PLANT SCIENCE TODAY
ISSN 2348-1900 (online)
Vol 11(2): 638-646
https://doi.org/10.14719/pst.3294

HORIZON
e-Publishing Group
HePG

RESEARCH ARTICLE

Identification of the existing integrated farming systems in Udaipur district of Rajasthan

Akansha Yadav[1*], Rajshree Upadhyay[1] & Dhriti Solanki[1]

[1]Department of Extension Education and Communication Management, Maharana Pratap University of Agriculture & Technology, Udaipur - 313 001, India

*Email: akanshayadav661@gmail.com

OPEN ACCESS

ARTICLE HISTORY

Received: 08 January 2024
Accepted: 26 March 2024

Available online
Version 1.0 : 05 May 2024
Version 2.0 : 21 May 2024

Check for updates

Additional information

Peer review: Publisher thanks Sectional Editor and the other anonymous reviewers for their contribution to the peer review of this work.

Reprints & permissions information is available at https://horizonepublishing.com/journals/index.php/PST/open_access_policy

Publisher's Note: Horizon e-Publishing Group remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Indexing: Plant Science Today, published by Horizon e-Publishing Group, is covered by Scopus, Web of Science, BIOSIS Previews, Clarivate Analytics, NAAS, UGC Care, etc
See https://horizonepublishing.com/journals/index.php/PST/indexing_abstracting

CITE THIS ARTICLE

Yadav A, Upadhyay R, Solanki D. Identification of the Existing Integrated Farming Systems in Udaipur District of Rajasthan. Plant Science Today. 2024; 11(2): 638-646. https://doi.org/10.14719/pst.3294

Abstract

The integrated farming system (IFS) is an integrative whole-farm-oriented technique mainly used to resolve the problems of small and marginal farmers to enhance income, employment, and living standards, *etc*. Due to numerous crises and challenges such as unawareness, poverty, droughts, dry climate, the small and marginal distribution of land, *etc*., the identification of an appropriate integrated farming system model is highly required. So, this research aims to deliver a solution for the identification and finalization of the IFS model which is a critical task in front of farm families, Agri-scientists, policy-makers, and business organizations. This study is conducted through a field survey in the district of Udaipur, Rajasthan. This work has experimented with randomly selecting 4 panchayat samitis out of 20 panchayat samitis, 4 villages selected from each panchayat samitiee to identify existing integrated farming systems among farm families. This study observed the prominent integrated farming system model among the considered models. This work identifies the IFS models which are the most prominent farming system (M1: crop+ dairy) and are adopted by most farm families. This research work also identified integrated farming models M1 and M2 as the most preferred, profitable, and very suitable for business decision-making. Similarly, M3 and M4 are also good but less preferred than M1 and M2.

Keywords

identification; integrated farming system; agriculture business; field survey; income generation; employment generation

Introduction

Nowadays, the agriculture system is a core part of the economy in India that gives us food and livelihood security. In the Indian economy, the farming system contributed 22.2% to the total GDP in 2020-2021. According to the Report of Economic Survey of India (2019-2020) in Agriculture, the estimated food grain production in India is approximately 296.65 million tonnes. It is 11.44 million tonnes higher as compared to 285.21 million tonnes production of food grain developed during 2018-2019. Currently, India has the second-largest population in the world and to meet future demands, we have to produce 341 million tonnes of food grains and also provide employment to more than 60% of the population (*refer to survey report* (3)).

Rajasthan state occupies nearly 10.4% geographical area of the country. The main occupation of the people of Rajasthan is agriculture where approximately 70% people of the total population are engaged in agriculture and allied pursuits. It is to be noted here that in the state of Rajasthan, the major challenge is rainfed areas which are prone to high production risk. Presently the state's agriculture is facing various challenging issues and crises such as dry climate, droughts, pests and diseases, famines, hailstorms, indebtedness and poverty among farmers, etc. Farmer's socioeconomic life is directly affected by the agrarian crisis (1-4). The solution to such challenging problems and issues can be achieved through the integrated farming system (1-8).

According to the studies, the idle conditions for an IFS system are referred to as (i) No waste, (ii) Misplaced resources may be considered as waste that may be valuable for another (5-7). It was revealed that the utilization of urban waste for farming as liquid organic fertilizer for vegetable crops (8). These key points are not always reliable but may drive maximum compatibility and replenishment of organic matter such as residues, wastes, *etc*. So, the IFS combines livestock, agriculture, aquaculture, and agro-industry through an integrated and synergetic system where the waste of one process can be utilized as input for another process that may deliver maximum productivity at minimum cost. The IFS is incorporated with an eco-biological system that is not available in the traditional system.

The ecosystem services provided by IFS are given in Fig. 1 and the employment opportunities provided by IFS are revealed in Table 1 (9).

Challenges of IFS

The major challenges of IFS that are associated with the identification of IFS models are (i) knowledge (ii) resources, (iii) skill, (iv) labor, and (v) capital. Such challenges may not affect small and marginal farmers (4, 9 -12). Sometimes due to these challenges, the identification of an effective and appropriate IFS model is a critical task for farm families.

