms we considered for this study. Efficiency is defined as the ratio of output to input.

Regenerative farms performed better in 'Responsible governance' compared to other two types of farms. This is one of the most interesting findings of this study. Some Regenerative farms in Kathmandu Valley are small family farms that emerged after the COVID crisis in response to the food safety and security concerns. So, they are rooted in the concepts of self-reliance and resilience. Participation of women is encouraging in such farms and they also have an underlying intuition for conservation of natural resources. It may be crucial for organic farming in future to improve their performance in 'Responsible Governance', so as to move to a higher transition in Agroecology.

Conclusion

In this study, we successfully employed TAPE to characterize the agroecological transition of a suburban farming system in the periphery of Kathmandu Valley. The results were useful in identifying the bottlenecks in agroecological transition pathways and figure out the areas that need improvements and transformation.

It is the responsibility of Federal Government to plan and administer the land use systems of the country, including agriculture. However, as provisioned by the Constitution of Nepal 2072, agriculture development at local level fall under the direct jurisdiction of the local government. This includes formulating policies, legal standards, planning, implementation, monitoring and evaluation of projects and programs related to agriculture and animal husbandry. Municipal Agriculture Planning, at present suffer largely from unscientific planning process due to lack of proper assessment and planning tools. TAPE can serve as a useful scientific tool for formulating sustainable agriculture plans and policies in a participatory way. It can be used to establish baselines, assess community needs, as well as for the design and evaluation of agriculture projects and interventions at local level.

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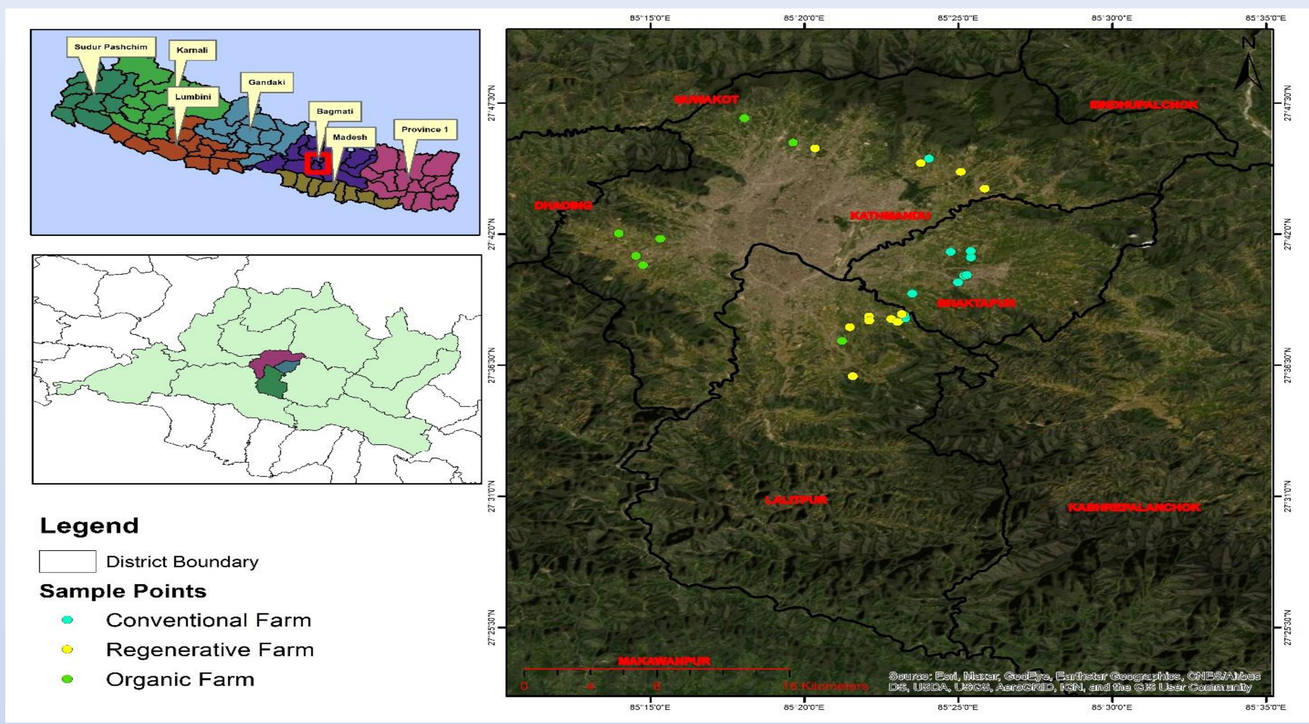

