

International Journal of Agriculture Extension and Social Development

Volume 9; Issue 7; July 2026; Page No. 358-364

Received: 24-04-2026

Accepted: 28-05-2026

Indexed Journal

Peer Reviewed Journal

Nutrition garden interventions in improving production, dietary diversity and livelihood security

¹Geetha M Yankanchi, ²Kalpana B, ³Divya C and ⁴Naveenkumar GM

¹Scientist, AICRP on Women in Agriculture, University of Agriculture Sciences, Bangalore, Karnataka, India

²Professor and Head, AICRP on Women in Agriculture, University of Agriculture Sciences, Bangalore, Karnataka, India

^{3,4}Young Professional-2, AICRP on Women in Agriculture, University of Agriculture Sciences, Bangalore, Karnataka, India

DOI: <https://www.doi.org/10.33545/26180723.2026.v9.i7e.3879>

Corresponding Author: Geetha M Yankanchi

Abstract

Food insecurity and malnutrition remain critical challenges in developing countries, necessitating nutrition-sensitive agricultural interventions to enhance household food and livelihood security. The present study evaluated the impact of the Nutri-Smart Village (NSV) approach implemented under the All India Coordinated Research Project on Women in Agriculture (AICRP-WIA), University of Agricultural Sciences, Bengaluru, in five villages of Sidlaghatta taluk, Chikkaballapura district of Karnataka. An ex-post facto research design was followed with 150 farm families purposively selected as beneficiaries. The interventions included establishment of homestead nutrition gardens, promotion of millets and nutrient-rich crops, beekeeping, and mushroom cultivation. Data were collected through structured interviews before and after intervention and analyzed using percentage analysis and paired comparison tests. Results revealed substantial improvement in area under diversified crops, with green leafy vegetables increasing from 3.11 m² to 9.28 m² and other vegetables from 3.48 m² to 10.34 m². Production of green leafy vegetables increased from 10.58 kg/year to 46.41 kg/year, while other vegetables rose from 18.60 kg/year to 201.79 kg/year. Household consumption of nutritious food groups significantly improved, indicating enhanced dietary diversity and nutrition awareness. Newly introduced enterprises such as chia seeds, grain amaranth, millets, honey production, and mushroom cultivation contributed to both nutritional enhancement and livelihood diversification. Marketable surplus and income generation also improved considerably. The economic value of production increased from ₹2,844.19 to ₹26,123.81 after intervention. The study demonstrated that the Nutri-Smart Village approach effectively strengthens agriculture nutrition linkages, improves household food consumption, enhances income opportunities, and promotes sustainable livelihood security among small and marginal farm families.

Keywords: Nutri-smart village, nutrition-sensitive agriculture, nutri garden, dietary diversity, livelihood security, homestead farming.

Introduction

In recent times, agricultural productivity has improved; however, food insecurity continues to affect a significant proportion of the population, particularly in developing countries where access to adequate and nutritious food remains limited (FAO, 2014; Kumari *et al.*, 2019) ^[1, 2]. Recent estimates indicate that nearly two billion people experience moderate or severe food insecurity, while approximately 3.5 billion individuals suffer from different forms of malnutrition (FAO, 2022; WHO, 2022) ^[3, 4]. Further, globalization and rapid dietary transitions have increased the consumption of processed and fast foods, extending beyond urban centers into rural and tribal areas, thereby aggravating nutrition-related health challenges (Kaur *et al.*, 2022) ^[5]. In India, malnutrition remains a major public health concern. Findings from the National Family Health Survey (NFHS-5) ^[6] reveal the coexistence of undernutrition, micronutrient deficiencies, and rising prevalence of overweight and obesity, representing the country's triple burden of malnutrition. India continues to report one of the highest child wasting rates globally (19.3%) along with a high prevalence of child stunting (35.5%), indicating considerable regional and socio-economic disparities. The seriousness of the situation is