Table 1. Employment opportunities provided by integrated farming system (9)

Probable areas	Opportunities
Agro-ecotourism	Linking traditional farming landscapes with tourism Development of herbal gardens, fish spas/farms, and biodiversity parks
Livestock and fodder component	Animals caring Maintaining fodder block of forages, Azolla unit, and legumes
Organic farming	Post-harvest, supply chains and farm-to-market Organic input production such as compost as well as vermicompost for enhancing the income
Management of resources	Developing nurseries for plants and supplying related material Production of seed for targeting a higher price in the market Plantation of diverse tree species Maintaining diverse species economically

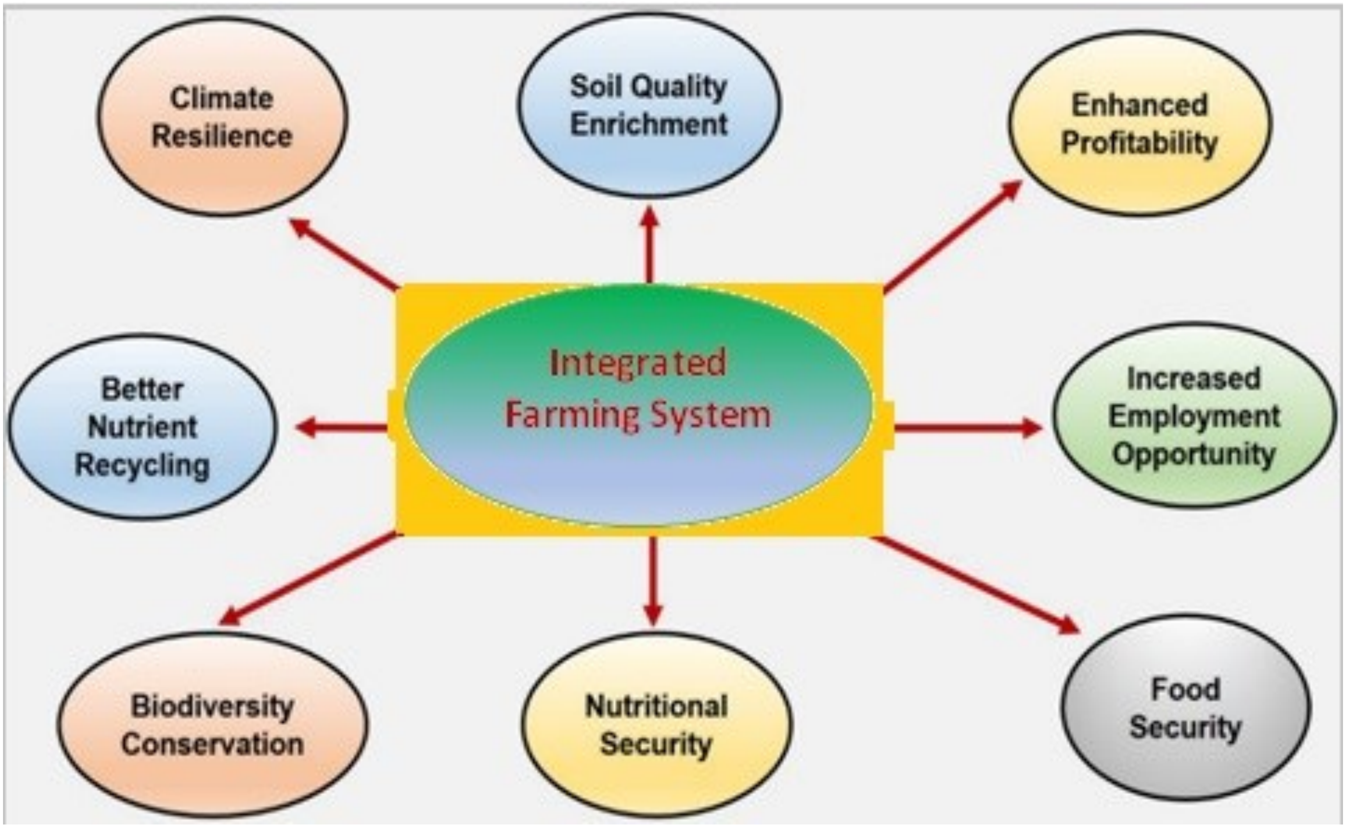

Fig. 1. An ecosystem service provided by IFS.

Aim of IFS

The main aim of an integrated farming system is to fulfill multiple objectives of investigating a method so that farm families focus on the improvement in living standard, generation of employment, maximizing food productivity, minimizing the cost of production, minimizing uncertainties/risks, *etc*. The integrated farming system also assists farmers to utilize the available resources properly. So, the integrated farming system is a unique procedure that is applied for the overall upliftment of farming communities in rural areas and crop diversity along with the conservation of natural resources effectively.

The main idea here is that the awareness among farm families should be linked to different aspects of the farming system i.e. how these aspects are linked together along with the consequences of such interactions for better productivity under a suitable environment. Generally, farm families are unaware of the term integrated farming system and sometimes farm families don't know about the main principle behind it. So, to identify the effectiveness of the integrated farming system in farm family's life and its applicability in the district of Udaipur, Rajasthan through this research work. In this work, the farmers are interviewed across various aspects and claimed to practice some important components of the integrated farming system.

The identification of IFS models for future perspective is the main motive behind this research work that aims to deliver growth to farm families. According to the census survey report (2015-2016), small and marginal farmers are the main components of the Indian rural economy, which constitutes 85% of the total farming community. Here, an integrated farming system is considered for delivering an effective solution to fulfill the demand for food production and maintaining stability to enhance income as well as employment along with nutritional security. The IFS model and its components are shown in Fig. 2.

Importance and Major Components of IFS

The importance of the integrated farming system and its major components can be understood in Table 2.

The IFS is a type of whole or mixed farming approach that includes at least 2 processes that are separately processed but dependent on each other but logically these are interdependent parts of livestock enterprise and crops.

Benefits of the Integrated Farming System

An integrated farming system is an eco-friendly technique that utilizes the waste from one firm and uses it as input for another and then allows for farm resources more effectively. In the agriculture domain, the IFS can improve the following (1-9):

- To improve soil health and fertility.
- To enhance the livelihood as well as the status of the farm families.
- To develop multiple sources of income.
- To minimize the production cost and farm input requirements.

