P.ISSN: 0971-8184 II E ISSN: 0976-1926
DOI: https://doi.org/10.56093/ijpgr.v39i1.175906

Indian Journal of Plant Genetic Resources

RESEARCH ARTICLE

Economic, Social, and Cultural Factors Influencing On-farm Mango (*Mangifera indica*) Diversity Conservation in Uttar Pradesh

Pranav Kumar Mishra[1#], Shailendra Rajan[1]*, Kumar Aditya[1], Parul Sagar[1] and Vaibhav Srivastava[1]

Abstract

This study examines the conservation practices employed by mango custodian farmers in Uttar Pradesh, specifically targeting those who cultivate a minimum of ten mango varieties in their orchards. Data were collected on various motivational factors (personal, social, economic, cultural, environmental and policy) influencing on-farm mango diversity conservation from 101 mango farmers in 23 districts of India. Results indicated that economic and personal incentives were the most driving factors for the farmers to conserve and maintain mango diversity. This research underscores the essential contribution of custodian farmers to the conservation of mango diversity and the necessity for supportive policies that acknowledge farmers' roles in these conservation initiatives. Comprehending these motivational factors enables stakeholders to formulate effective strategies for improving on-farm biodiversity conservation in mango cultivation regions of Uttar Pradesh.

Keywords: Custodian farmer, Diversity conservation, Mango, Motivational factor

[1]ICAR-Central Institute for Subtropical Horticulture, Lucknow, Uttar Pradesh, 226101, India

[#] Currently at Shri Ramswaroop Memorial University, Barabanki, Uttar Pradesh, 225003, India

***Author for correspondence:**
srajanlko@gmail.com

Received: May 17, 2025

Revised: November 19, 2025

Accepted: December 14, 2025

How to cite this article: Mishra PK, S Rajan, K Aditya, P Sagar and V Srivastava (2026) Economic, Social, and Cultural Factors Influencing On-farm Mango (*Mangifera indica*) Diversity Conservation in Uttar Pradesh. *Indian J. Plant Genet. Resour*. 39(1): 62-71.

DOI: https://doi.org/10.56093/ijpgr.v39i1.175906

Introduction

Mango (*Mangifera indica* L.) is a paramount fruit crop in India, holding substantial cultural and economic importance. Uttar Pradesh, especially areas such as Malihabad, is distinguished for its vast mango orchards, which significantly bolster the state's agricultural economy (Yadav and Rajan, 1993; Rajan *et al.*, 2011; 2024). The preservation of traditional mango varieties encounters escalating challenges due to urbanization, alterations in cropping patterns, and economic factors. The motivation of farmers to preserve these varieties is shaped by a complex interaction of economic, social, cultural, environmental, and policy-related factors (Mal *et al.*, 2010; Gajanana *et al.*, 2015). Custodian farmers are essential for the conservation and propagation of traditional agricultural varieties on farms, greatly influencing biodiversity and sustainable agriculture. In Uttar Pradesh, especially in its varied mango cultivation areas, these farmers act as custodians of the state's abundant mango heritage, diligently preserving multiple indigenous mango varieties (Rajan *et al.*, 2013; 2015). Custodian farmers engage in more than simple cultivation; they employ Indigenous Technical Knowledge (ITK) to preserve and augment the genetic diversity of mango species, demonstrating a profound connection to their agricultural

© IJPGR, 2025. Open Access This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit https://creativecommons.org/licenses/by-nc-sa/4.0/.

practices and local ecosystems (Sthapit *et al.*, 2013; Rajan *et al.*, 2024).

A thorough survey conducted in 23 districts rich in mango diversity in Uttar Pradesh highlighted the significant contributions of 101 custodian farmers who collectively preserve various mango types, illustrating the district-specific differences in cultivation practices and fruit attributes (Rajan *et al.*, 2024). The motivations of these farmers include self-interest, social prestige, and the desire to conserve unique varieties, as emphasized by Dinesh *et al.,* (2015), which highlights the influence of personal and cultural ties on agricultural practices.

Malihabad region of UP upholds a strong tradition of mango conservation, owing to traditional agricultural practices, the proficiency of nursery experts, community engagement, and economic viability. Heritage orchards have been maintained, nursery specialists have been involved to conserve genetic diversity, and participatory rural appraisal tools have also been employed to enhance mango diversity in the region. In addition, the cooperation of the community with agri-experts leads to new conservation plans that combine scientific technology and traditional wisdom (Ram and Rajan, 2003; Rajan *et al.*, 2015).

Materials and Methods

Study Area

This study was conducted across major mango-growing regions in 23 districts of Uttar Pradesh, India (Table 1). These districts were chosen for their significance in mango diversity and production, which represent a variety of agro-climatic conditions conducive to mango cultivation. Surveys were executed in principal mango-producing regions within these districts to evaluate the conservation of on-farm mango diversity and to comprehend the factors incentivizing farmers to serve as custodians of traditional mango varieties