Figure 1Map of the study area with point location of farms

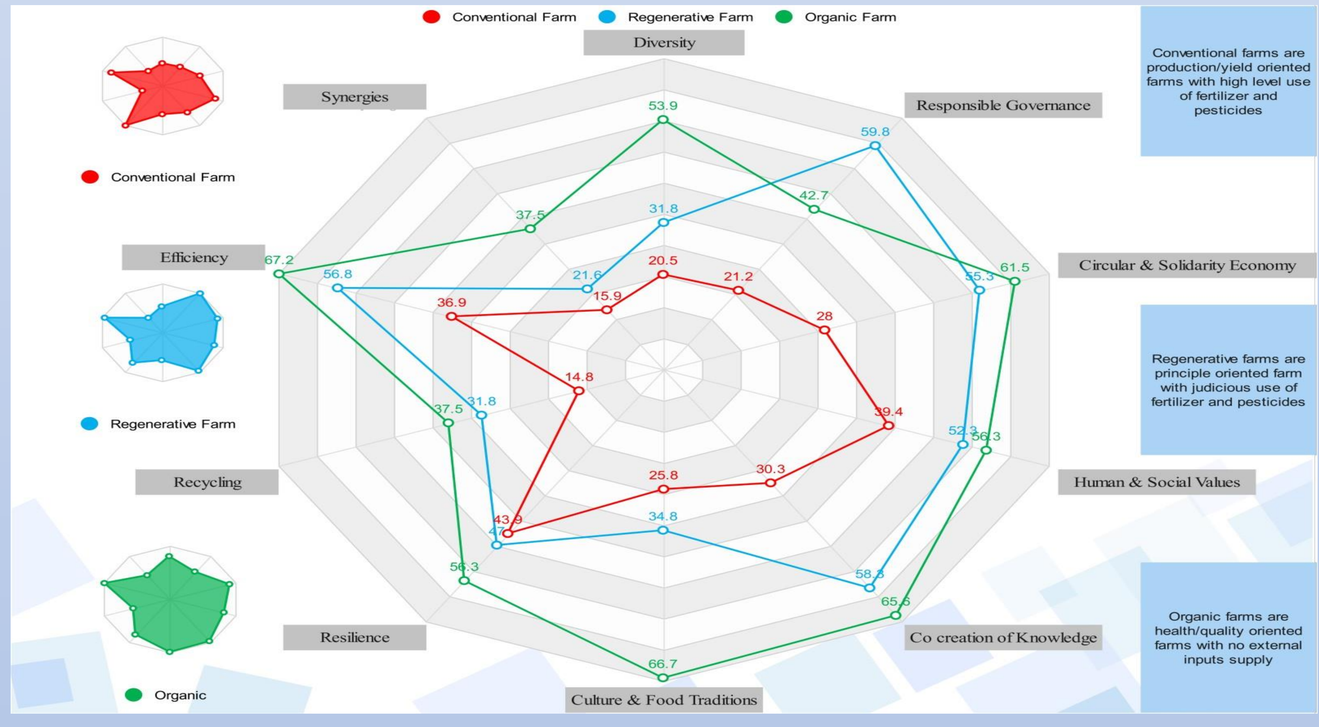

Figure 2:Visualization of CAET performance of three different farms in Kathmandu Valley

Table 1: Descriptive statistics for elements of agroecology as scored by 30 farms

Elements	Minimum	Maximum	Median	Mean	Standard Deviation
Diversity	0.0	100.0	25.0	33.5	25.8
Synergies	0.0	81.3	12.5	23.8	22.2
Efficiency	18.8	93.8	50.0	52.3	18.8
Recycling	6.3	75.0	25.0	27.1	18.0
Resilience	8.3	91.7	50.0	48.3	20.8
Culture & Food Traditions	8.3	91.7	29.2	40.0	22.9
Co-creation and Sharing of Knowledge	8.3	100.0	41.7	50.0	29.1
Human & social Values	16.7	91.7	50.0	48.6	19.6
Circular & Solidarity economy	16.7	91.7	25.0	36.9	19.8
Responsible governance	0.0	100.0	33.3	41.1	27.8
CAET Score	8.3	91.7	34.2	40.2	22.5

Table 2: Percentage Score secured by three agroecological transition in Kathmandu Valley

Elements	Conventional farms	Regenerative farms	Organic farms
Diversity	20.5	31.8	53.9
Synergies	15.9	21.6	37.5
Efficiency	36.9	56.8	67.2
Recycling	14.8	31.8	37.5
Resilience	43.9	47.0	56.3
Culture & Food Traditions	25.8	34.8	66.7
Co creation of Knowledge	30.3	58.3	65.6
Human & social Values	39.4	52.3	56.3
Circular & Solidarity economy	28.0	55.3	61.5
Responsible governance	21.2	59.8	42.7

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