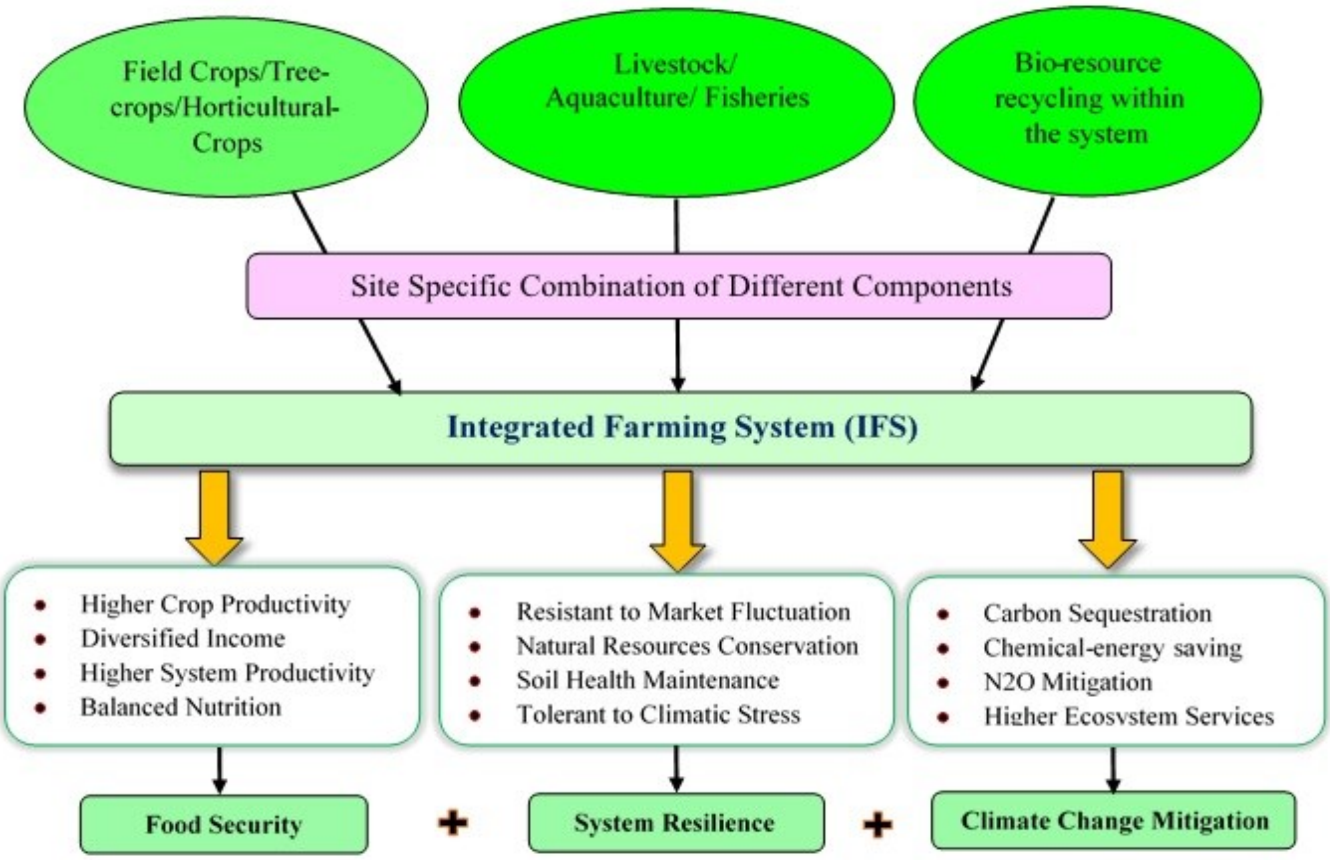

Fig. 2. Integrated farming model and its components.

Table 2. Major key components and features of IFS

Determinants of IFS	Components of IFS	IFS practicing Systems in India	Factors affecting IFS	Impact of IFS-based research
Natural resources (climate, soil, biodiversity)	Crops and cropping system	Crop livestock farming system	Availability of labor, land, resources, and capital	Empowering the economic status of a farm family
Farm size and farm resources	Food, fodder, fiber, fuel	Crop livestock pastoral system	Utilization of resources	maximizing food productivity
Storage and Transport	Fruit, flower, vegetable, mushroom	Livestock-based farming system	Soil and climate	Production efficiency
Road Connectivity	Pulses, oilseeds	Agroforestry system	The skill of farm families	Employment
Knowledge of Science and Technology	Commercial crops: sugarcane, spices, tea, coffee, rubber, medicinal-aromatic plants	Agri horticulture farming system	Economics of considered IFS	minimizing the cost of production and minimizing uncertainties/risks
Market development	Livestock: cattle, buffalo, cow, goat, sheep, pig	Sole/Twice/Thrice crop farming system	Training of farm families	improvement in living standard
Pricing policy	Dairy, poultry, duckery, fishery, apiary, sericulture	ICT-based farming system	Govt. schemes and availability of credit	Integration of different enterprises *i.e.* IFS
Training institutions	Biogas	Mixed farming	Customs, sentiments, and believes	Maintaining biological diversity and ecological stability

- To minimize the excess use of pesticides and chemical fertilizers.
- To enhance economic yield per unit area.
- To develop employment for family members and others.
- Effective utilization of resources.
- To develop a balanced diet and nutritious food for the farm families.
- To resolve the problem of energy through biogas or solar systems.
- To avoid the degradation of forests and ponds.
- Recycling of available resources.

The present study will ascertain the existing IFS in this domain. The identified integrated farming systems with different combinations will help to understand the supplementary and complementary relationship among different enterprises for increasing the income of farmers. This study has focused on possible combinations of existing IFS models in the considered areas. The integrated farming system has been identified among these enlisted combinations through the focus group interview process and available key informants' techniques.