Data Collection Framework

The data collection process aimed to identify the motivations influencing farmers' decisions to maintain mango diversity, employing six key dimensions based on the framework developed by Padulosi (2011). The examined drivers are listed in Table 1. The dimensions included personal drivers, encompassing intrinsic motivations such as a passion for mango cultivation, hobby farming, familial preferences, and an awareness of the significance of conserving diversity for future generations. Social drivers encompassed community-oriented motivations, such as the aspiration to safeguard local agricultural heritage, disseminate planting materials among friends and relatives, and sustain a diverse mango collection. The economic drivers emphasized the significance of diversity in enhancing economic resilience, offering a variety of marketable alternatives, and alleviating risks associated with fluctuating yields or prices. Cultural factors demonstrated the acknowledgement of the relationship between agricultural biodiversity and cultural identity, traditions, and customs. Environmental factors highlighted the significance of biodiversity in enhancing ecosystem services, advancing soil and plant health, and fostering sustainable agricultural practices. Finally, policy-related factors examined the impact of governmental policies, programs, or institutional support systems that promote *in-situ* conservation of agrobiodiversity. The data collection process sought to ascertain the motivations affecting farmers' choices to preserve mango diversity, utilizing six principal dimensions derived from the framework established by Padulosi (2011) and adapted from Rajan *et al.,* (2024). The drivers studied are mentioned in Table 1. These dimensions included personal drivers, which encompassed intrinsic motivations such as a passion for mango cultivation, hobby farming, family preferences, and an awareness of the importance of preserving diversity for future generations. Social drivers included community-

Table 1: Selected districts, mango-growing areas, and custodian farmers involved in mango diversity conservation

S.N.	District	Blocks/areas	Custodian farmer
1.	Aligarh	Billona (Billona Chitrasi)	Asif Khan, Mehandi Hasan
2.	Amethi	Thauri	Anant Bahadur Singh
3.	Amroha	Sihali Jagir (Block -Gajraula), Salempur (Hemnagar), Keshavpur, Sekhupura Jhakari	Sabahat Ali Khan, Wazahat Ali Khan, Mohammad Suleman, Bijay Kumar Yadav, Santosh Kumar
4.	Bagpat	Rataul	Junaid Faridi, Sahabuddin Ahamad Siddiqui, Abdul Kalam

5.	Balrampur	Chirraiya, Phulveria Birahimpur	Sadhu Ram Maurya, Rajeshwar Pratap Singh
6.	Bulandsahr	Alipur (Pahanshu), Bharkaow (Block- Unchagaon, Tehsil- Siyana), Bhoranshi (Nawab Chhatari, Block- Pahanshu), Patti Hazari (Siyana), Siyana	Firoz Mohammad Khan, Hazi Jameel, Narendra Kumar Tyagi, Anil Tyagi, Abhay Narayan Singh
7.	Faizabad	Sariyawa, Masodha	Tej Bahadur Singh
8.	Gonda	Pure Chain Kunwar, Sahjanwa-Rupaideeh	Anil Chandra Pandey
9.	Jaunpur	Mai (Buxa), Barauli (Badlapur), Kuddupur, Purew	Shashikant Yadav, Triveni Singh, Dinesh Singh
10.	Kannauj	Gadanpur Baddu	Ashwini Kumar Pathak, Om Prakash Tiwari
11.	Kasganj	Mahawar, Dehari, Nagla Amber (Inayati), Lodhipur	Brajendra Singh, Ganga Singh, Ram Naresh Yadav, Hem Singh
12.	Lakhimpur Khiri	Hindustan Farm	Nirmal Singh
13.	Lucknow	Gopramau, Sarsanda, Kasmandi Kalan, Mohammed Nagar Talukedari, Nabipanah, Nadan Mahal Road, Malihabad, Narauna, Tiwari Kheda, Naubasta, Mall, Gosaiganj, Godwa, Para Bandrahi	Kamla Devi, Mahadin, Moin Ashraf, Monish Ahemad, Muneshwar, Narendra Shukla, Ram Asre Sharma, Sunil Kumar, Parmeshar Sharma, Ram Swaroop, Vidyawati, Ram Naresh, Ajajul Hasan, Mahesh Kumar, Ram Kishor, Chhote Lal Kashyap, Maiku Lal, Nawab Hasan, Upendra Kumar Singh, Abdul Samad, Sadab Ali, S. C. Shukla, Haji Kalimullah Khan, Durga Prashad, Iqbal Ahmad, Kuldeep Kumar, Mandhvendra Deo Singh, Md Iliyas, Ram Pal Maurya, Sanjay Singh, Shiv Kumar Dwivedi, Utkarsh Singh Chauhan, Ajeet Shukla
14.	Mau	Galib Pur, Muhammadabad Gohna	Abdul Salam Khan
15.	Meerut	Kithore	Mustafa, Ragib Ali, Mumtaz Ali, Sarafat Ali
16.	Muzaffarnagar	Pinna, Purkazi	Shiv Narayan, tariq Mushtafa
17.	Saharanpur	Behat, Kheda Afgan, Nandi Firojpur,Toli, Kashipur	Ajai Jain, Amir Khan, Azam Khan, Khairati Lal, Seth Pal Singh, Satya Kumar, Ramvir Singh Chauhan, Tafzeel Ahmad
18.	Sant Kabir Nagar	Harraiya	Akhand Pratap
19.	Shamli	Babri, Gazipur	Shri Somansh Prakash, Raghav Swaroop, Ali Mia
20.	Shravasti	Labedpur	Pankaj Deo Singh
21.	Siddharthanagar	Dhanghata	Ram Swarth Mishra
22.	Sitapur	Achra Mau, Barsandhiya, Nighuwa Mau, Rehamabad, Dharwa Garhi, Revankala Garhi, Kala Bagahiya, Kesharipur Kothar, Sita Rasoi- Sidhauli, Indrauli Maholi Block, Ambarpur Biswan, Biswa	Mohd. Ayaz, Sankar Bakhs Singh, Awadhesh Birbal, Mohd. Farid Khan, Mohd. Rafik, Vishal Singh, Dr Yash Pal Singh, Deepak Yadav, Indu Shukla, Bhanu Pratap Singh, Naresh Pal Singh, Md. Haneef, Md. Tafzeel
23.	Varanasi	Chiraigaon, Barbaspur, Barai-Umaraha, Sultanpur, Pilkhini, Kibli Bhtsar	Aditya Narayan Maurya, Kaushal Kumar Maurya, Subhash Chandra Pandey, Anil Singh, Akhilesh Narayan Singh