Need for Farming System

For the last 4 to 5 decades, more emphasis has been given to component and commodity-based research for developing different varieties of crops, animal breeds, *etc.* in isolation that inadequately addresses miscellaneous problems (AICRP Report (10) on IFS) of small farmers. Due to such problems, low productivity, improper utilization of effective resources, and less profitability have been raised. Less knowledge of climate, water contamination, and the use of toxic substances are also incorporated to raise problems. To handle or minimize such problems, the Indian farming system focused on research on various factors related to climate, socio-economic, availability of resources, training, Govt. schemes, size of farmland, quality of seeds, and physical and biological challenges (9-12). Rather than single farm enterprise, the adoption of technology and IFS has been considered for improving the productivity, employment, socio-economic growth, livelihood security, nutritional security, *etc.* of farm families (12). The Government trying to provide training and resources (machinery, water, seed, market *i.e.* mandi, *etc.* at low cost through various schemes in Rajasthan.

Related Literature

In literature, various researchers have delivered solutions in different geographical regions for IFS and also focused on the adoption of different farming systems through identification. In this section, this study also considers a few related works.

According to a study, the integrated farming system helps with any investigation and reveals ideas from past research work (14). It also presents an interpretation-based discussion for the prediction of the outcomes for the future. It was described as an IFS as the practice of raising diverse yet dependent enterprises where various enterprises are reliant they are principally supplementary and complementary to each other (15). Integrated farming systems portray multiple crops (*e.g.* vegetable trees, crops, legumes, cereals, *etc.*) and multiple enterprises (*e.g.* aquaculture, livestock, apiary, *etc.*) on a single farm in an integrated manner. The farmer, farm, resources of the farmer, and farming environment together constitute a complex system, which is termed a farming system.

The use of chemicals (pesticides, fertilizers) should be reduced through the utilization of the IFS strategy to supply healthy food to society that is also chemical-free (16). The integrated farming system increased profitability, productivity, and employment generation by 40, 48, and 45% respectively, as compared to conventional farming systems (12). It was described the IFS as a mixed crop animal system in which agricultural waste products are used to raise the animal component while the animal is used for tillage and other purposes on crop fields and supply manure used as fertilizer (17). It was revealed doubling the farmer's income (11). Studies have discussed contexts and assumptions of integrated smart agriculture for a broader concept (18). It was explained an integrated farming system is a core part of farming systems that utilizes the concepts of increasing production, minimizing risk, and enhancing profit whilst increasing the utilization of crop residues and organic wastes of the field (19). It was discussed the need (13), for effective resources and their utilization for IFS (20) in the Udaipur district of Rajasthan. Similarly, a study focussed on the economic status of the farming System in South-East Rajasthan (21).

It focused on various critical challenges of the farming system and analyzed various components of the farming system for the environmental and societal impacts (22). This work delivered solutions for farming systems and focused on alternatives to the challenges of maintaining sustainable development through integrated farming systems. It was focused on the link between intensification and sustainability this review work summarizes numerous old farming systems and develops various strategies for focusing on sustainable intensification (23). This review work aims to summarize and explore the requirements and identify the critical challenges along with effective solutions to sustainability for present and future trends that strengthen the investment and productivity in the agriculture domain in an optimized structure of integrated efforts. Studies have discussed a case study using the intensification of agricultural and allied activities through an integrated farming system (24). This work also discussed the benefits and economic efficiency of IFS for the area (ha).

In the context of various problematic challenges in the farming system have delivered an approach through the integration of cropping with some other kind of farming enterprise that could enhance productivity, employment, income, and effective utilization of resources (25). This work experiments with using various models of IFS over datasets of different states for system productivity, profitability, income, resource-saving, and utilization. This work also identified major researchable challenges from the perspective of farmers and also depicts the policy initiatives for IFS. A study has presented the current status and scope (26). It also predicted the future of IFS with an Indian perspective. This focused on limitations and opportunities for IFS through production, environment implications, and comprehensive services of an ecosystem of different types of IFS (9). This work explored the effort of IFS on farm income, employment, residues, soil health, climate resilience, nutrient recycling potential, biodiversity conservation, and food and nutritional security against major constraints during the adoption of IFS. It identified the risks associated with IFS and suggested a solution for the development of livelihood security of small and marginal farmers in India along with other developing nations (27). This work also focused on socio-economic, biophysical environment, sustainable agriculture, and services of an effective ecosystem.

It implemented a methodology to adapt artificial intelligence in agriculture along with optimization of irrigation for effective production and development (28). This work also demonstrates the effective utilization of technology in irrigation. It depicted perceptions of adapters of the push-pull technology through the survey of interview-based methodology and demonstrated 5 times greater productivity that also increases the resilience of farmers along with restoration of degraded lands (29).

This work computes the frequency of respondents and the relative frequency of adaptation of push-pull technology for beans, maize, maize beans, *etc*. This work also demonstrates that the adaptation of push-pill technology performs better than maize monocrop and maize-bean intercrop. It was identified the adaption of an IFS to gain food and nutritional security through the availability of resources and socioeconomic conditions of farm families in small and marginal holdings (30).