Table 2: Motivational factors influencing custodian farmers in the maintenance of diverse mango varieties

S.N.	Custodian farmers	Varieties maintain	Orchard size (ha)	Average orchard age (years)	Motivation	Source of motivation
1.	Asif Khan	13	2.4	22	SELF, SOIN	PSNL, ECON
2.	Mehandi Hasan	39	4.4	30	NEXT, SELF, SOIN	SOCL, PSNL, ECON
3.	Anant Bahadur Singh	11	1	30	SELF, IDMO, ATMA	PSNL
4.	Sabahat Ali Khan	21	15	60	IDMO, ATMA, SELF, SOIN	PSNL, ECON
5.	Wazahat Ali Khan	13	15	30	SELF, SOIN	PSNL, ECON
6.	Mohammad Suleman	22	13.5	40	SELF, ATMA, ANCP	PSNL, ECON, SOCL
7.	Bijay Kumar Yadav	11	0.8	30	SELF, SOIN, ATMA, SOPR	PSNL, ECON, SOCL

8.	Santosh Kumar	12	5	20	SOIN, SELF, ENVN	ECON, PSNL, ENVM
9.	Junaid Faridi	27	12	80	SELF, SOIN	PSNL, ECON
10.	Sahabuddin Ahamad Siddiqui	25	12	100	ANCP, SOPR, SOIN	SOCL, ECON
11.	Abdul Kalam	105	5	60	SELF, ATMA, SOIN	PSNL, ECON
12.	Sadhu Ram Maurya	12	4	50	SOIN, SELF	ECON, PSNL
13.	Rajeshwar Pratap Singh	31	2.5	10	SELF, COLM, SOIN	PSNL, ECON
14.	Firoz Mohammad Khan	17	25	50	ANCP, SELF, SOIN	SOCL, PSNL, ECON
15.	Hazi Jameel	20	22	250	ANCP, FPRO, SOIN	SOCL, PSNL, ECON
16.	Narendra Kumar Tyagi	12	2.8	18	SELF, SOIN	PSNL, ECON
17.	Anil Tyagi	12	38	50	SOIN	ECON
18.	Abhay Narayan Singh	17	103	130	ANCP, SOIN, SOPR	SOCL, ECON
19.	Tej Bahadur Singh	11	12	50	SOIN	ECON
20.	Anil Chandra Pandey	10	0.4	20	SELF, SOIN	PSNL, ECON
21.	Shashikant Yadav	10	3.75	200	ANCP	SOCL
22.	Triveni Singh	11	22.6	35	SOIN, SUSE, DAFR	ECON, PSNL, SOCL
23.	Dinesh Singh	10	1	60	SOIN, SUSE	ECON, PSNL
24.	Ashwini Kumar Pathak	55	23	50	ANCP, SELF, SOIN	SOCL, PSNL, ECON
25.	Om Prakash Tiwari	12	10.5	75	SELF, SOIN	PSNL, ECON
26.	Brajendra Singh	11	2.4	47	SOIN, SELF, SOPR	ECON, PSNL, SOCL
27.	Ganga Singh	13	9	35	SOIN, SELF, SOPR	ECON, PSNL, SOCL
28.	Ram Naresh Yadav	20	2	40	SOIN, SELF, SOPR	ECON, PSNL, SOCL
29.	Hem Singh	13	2.4	50	SOIN, SELF	ECON, PSNL
30.	Nirmal Singh	10	2	16	SELF, SOIN, ATMA, SOPR	PSNL, ECON, SOCL
31.	Kamla Devi	25	2.25	25	SOIN, SUSE, DIVF	ECON, PSNL
32.	Mahadin	38	0.38	30	SOIN, SUSE	ECON, PSNL
33.	Moin Ashraf	25	1.25	35	SOIN	ECON
34.	Monish Ahmad	28	1.5	30	SOIN	ECON
35.	Muneshwar	25	0.75	35	SOIN	ECON
36.	Narendra Shukla	40	2.25	40	SOIN, SUSE, DAFR, SOPR	ECON, PSNL, SOCL
37.	Ram Asre Sharma	25	1	41	SOIN, SUSE	ECON, PSNL
38.	Sunil Kumar	21	0.75	35	SOIN, SUSE, DAFR	PSNL, ECON, SOCL
39.	Parmeshar Sharma	44	1	30	SOIN, AREA, SUSE	ECON, ENVM, PSNL
40.	Ram Swaroop	18	1.5	31	SOIN, SUSE, AREA, ATMA, DAFR	ECON, PSNL, ENVM, SOCL
41.	Vidyawati	15	1.25	25	SOIN	ECON
42.	Ajajul Hasan	12	1.25	65	SOIN, SUSE	ECON, PSNL
43.	Mahesh Kumar	12	0.5	30	SOIN, SUSE	ECON, PSNL
44.	Ram Kishor	10	0.63	42	SOIN, SUSE	ECON, PSNL
45.	Chhote Lal Kashyap	138	2	40	IDMO, SOIN, COLM	PSNL, ECON, SOCL
46.	Maiku Lal	42	3	35	SELF, IDMO, COUV, COLM	PSNL, ECON
47.	Nawab Hasan	51	1.5	75	SOIN, ATMA, ANCP, COUV	SOCL, PSNL, ECON
48.	Upendra Kumar Singh	19	5.5	35	ATMA, COLM, DIVF	PSNL, SOCL
49.	Abdul Samad	18	3.5	60	COLM, ANCP, ATMA, SELF, COLM	PSNL, SOCL
50.	Sadab Ali	50	7.2	25	SELF, SOIN, ATMA, SOPR	PSNL, ECON, SOCL
51.	S. C. Shukla	272	25	30	MGOV, SELF, DIVF	SOCL, PSNL
52.	Haji Kalimullah Khan	53	5.5	100	SELF, ATMA	PSNL
53.	Durga Prashad	11	1.5	50	SELF, SOIN	PSNL, ECON
54.	Iqbal Ahmad	13	2.5	55	SOIN, ANCP, AREA, SELF	ECON, ENVM, PSNL
55.	Kuldeep Kumar	11	1	30	ANCP, SOIN	SOCL, ECON
56.	Mandhvendra Deo Singh	80	20	100	ANCP, AREA, ATMA, SELF, COLM, COUV	SOCL, ENVM, PSNL

57.	Md Iliyas	10	0.25	100	SOIN, SELF	ECON, PSNL
58.	Ram Pal Maurya	11	0.25	30	SELF, SOIN	PSNL, ECON
59.	Sanjay Singh	15	8	40	SELF, SOIN	PSNL, ECON
60.	Shiv Kumar Dwivedi	17	12	30	ANCP, COLM, SOIN	SOCL, PSNL, ECON
61.	Utkarsh Singh Chauhan	14	4	35	SOIN, AREA, SELF	ECON, ENVM, PSNL
62.	Ajeet Shukla	17	12.5	40	SELF, DIVF, COUV, NEXT	PSNL
63.	Abdul Salam Khan	24	1	30	SELF, SOIN, ATMA	PSNL, ECON
64.	Mustafa	19	25	50	ANCP, SOIN	SOCL, ECON
65.	Ragib Ali	11	2	40	SOIN	ECON
66.	Babu Mumtaz Ali	20	42	60	ATMA, ANCP, SOPR	PSNL, SOCL
67.	Sarafat Ali	24	51	45	ANCP, SELF	SOCL, PSNL
68.	Shiv Narayan	18	25	75	SELF, SOIN	PSNL, ECON
69.	Tariq Mustafa	104	29	75	ANCP, SELF, SOIN	SOCL, PSNL, ECON
70.	Ajai Jain	40	154	60	SELF, SOIN	PSNL, ECON
71.	Amir Khan	57	65	80	SELF, SOIN, SUSE, DAFR	PSNL, ECON, SOCL
72.	Azam Khan	36	51	55	SOIN, SELF, SOPR, EXOM	ECON, PSNL, SOCL
73.	Khairati Lal	24	11	60	SELF, SOIN, SOPR	PSNL, ECON, SOCL
74.	Seth Pal Singh	14	2.5	25	SOIN, SELF, DIVF, MRKT	ECON, PSNL
75.	Satya Kumar	16	28	60	SELF, DIVF, COLM, SOIN	PSNL, ECON
76.	Ramvir Singh Chauhan	77	102	40	PLFS	RULE
77.	Tafzeel Ahmad	12	7.5	40	SOIN, AREA, SELF	ECON, ENVM, PSNL
78.	Akhand Pratap	12	16	20	SELF, MGOV	PSNL, SOCL
79.	Somansh Prakash	16	128	60	SELF, AREA	PSNL, ENVM
80.	Raghav Swaroop	16	16	60	SELF, SOIN	PSNL, ECON
81.	Ali Mia	19	64	50	ANCP, SELF, ATMA, SOIN	SOCL, PSNL, ECON
82.	Pankaj Deo Singh	35	14	5	SOIN, SELF, IDMO, COLM, COUV, DIVF	ECON, PSNL
83.	Ram Swarth Mishra	10	0.4	20	SELF, ATMA, SOIN	PSNL, ECON
84.	Mohd. Ayaz	13	0.8	40	SOIN, SUSE	ECON, PSNL
85.	Sankar Bakhs Singh	13	0.6	20	SOIN, SUSE	ECON, PSNL
86.	Awadhesh Birbal	14	3.2	60	SOIN, SUSE, SOPR	ECON, PSNL, SOCL
87.	Mohd. Farid Khan	11	1.21	40	SOIN, SUSE	ECON, PSNL
88.	Mohd. Rafik	12	0.41	18	SOIN, SUSE	ECON, PSNL
89.	Vishal Singh	10	10	40	IDMO, SOIN, SUSE	PSNL, ECON
90.	Dr Yash Pal Singh	15	6	22	SOIN, SUSE, SOPR	ECON, PSNL, SOCL
91.	Deepak Yadav	12	0.8	50	SOIN, SUSE	ECON, PSNL
92.	Indu Shukla	12	1.2	50	SOIN, SUSE	ECON, PSNL
93.	Bhanu Pratap Singh	21	3.2	150	SOIN, SUSE	ECON, PSNL
94.	Naresh Pal Singh	17	4.5	60	SELF, ANCP, COLM	SOCL, PSNL
95.	Md. Haneef	12	4	40	SELF, SOIN	PSNL, ECON
96.	Md. Tafzeel	57	30	50	ANCP, SOIN	SOCL, ECON