Materials and Methods

This research study was conducted in the Udaipur district of Rajasthan. Based on the availability of resources and research domain, we have selected Udaipur district of Rajasthan. Here Badgaon, Girwa, Gogunda, and Vallabhnagar panchayat samities were selected out of 20 panchayat samities. Among four selected panchayat samities, 16 villages were selected for this study. Multi-stage sampling techniques were applied to finalize the sample size. In the first stage, 20 farm families from each of the 16 selected villages were selected randomly to explore integrated farming systems practiced by the farm families. The final sample size is 320 for the identification of the existing integrated farming systems. In this work, most of the respondents 77.19% were practicing different integrated farming systems. While 22.81% of respondents were practicing only crops and they were not practicing any integrated farming system model. Therefore, this research work uses 247 respondents who are practicing IFS. The data is collected through a pre-structured interview schedule (face-to-face interaction with clarification of doubts if any) gathering in-depth information about farm families. This study observed the prominent farming system models (*i.e.* M1, M2, upto M12) in this area, *viz*. M1: Crop + Dairy, M2: Crop + Dairy+ Vegetables, M3: Crop + Dairy + Goatery, M4: Crop + Vegetable + Fruit + Dairy, M5: Crop + Dairy + Goatery + Poultry *etc*.

Results

The integrated farming system plays a significant role in the farming system in India. In India, the population is increasing tremendously, so the demand for food is also increasing along with the demand for employment. However, the traditional systems are not capable enough to fulfill such requirements. Thus, the farm families use a new technique *i.e.* integrated farming system. The integrated farming system more suitable and effective technique for handling the existing problem of required food and employment. It also enhances the living and economic standard of farm families.

The proposed work is experimented with using various models of IFS, these models (Fig. 3) include components such as crop, dairy, vegetables, goatery,

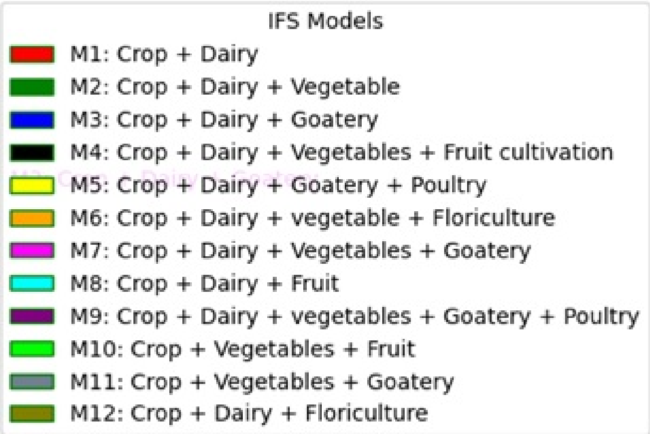

Fig. 3. Considered integrated farming models.

poultry, fruit, and floriculture through integrated farming systems.

This work reveals the most preferred IFS model based on the frequency and percentage that were practiced by farm families. It is depicted in Table 3 which shows M1 (Crop + Dairy). It can also be evaluated through the income generation for each integrated farming model which will be computed in future research work. The economic evaluation will deal with growth, economic outcome, and recycling of considerable components.

The possible combination of the different farming systems is depicted in Table 3, in this study all the combinations of farming systems crop + dairy are one of the main components, being the staple food, which shows that most of the combinations of the farming systems were crop and dairy-based. Most of the respondents (77.19%) were practicing integrated farming systems and the rest 22.81% were not practicing IFS they practiced crop only. The non-adoption of the IFS is due to various challenges such as unawareness of Govt. schemes, droughts, dry climate, poverty, small and marginal distribution of land, *etc*. So, due to such critical crises, the identification of the right integrated farming system model is highly required. So, the survey-oriented research work and its analysis help to identify and choose the correct IFS model among considered models. This solution is very helpful for farm families, agri-scientists, policy-makers, business organizations, *etc*. Table 3 shows the distribution of identification of existing integrated farming systems among farm families where *n* is the total number of respondents who were practicing IFS.

All the integrated farming models (M1, M2, upto M12) along with their frequency are shown in the pie chart in Fig. 4 respectively. These diagrams also revealed that

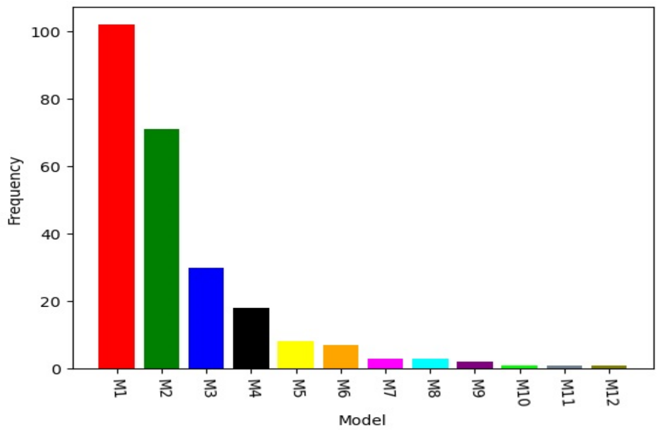

Fig. 4. Percentage-wise identification of IFS models.

Table 3. Distribution of identified existing IFS (n=247, Model (M1, M2, upto M12))

S. No.	Integrated Farming systems	Frequency	Percentage	Rank	Representation of IFS Models
1.	Crop + Dairy	102	41.3	1	M1
2.	Crop + Dairy + Vegetable	71	28.7	2	M2
3.	Crop + Dairy + Goatery	30	12.1	3	M3
4.	Crop + Dairy + Vegetables + Fruit cultivation	18	7.3	4	M4
5.	Crop + Dairy + Goatery + Poultry	8	3.2	5	M5
6.	Crop + Dairy + vegetable + Floriculture	7	2.8	6	M6
7.	Crop + Dairy + Vegetables + Goatery	3	1.2	7	M7
8.	Crop + Dairy + Fruit	3	1.2	7	M8
9.	Crop + Dairy + vegetables + Goatery + Poultry	2	0.8	8	M9
10.	Crop + Vegetables + Fruit	1	0.4	9	M10
11.	Crop + Vegetables + Goatery	1	0.4	9	M11
12.	Crop + Dairy + Floriculture	1	0.4	9	M12

models M1, M2, M3, and M4 are preferable and profitable as per their applicability by the respondents of Udaipur district.