97.	Aditya Narayan Maurya	11	1.1	50	SOIN, SUSE, FFTM	ECON, PSNL
98.	Kaushal Kumar Maurya	10	1	60	SOIN, SELF	ECON, PSNL
99.	Subhash Chandra Pandey	10	0.5	100	SOIN, SUSE	ECON, PSNL
100.	Anil Singh	11	4	60	SOIN, SUSE, DAFR	ECON, PSNL, SOCL
101.	Akhilesh Narayan Singh	10	1.2	70	SOIN, SUSE	ECON, PSNL

Motivation = ANCP (as a heritage, ancestral property, conserving as a parental property, old family orchard), AREA (mango growing area), ATMA (attachment and love for mango), COLM (collection of mango varieties, genetically divers varietals collection of trees, interest to develop orchard based on seedlings or some lesser-known varieties, to increase the number of mango varieties in orchard), COUV (conservation for the unique varieties, maintenance of available varieties in the orchard, conserve mango varieties for next generation), DAFR (distribution among friends and relatives), DIVF (motivated by mango diversity fair), ENVN (environmental friendly), EXOM (export), FFTM (wood for cooking, furniture etc.), FPRO (family profession), IDMO (interested to develop mango orchard), MGOV (motivated by government institutions i.e. ICAR-CISH, Lucknow and State Horticulture Department), MRKT (good market of mango), NEXT (established orchard for next generation), PLFS (prevent land from sealing), SELF (self interest), SOIN (source of income), SOPR (social prestige), SUSE (self use). Source of Motivation = ECON (economic), ENVM (environment), PSNL (personal), RULE (policy/rule), SOCL (social)

oriented motivations, such as the aspiration to safeguard local agricultural heritage, disseminate planting materials among friends and relatives, and sustain a diverse mango collection. Economic factors underscored the importance of diversity in bolstering economic resilience, offering a variety of marketable alternatives, and alleviating risks associated with fluctuating yields or prices. Cultural factors demonstrated the acknowledgement of the relationship between agricultural biodiversity and cultural identity, traditions, and customs. Environmental factors highlighted the significance of biodiversity in enhancing ecosystem services, augmenting soil and plant health, and fostering sustainable agricultural practices. Finally, policy-related factors examined the impact of governmental policies, programs, or institutional support systems that promote *in-situ* conservation of agrobiodiversity.

Survey Methodology

We conducted a structured questionnaire at each district to identify qualitative and quantitative data about motivational factors in key mango-producing regions. This study explores the motivations of traditional mango variety maintainers and their perceived importance of biodiversity through farmer interviews.

Sampling Framework

To ensure district representation, a multistage sampling method was employed. Experienced mango experts had taken special care in the selection of mango villages in each district. Random samples of farmers were then drawn from within each village to gather detailed data on conservation techniques and motivation drivers.

Data Analysis

In addition to motivational factors, information was gathered on unique mango varieties maintained by farmers based on farmer descriptions. Data included traits such as fruit maturity period, fruit quality (e.g., table fruit or pickling), peel colour, pulp colour, fibre content, and fruit size. We analyzed the collected data using descriptive statistics to assess trends in motivational factors across districts. Motivations were framed as personal (SELF), social (SOIN), economic (SUSE), cultural (ANCP), environmental (ENVN), and policy-related (MGOV), and each classification was plotted in a frequency distribution to assess their relative importance as drivers of conservation.

Results and Discussion

Summary of the motivational factors for custodian farmers in conserving mango varieties presented in Table 2 revealed multiple drivers for custodian farmers ranging from economic, social, religious, ethnic and biodiversity interests. Self-interest (SELF, 55%) and a stable source of income (SOIN, 85%) were found to be the most important and frequent motivation factors among the farmers (Fig.1). The farmers were likely to conserve mango varieties if they had private benefits

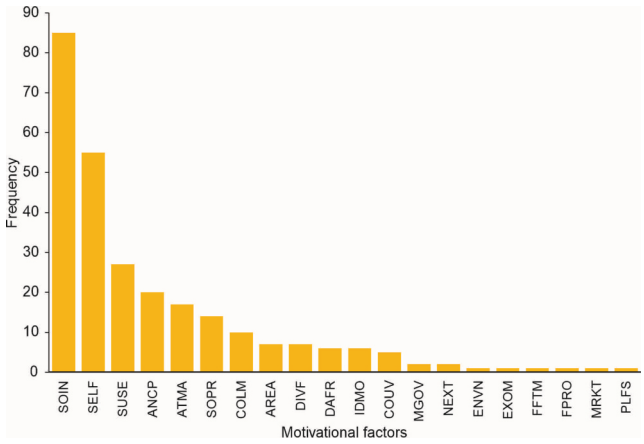

Fig. 1: Frequency of responses for various motivational factors driving on-farm mango conservation.

and economic sustainability. Despite the lesser mention, sustainable use (SUSE, 27%) is also highly relevant, which indicates farmers' priority on resource sustainability through time. Social prestige (SOPR, 14%), which indicates farmers' tendency to conserve partly because they want to be appreciated by the community, and attachment and love for mango (ATAM, 17%), which indicates that farmers have cultural and emotional attachment to the mango cultivation. These were the most notable motivational factors.