In terms of a business perspective, the proposed work has identified the integrated system models. Based on their usability, we can suggest the most profitable models. The integrated farming model (M1) is the most profitable and it is practiced by most of the respondents (41.3%). The integrated farming model (M2) is the second-highest profitable model and is practiced by the majority of the respondents (28.7%). The M3 is the third highest preferred model followed by 12.1% of respondents. The M4 is a moderately preferred model and is followed by 7.3% of the respondents. Similarly, the M5 (3.2%) and M6 (2.8%) models are moderately preferred. It is to be noted here, that IFS models M7 and M8 are preferred by 1.2% of the respondents, 1.2%. Here, the IFS model M9 is practiced by 0.8% of the respondents. Similarly, M10, M11, and M12 models are practiced by 0.4% of respondents and it contribute 0.4% which overlap due to similar values.

Therefore, respondents, agri-extension agencies, and agribusiness organizations can focus on the most preferred and usable farming System model *i.e.* here M1, M2 M3 and M4 are more suitable models in the study area of Udaipur district. Fig. 5 shows all farming models with the percentage of frequency.

Discussion

The major key points are given below.

- The critical findings through the analysis of the proposed work for the identification of IFS models are given below.
- Based on the frequency, the IFS model M1 (Crop + Dairy) was assigned rank 1 highest frequency *i.e.* 102 out of 247 respondents. Similarly, based on the % of frequency, M1 has 41.2% which is the highest among all other IFS models.
- Similarly, the IFS model M2 (Crop + Dairy + Vegetable) with rank 2 has the second highest frequency *i.e.* 72 out of 247. Similarly, based on the % of frequency, the IFS model M2 has 28.74% which is the highest among all other IFS models.
- The IFS models M1 and M2 are the most preferable models by the considered respondents among all considered 12 models. According to Table 3, the total respondents in M1 and M2 are 173 out of 247 which is 70%.
- Table 3 revealed that IFS model M3 (Crop + Dairy + Vegetables + Goatery) with the rank of 3 has a frequency of 30 and a % of frequency 12.14%.
- Similarly, Table 3 also presented that the IFS model M4 (Crop + Dairy + Vegetables + Fruit cultivation) with the rank of 4 has a frequency of 18 and a % of frequency 7.28%.
- Here, it can be analyzed that the IFS models M3 and M4 can be considered moderately preferred by the farm families.
- Similarly, other IFS models (M5, M6, M7, M8, M9, M10, M11 and M12) are less preferred by the farm-families. The frequency and % of frequency of these can be represented as M5 (8 and 3.23%), M6 (7 and 2.83%),

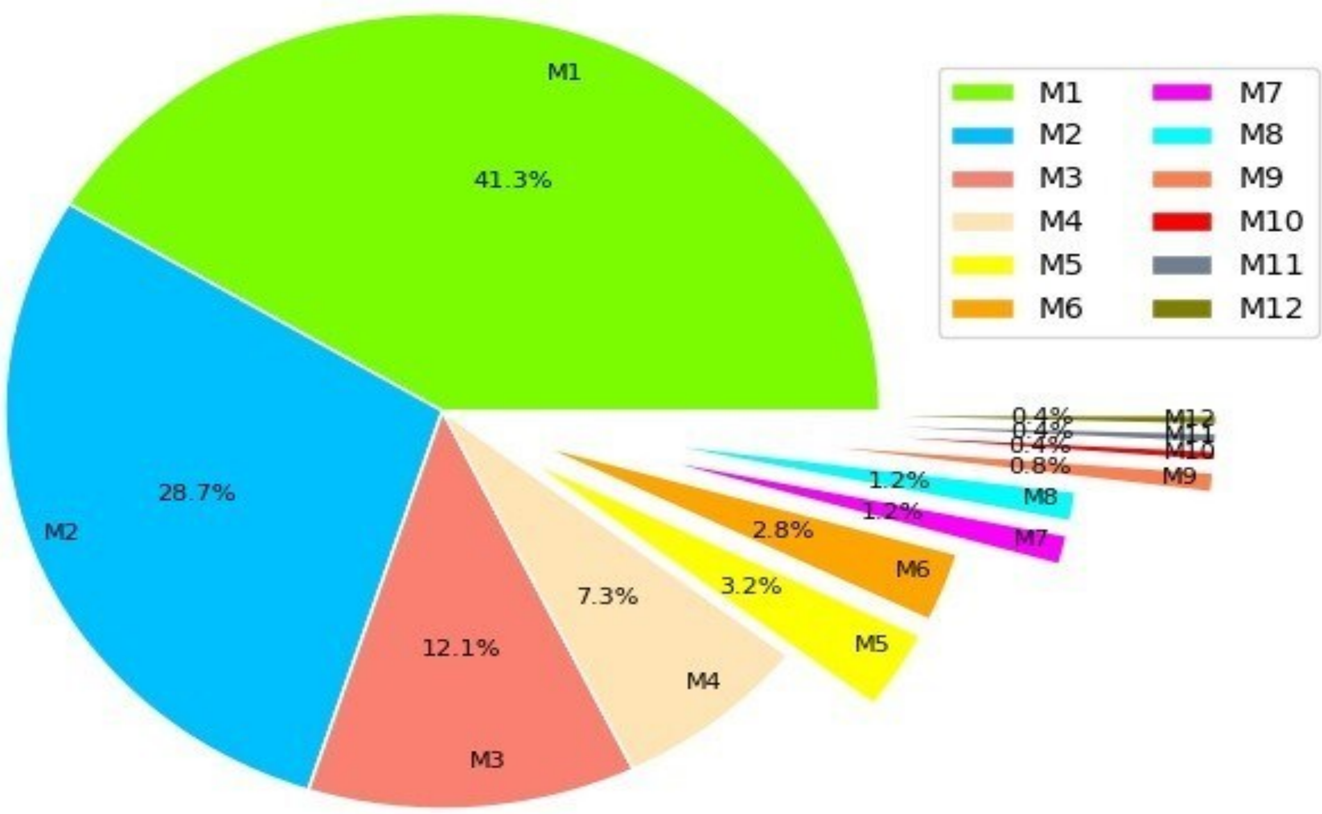

Fig. 5. Pie-chart of representation of all farming models with frequency-percentage.