External factor-related motivations, including government support (MGOV), export potential (EXOM), market opportunities (MRKT), and environmental concerns (ENVN), were negligible, with frequencies of 2, 1, 1, and 1, respectively. This indicates that these factors are not significant determinants for the majority of farmers. Likewise, motivations such as the establishment of orchards for future generations (NEXT) and the prevention of land sealing (PLFS) were mentioned by only a limited number of farmers. Practical applications such as wood for cooking or furniture (FFTM) were infrequently referenced.

The examination of the motivational factors influencing custodian farmers who cultivate various mango varieties uncovers several significant insights. Farmers maintain between 10 and 272 mango varieties, with notable instances such as S.C. Shukla, who preserves 272 varieties, and Ramvir Singh Chauhan, who has 77 varieties. This indicates a robust dedication to conservation among these farmers. Orchard sizes exhibit significant variation, ranging from a mere 0.25 hectares (Md Iliyas) to an expansive 154 hectares (Ajai Jain), suggesting a relationship between land availability and the diversity of mango varieties cultivated. Orchard ages vary from 5 years (Pankaj Deo Singh) to an impressive 250 years (Hazi Jameel), representing both newly established and heritage orchards of considerable cultural and historical significance.

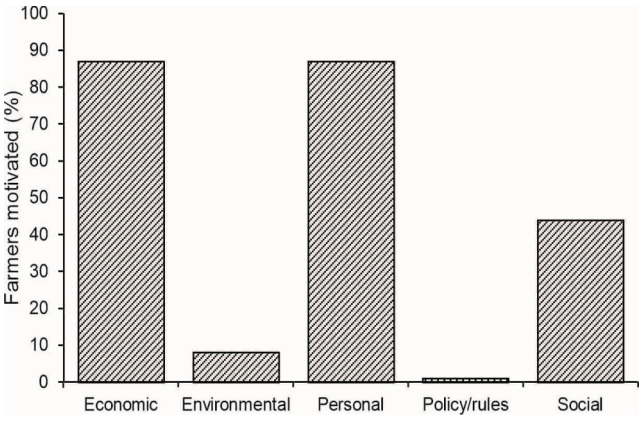

Fig. 2: Relative importance of motivational factors to the custodian farmers for the conservation of mango varieties.

A trend has emerged indicating that economic incentives are associated with larger orchard sizes and an increased number of cultivated varieties. Farmers motivated by ancestral land frequently oversee mature orchards, highlighting the cultural importance of mango cultivation in heritage preservation. While environmental considerations are infrequently observed, their occurrence among specific farmers signifies an increasing awareness of sustainable practices. Furthermore, individuals driven by the collection of varieties (COLM) and the conservation of unique varieties (COUV) typically cultivate specialized orchards that emphasize genetic diversity.

To improve conservation strategies, connecting mango diversity to market opportunities could incentivize economically motivated farmers, while promoting value addition through diversity fairs or roadside stalls may increase financial returns. National policies ought to prioritize the registration of farmers' varieties and the enhancement of skills in grafting and genetic resource management. Promoting community involvement via social incentives can enhance conservation initiatives, and emphasizing environmental advantages may entice additional farmers to embrace sustainable practices. This analysis highlights that custodian farmers are motivated by a variety of economic, personal, social, ancestral, and environmental factors; customized strategies that address these motivations can substantially improve mango diversity conservation while ensuring sustainability and profitability for farmers.

Fig. 2 depicts the comparative importance of various motivational factors influencing custodian farmers in conserving mango varieties. Economic and personal motivations emerged as the primary factors, with 87 farmers (38.33%) citing each as a crucial reason for their conservation efforts. This indicates that financial incentives and personal satisfaction or passion for agriculture are equally important in motivating farmers. Social factors were identified as the second most significant, motivating 44 farmers (19.38%), suggesting that community engagement and peer influence play a role in their commitment, though to a lesser extent.

Only 8 farmers (3.52%) cited environmental motivations, suggesting that ecological concerns are not a predominant factor for the majority of farmers. Likewise, policies and regulations exerted negligible influence, with only one farmer (0.40%) identifying

them as a motivating factor. This indicates that current policies may not adequately align with the interests or priorities of farmers. The findings indicate that economic and personal factors are the primary motivators for mango variety conservation, whereas environmental and policy-related motivations are significantly less impactful. These insights can assist stakeholders in formulating targeted strategies to promote conservation efforts by aligning them with farmers' principal motivations.

The historical importance of orchards, including the two-century-old ones in Bulandshahr, exemplifies the enduring dedication of custodian farmers to safeguarding biodiversity and the cultural heritage linked to mango cultivation (Rajan *et al.*, 2024). This historical context corresponds with the observations made by Sthapit *et al.,* (2013), who emphasized the persistent significance of traditional knowledge in crop conservation initiatives throughout South Asia (Sthapit *et al.*, 2013). Their endeavours, grounded in cultural heritage and indigenous knowledge, not only aid in the preservation of mango diversity but also bolster social and economic resilience within their communities (Rajan *et al.*, 2024). The conservation strategies outlined by Gajanana *et al.,* (2015) emphasize the significant implications of preserving traditional varieties for food security and ecosystem services.

The analysis of motivational factors affecting custodian farmers in mango variety conservation reveals significant insights into the intricate relationship among personal, economic, and social motivations. The dominance of self-interest and the pursuit of a reliable income highlight the essential influence of economic factors in agricultural practices. Considering that mango cultivation frequently serves as a principal source of income for these farmers, it is unsurprising that motivations associated with financial stability are highly prioritized. This indicates that conservation strategies designed to improve mango varieties must also take into account the economic conditions encountered by farmers.