M7 (3 and 1.21%), M8 (3 and 1.21%), M9 (2 and 0.80%), M10 (1 and 0.40%), M11 (1 and 0.40%) and M12 (1 and 0.40%).

- Here, the % use is much less (*i.e.* below 5%), so we can assume these IFS models are less preferred IFS models by the respondents of considered farm families.
- Thus, Table 3 demonstrates that this study has identified integrated farming models M1 and M2 as the most preferred. The IFS models M3 and M4 are preferred moderately. Whereas IFS models M5, M6, M7, M8, M9, M10, M11, and M12) are less preferred by respondents of the farm families.

This work can also be evaluated through the profit in terms of income generation for each integrated farming model which will be computed in future research work. The economic evaluation will deal with growth, economic outcome, and recycling of considerable components such as waste, manure, *etc*. Integrated farming systems involve the incorporation of various agricultural practices such as crop cultivation, animal husbandry, horticulture, aquaculture, and agroforestry in a synergistic manner. According to this study, the most preferred models are more valuable in terms of benefits, employment, income, livelihood empowerment, *etc*. In this way, this work identifies the appropriate IFS models for considered regions of the Udaipur district of Rajasthan for enhancing the farm family's income, living standard, and employment.

Finally, the proposed solution for the identification of IFS models is simple and easy to understand. It is very helpful for decision-based analysis for making policies, researchers, or other agri-related services, *etc*. So, such solutions are really helpful and deliver better outcomes in less time and less effort in terms of work, time, and money. From a business perspective, farmers, business organizations, and distributors must consider the most profitable and applicable farming system models for the present study.

Conclusion

This study was purposively conducted in the Udaipur district of Rajasthan. This study aims to identify the existing integrated farming systems adopted by farm families. Such work is helpful for farmers to enhance their living standards and income. It is also helpful for optimal utilization of resources through IFS. According to this research study, the M1 (Crop + Dairy) model having 41.3% of respondents is considered as most preferred and the M2 (Crop + Dairy + Vegetables) with respondents of 28.7% is also considered another most preferred IFS model. So, M1 and M2 are observed as the main profitable IFS models of this study in the Udaipur district. The IFS model M3 (Crop + Dairy + Vegetables + Goatery) has 12.14%. Similarly, the IFS model M4 (Crop + Dairy + Vegetables + Fruit cultivation) was 7.28%. The IFS models M3 and M4 are preferred moderately. Whereas IFS models M5, M6, M7, M8, M9, M10, M11, and M12 are less preferred by respondents of the farm families, as mentioned in Table 3. Thus, the proposed work demonstrates that this study has identified integrated farming models M1, M2, M3, and M4 as the most preferred and profitable for business purposes. The proposed study identifies the appropriate IFS models for considered villages of four different tahsils of the Udaipur district of Rajasthan for enhancing the farm family's income, employment living standard, *etc*.

In the future, this work can be enhanced for the development of a method by incorporating the machine learning-based algorithm for the identification of the most prominent integrated farming model. We will also work for the adoption of ICT and IoT-enabled devices for smart farming system and their impact on IFS.

References

1. Walia SS, Kaur T. Integrated farming systems: Research, extension and scope in Punjab. In: Bahar FA, Bhat MA, Mahdi SS editors. Secondary Agriculture. Springer, Cham. 2022;47-58. https://doi.org/10.1007/978-3-031-09218-3_5
2. Survey report of budget: https://www.indiabudget.gov.in/economicsurvey/
3. Sharma P, Basotia N. Agrarian crisis in Rajasthan: Impact on agricultural economy of state. Journal of Modern Management and Entrepreneurship. 2010;8(1):101-06.
4. Bahire VV, Kadam RP, Sidam VN. Sustainable integrated farming is the need of the Indian farmer. In the 22nd National Seminar on Role of Extension in Integrated Farming Systems for Sustainable Rural Livelihood, Maharastra, India. 2010 Dec 9-10;65:1-5.
5. Shyam CS, Shekhawat K, Rathore SS, Babu S, Singh RK, Upadhyay PK *et al*. Development of integrated farming system model - A step towards achieving biodiverse, resilient, and productive green economy in agriculture for small holdings in India. MDPI. Agronomy. 2023;13(4):955:1-23. https://doi.org/10.3390/agronomy13040955
6. Kumar S, Dey A, Kumar U, Chandra N, Bhatt BP. Integrated farming system for improving agricultural productivity. In chapter 3.6: Bhatt BP, Sikka AK, Mukherjee J, Islam A, Dey A editors. Status of Agricultural Development in Eastern India. ICAR Research Complex for Eastern Region, Patna. 2012;205-30. https://doi.org/ 10.5281/zenodo.813301
7. Edwards CA, Grove TL, Harwood RR, Colfer CJP. The role of agroecology and integrated farming systems in agricultural sustainability. Elsevier. Agriculture, Ecosystems and Environment. 1993;46(1-4):99-121. https://doi.org/10.1016/0167-8809(93)90017-J
8. Haryanta D, Sadah TT, Thohiron M, Rejeki FS. Utilization of urban waste as liquid organic fertilizer for vegetable crops in urban farming system. HORIZONe-Publishing Group. Plant Science Today. 2022;10(2):120-28. https://doi.org/10.14719/pst.2028
9. Parmesh V, Ravisankar N, Behera UK *et al.* Integrated farming system approaches to achieve food and nutritional security for enhancing profitability, employment, and climate resilience in India. Wiley. Food and Energy Security. 2022;11(e321):1-16. https://doi.org/10.1002/fes3.321
10. Report of AICRP on integrated farming system. https://www.bckv.edu.in/index.php/en/aicrp-on-integrated-farming-system-en
11. Ponnusamy K, Devi MK. Impact of integrated farming system approach on doubling farmers' income. Agricultural Economics Research Review. 2017;30:233-40. https://doi.org/10.5958/0974-