The crucial function of sustainable use (SUSE) indicates a growing consciousness among farmers about the significance of long-term resource management. This motivation signifies a transition towards more accountable agricultural practices, wherein farmers acknowledge that preserving mango varieties can result in sustainable income and ecological well-being. As sustainability gains prominence in global agriculture, initiatives that advocate for optimal practices in mango cultivation may align with farmers' motivations and bolster conservation efforts (Vasudeva *et al.*, 2015).

The emotional ties to mango cultivation, reflected in motivations linked to attachment and affection for mangoes (ATMA) and personal heritage (ANCP), underscore the cultural importance of mangoes in the lives of these farmers. These intrinsic motivations indicate that conservation initiatives should prioritize not only economic incentives but also the celebration and reinforcement of the cultural heritage linked to mango farming. Programs that integrate storytelling, community events, and educational initiatives regarding the historical and cultural significance of mango varieties could enhance emotional connections and promote more effective conservation practices.

Social factors, including social prestige (SOPR) and distribution among friends and relatives (DAFR), suggest that community dynamics influence farmers' motivation. This indicates that promoting community involvement via collaborative endeavours or local organizations may improve conservation initiatives. Utilizing social networks, stakeholders can establish platforms for knowledge exchange, resource aggregation, and collaborative action, thereby enhancing individual initiatives for mango variety conservation.

Notably, external factors such as government assistance (MGOV), export potential (EXOM), market opportunities (MRKT), and environmental issues (ENVN) were determined to exert negligible influence on farmers' motivations. This underscores a possible disparity between policy initiatives and the actual conditions encountered by farmers. It indicates that government programs may not be adequately aligned with the needs and priorities of custodian farmers. To bridge this gap, policymakers must directly engage with farmers to gain a deeper understanding of their perspectives and formulate customized interventions that align with their motivations.

Farmers in Uttar Pradesh cultivate a variety of mango cultivars as a risk management strategy to stabilize income amidst market fluctuations, pest infestations, and climatic variability. The robust correlation (r=0.997) between the quantity of traditional varieties and on-farm conservation success in UP underscores the importance of diversity in facilitating staggered fruit maturity, thereby prolonging market availability and diminishing dependence on monocultures (Rajan *et al.*, 2024). This is consistent with Smale *et al.,* (2004) and Smale (2006), who contend that crop diversity mitigates economic uncertainties by offering multiple sources of income. Nurseries in Malihabad, Lucknow, serve as economic

centres by providing planting materials for traditional varieties and generating livelihood opportunities associated with biodiversity. Kontoleon *et al.,* (2007) observe that market-driven approaches frequently overlook non-commercial varieties, thereby requiring policy interventions to promote conservation via subsidies or acknowledgement of ecosystem services.

Custodian farmers in Uttar Pradesh enjoy social prestige through the conservation of rare varieties, thereby elevating their status as leaders of community knowledge. This reflects findings from Bihar and Jharkhand, where farmers cultivating over ten varieties are esteemed as scion donors and advisors (Singh *et al.*, 2015; 2019). Indigenous Traditional Knowledge (ITK) forms the foundation of conservation practices, including the selection of disease-resistant varieties and grafting techniques, which are transmitted across generations. Subedi *et al.* (2003) assert that these knowledge networks promote collective action, essential for the conservation of agro-biodiversity. Labour shortages and youth migration jeopardize these social structures, as evidenced in Bihar, highlighting the necessity for institutional support to involve younger generations.

The historical and cultural connection to mango diversity is significant. The 250-year-old orchard in Bulandshahr epitomises the custodians' role as heritage protectors, illustrating the documentation of Nawab Hasan's endeavours to preserve heirloom varieties in Kasmandi Kalan, Malihabad (Rajan *et al.*, 2013). Mangoes are vital for local festivals, ceremonies of faith, and culinary traditions, therefore highlighting their cultural importance. Often, cultural identity drives farmers to keep kinds of symbolic significance even though they are less profitable (Sthapit *et al.*, 2013; Rajan *et al.*, 2015). Despite commercial pressures, Saharanpur farmers set aside large orchard areas for traditional mango types, therefore reflecting Negi's (2003) claim that landraces are "living memories" of agricultural legacy.

While UP's custodian farmers show good on-farm preservation, commercial mono-cultures (e.g., Dashehari) pose risks. Pascual and Perrings (2007) suggest combining economic incentives with cultural values, as shown by the certification of traditional types for niche markets. While Swanson (1996) stresses the worldwide public benefit resulting from the preservation of genetic resources, Padulosi (2011) underlines participatory approaches for including custodian farmers in national biodiversity plans. Enhancing Indigenous Traditional Knowledge (ITK) through formal acknowledgement, as suggested by Rajan *et al.,* (2015), may integrate traditional methodologies with scientific inquiry, thereby fortifying resilience against climate change and biotic pressures.

The infrequent occurrence of motivations linked to environmental concerns signifies a necessity for heightened awareness of ecological issues among farmers. Although sustainability is acknowledged as significant, there may be a restricted comprehension of how conservation practices can directly enhance both livelihoods and the environment. Educational initiatives designed to emphasize the ecological advantages of preserving diverse mango varieties may assist in closing this knowledge gap.