0279.2017.00037.4

12. Sukardi S, Ismayana A. Identification of integrated system of sustainable agricultural with partnership system in supporting food security: A review. ITaMSA2021: Bogor, Indonesia. IOP Publishing, IOP Conf. Series: Earth and Environmental Science. 2022;1063(012047):1-9. https://doi.org/10.1088/1755-1315/1063/1/012047
13. Dashora LN, Singh H. Integrated farming system need of today. International Journal of Applied Life Sciences and Engineering. 2014;1(1):28-37.
14. Sasikala V, Tiwari R, Saravanam M. A review on integrated farming system. Journal of International Academic Research for Multidisciplinary. 2015;3(7):319-28.
15. Behera UK. A textbook on farming systems. Udaipur, India. KK Publications. ISBN-13:978-8183213271.2014;1-273.
16. Gupta AK, Yadav D, Dungdung BG, Paudel J, Chaudhary AK, Arshad R. Integrated farming system (IFS) –A review. International Journal of Engineering Applied Sciences and Technology. 2020;4(9):134-37. https://doi.org/ 10.33564/IJEAST.2020.v04i09.016
17. Jayanthi C, Rangasamy A, Chinnusamy C. Water budgeting for components in lowland integrated farming systems. Madras Agricultural Journal. 2000;87(7-9):411-14. https://doi.org/https://doi.org/10.29321/maj.10.a00486
18. Martinho VJPD, Guiné RdPF. Integrated-smart agriculture: Contexts and assumptions for a broader concept. Agronomy. 2021;11(8):1568:1-21. https://doi.org/10.3390/agronomy11081568
19. Radhamani S, Balasubramanian A, Ramamoorthy K, Geethalakshmi V. Sustainable integrated farming systems for drylands: A review. Agricultural Reviews. 2003;24(3):204-10.https://arccarticles.s3.amazonaws.com/webArticle/articles/ar243007.pdf
20. Singh H, Meena GL, Sharma L, Jangid MK, Bhushan B, Manju. Resource use efficiency in integrated farming systems of Banswara district of Rajasthan. Journal of Animal Research. 2018;8(4):703-08. https://doi.org/10.30954/2277-940X.08.2018.24
21. Singh H, Sharma SK, Dashora LN, Jajoria D. Economics of farming system in South-East Rajasthan. International Journal of Extension Education and Rural Development. 2014;22:98-102. https://businessdocbox.com/Agriculture/95572390-Economics-of-farming-system-in-south-east-rajasthan.html
22. Zhang HL, Dang YP, Li L. Farming system: A systemic solution to sustainable agricultural development. Elsevier. Farming System. 2023;1(1):1-3. https://doi.org/10.1016/j.farsys.2023.100007
23. Liu X. Sustainable intensification: A historical perspective on China's farming system. Elsevier. Farming System. 2023;1(1):1-9. https://doi.org/10.1016/j.farsys.2023.100001
24. Holachi H, Arora HTS, Achar RR, Tulasidas VK. A sustainable way for integrated farming system: A case study on Bellary district of Karnataka, India. World Journal of Environmental Biosciences. 2023;12(1):10-15. https://doi.org/10.51847/Ucdm0q75V8
25. Singh VK, Rathore SS, Singh RK, Upadhyay PK, Shekhawat K. Integrated farming system approach for enhanced farm productivity, climate resilience and doubling farmers' income. The Indian Journal of Agricultural Sciences. 2020;90(8):1378-88. https://doi.org/10.56093/ijas.v90i8.105884
26. Singh PK, Rani R, Singh AC, Kumar A, Kumar S. Integrated farming systems; current status, scope and future prospects under Indian perspective. International Journal of Current Microbiology and Applied Science. 2022;11(9):14-26. https://doi.org/ 10.20546/ijcmas.2022.1109.003
27. Behera UK, France J. Integrated farming system and the livelihood security of small and marginal farmers in India and other developing countries. Elsevier. Advances in Agronomy. 2016;138:235-82. https://doi.org/10.1016/bs.agron.2016.04.001
28. Talaviya T, Shah D, Patel N, Yagnik H, Shah M. Implementation of artificial intelligence in agriculture for optimization of irrigation and application of pesticides and herbicides, Elsevier. Artificial Intelligence in Agriculture. 2020;4:58-73. https://doi.org/10.1016/j.aiia.2020.04.002
29. Ndayisaba PC, Kuyah S, Midega CAO, Mwangi PN, Khan ZR. Push-pull technology enhances resilience to climate change and prevents land degradation: Perceptions of adopters in Western Kenya. Elsevier. Farming System. 2023;1(2):1-11. https://doi.org/10.1016/j.farsys.2023.100020
30. Innazent A, Jacob D, Bindhu JS, Joseph B, Anith KN, Ravisankar N *et al*. Farm typology of smallholders integrated farming systems in Southern coastal plains of Kerala, India. Nature: Scientific Reports. 2022;12(333):1-14. https://doi.org/10.1038/s41598-021-04148-0