Conclusion

The study indicates that intrinsic motivations, including self-interest, income generation, sustainable utilization, and emotional attachment, are the principal catalysts for mango conservation initiatives. Social factors such as prestige and heritage are influential, whereas external influences like government policies or market opportunities exert minimal impact. These insights may help stakeholders design targeted interventions that relate to farmers' main motivations to increase the uptake of conservation practices. This emphasizes the importance of finding a balance between nature conservation, including economic viability, cultural value, community, and nature awareness. By linking conservation strategies to the intrinsic motivations of custodian farmers, stakeholders can develop more efficient and sustainable practices to promote mango conservation while ensuring the sustainability of farmers' livelihoods.

References

Dinesh MR, S Rajan, SK Singh, IP Singh, KV Ravishankar, BMC Reddy, VA Parthasarathy, B Sthapit, VR Rao and BS Sandya (2015) Heirloom/seedling mango varieties of India–Potentialities and future. *Indian J. Plant Genet. Resour*. 28(1): 139-152.

Gajanana TM, MR Dinesh, S Rajan, R Vasudeva, SK Singh, HAH Lamers, VA Parthasarathy, B Sthapit and V Ramanatha Rao (2015) Motivation for on-farm conservation of mango (*Mangifera indica*) diversity in India–a case study. *Indian J. Plant Genet. Resour*. 28(1): 1-6

Kontoleon A, U Pascual and TM Swanson (2007) *Biodiversity Economics: Principles, Methods and Applications*. Cambridge University Press, UK.

Mal B, V Ramanatha Rao, RK Arora, PE Sajise and BR Sthapit (2010) Conservation and sustainable use of tropical fruit species diversity: Biodiversity's efforts in Asia, the Pacific and Oceania. *Indian J. Plant Genet. Resour*. 24: 1-22.

Negi V (2003) Landraces in Central Italy: where and why they are

conserved and perspectives for their on-farm conservation. *Genet. Resour. Crop Evol.* 50: 871-885

Padulosi S (2011) Guideline note presented at the IFAD NUS planning meeting, Pokhara, Nepal.

Pascual U and C Perrings (2007) Developing incentives and economic mechanisms for *in situ* biodiversity conservation in agricultural landscapes. *Agric. Ecosyst. Environ*. 121 (3): 256-268.

Rajan S (2011) Mango biodiversity in Uttar Pradesh. UP State Biodiversity Board. *BIODIV News*: 2(7): 4-5.

Rajan S, HAH Lamers and B Lal (2015) A set of interconnected practices which enhance and conserve mango diversity in Malihabad, India. Tropical fruit tree diversity. Earthscan Routledge, pp 172-183.

Rajan S, PK Mishra, K Aditya, P Sagar and V Srivastav (2024) On-farm conservation of traditional mango varieties by custodian farmers in Uttar Pradesh." *Indian J. Tradit. Know.* 23(4): 372-380.

Rajan S, R Kishore, S Ahmad and Vijay (2013) 'Nawab Hasan: Conserving century-old mango varieties in Kasmandi Kalan: The story of the Nawabs'. In: Sthapit BR, H Lamers, and VR Rao (Eds), Custodian farmers of agricultural biodiversity: Selected profiles from South and South East Asia, *Proceedings of the Workshop on Custodian Farmers of Agricultural Biodiversity*, 11–12 February 2013, New Delhi, India; Bioversity International, New Delhi, India.

Ram S and S Rajan (2003) Status report on genetic resources of mango in Asia-Pacific Region, International Plant Genetic Resource Institute, New Delhi, 196 p.

Singh SK, V Nath, S Rajan and SD Pandey (2019) Surveying mango diversity and its custodian farmers in the states of Bihar and Jharkhand, India. *Indian J. Plant Genet. Resour.* 32(2): 200-206.

Singh SK, A Singh, V Nath, VA Parthasarathy, B Sthapit, S Rajan and S Vinoth (2015) Genetic diversity in seedling populations of Mango. *Indian J. Plant Genet. Resour*. 28(1): 123-131.

Smale M (2006) Valuing crop biodiversity: On-farm genetic resources and economic change. CABI Publishing, Wallingford, UK.

Smale M, MR Bellon, D Jarvis and B Sthapit (2004) Economic concepts for designing policies to conserve crop genetic resources on-farms. *Genet. Resour. Crop Evol*. 51: 121-135.

Sthapit B, H Lamers and V Ramanatha Rao (2013) Custodian farmers of agricultural biodiversity: Selected profiles from South and South East Asia. *Proceedings of Workshop on Custodian Farmers of Agricultural Biodiversity*, 11-12 February, 2013, New Delhi, India.

Subedi A, P Chaudhary, BK Baniya, RB Rana, RK Tiwari, DK Rijal, BR Sthapit and DI Jarvis (2003) Who maintains crop genetic diversity and how?: Implications for on-farm conservation and utilization. *Cult. Agric*. 25 (2): 41-50.

Swanson T (1996) Global values of biological diversity: The public interest in the conservation of plant genetic resources for agriculture. *Plant Genet. Resour. Newsl.* 105: 1-7.

Vasudeva R, B Sthapit, I Salma, S Changtragoon, IW Arsanti, D Gerten, D Nataya, S Rajan, MR Dinesh, IP Singh, SS Kumar, VA Parthasarathy and VR Rao (2015) Use values and cultural importance of major tropical fruit trees: An analysis from 24 village sites across South and South-East Asia. *Indian J. Plant Genet. Resour.* 28(1): 17-30.

Yadav IS and S Rajan (1993) Genetic resources of *Mangifera.* In: Chadha KL and Pareek OP (Eds) *Advances in Horticulture,* Vol 1, Part 1. Malhotra Publishing House, New Delhi, pp 77-93.