further reflected in India's ranking of 105th among 127 countries in the Global Hunger Index 2024, with a score of 27.3, categorized under a serious level of hunger. Recognizing these challenges, India has committed to achieving global nutrition targets under the World Health Assembly nutrition agenda and the Sustainable Development Goals aimed at eliminating hunger and all forms of malnutrition by 2030. National initiatives such as POSHAN Abhiyaan, launched in 2018, focus on improving nutritional outcomes among children, pregnant women, and lactating mothers through multisectoral convergence. Strengthening such initiatives requires closer integration between agriculture and nutrition systems, as agricultural production directly influences food availability, dietary diversity and household nutritional well-being. Farm women play a vital role in this linkage, acting as key agents connecting agricultural activities with household food preparation, consumption practices, and nutrition outcomes. Vegetable consumption in India remains considerably lower than the recommended level of 300 g per person per day. The current per capita availability is approximately 135 g per day, which is far below the quantity required for a balanced and nutritious diet. Consumption levels are even lower among rural households and economically weaker

sections, often falling below 40 g per person per day (Kumari *et al.*, 2019)^[7]. The reduced consumption of green leafy vegetables, fruits, indigenous fruits and vegetables can also be associated with decreased dietary diversity. Inclusion of green leafy vegetables and diverse horticultural crops can substantially improve dietary quality. In this context, promotion of nutri-gardens provides a practical and sustainable strategy to enhance household food and nutrition security. A nutri-garden is defined as a cultivation method focused on planting and harvesting nutrient-dense crops in close proximity to residences such as backyards, terraces, or rooftops to fulfill a family's annual nutritional requirements. (Salam, 2024)^[8]. Nutri gardens ensure year-round availability, accessibility, and stability of safe and nutritious food while promoting dietary diversity and addressing micronutrient deficiencies. They contribute to improved nutritional intake, additional income generation, efficient utilization of family labour and household resources, recycling of kitchen waste and wastewater, environmental sanitation, and enhanced participation of family members in nutrition-related activities (Kolekar, 2025)^[9]. For small and marginal farmers, particularly women, nutri gardens support diversified diets, livelihood resilience and improved household well-being (Mamgai *et al.*, 2021)^[10]. Operationalizing these principles at the community level, the Nutrition sensitive kitchen garden: Nutrigarden approach has emerged as an innovative model integrating agriculture, nutrition, and rural development. The programme, implemented under the All India Coordinated Research Project on Women in Agriculture (AICRP-WIA) at the University of Agricultural Sciences, Bengaluru, aims to strengthen the objectives of POSHAN Abhiyaan through nutrition-sensitive agricultural interventions. The NSV programme was implemented in selected villages of Sidlaghatta taluk of Chikkaballapura district in Karnataka state. Major interventions under the programme included promotion of protective foods to improve dietary diversity,

establishment of nutrition gardens for year-round availability of vegetables and fruits, to enhance household nutrition and income. Capacity-building programmes were also conducted to promote beekeeping, mushroom cultivation, and utilization of nutrient-dense foods. Continuous technical handholding, regular monitoring, and active community participation formed integral components of the intervention strategy, ensuring effective adoption and sustainability of nutrition-sensitive practices at the household level. In this context, the present study was undertaken to evaluate the contribution of homestead farming systems and nutrition-sensitive kitchen gardens interventions implemented under the Nutri-Smart Village approach toward enhancing household food and livelihood security in Karnataka. Specifically, the study examines changes in area under diversified crops, production of nutrient-rich food groups, household consumption patterns, and improvements in marketable surplus and income generation among participating farm households.

Materials and Methods

Study Area

The study was carried out in five villages Basavapattana, Bodhaguru, Hospete, Thippenahalli, and Yennaguru situated in Sidlaghatta taluk of Chikkaballapura district, Karnataka, India. The area belongs to the semi-arid agro-climatic zone, marked by irregular rainfall patterns, limited irrigation resources, and the dominance of small and marginal farmers. Agriculture and allied activities form the main source of livelihood for the rural households in the study region. These five villages, adopted under the Nutri-Smart Village Programme implemented by the University of Agricultural Sciences, Bengaluru, through the All India Coordinated Research Project on Women in Agriculture (AICRP-WIA), were purposively selected for the study and are illustrated in Figure 1.

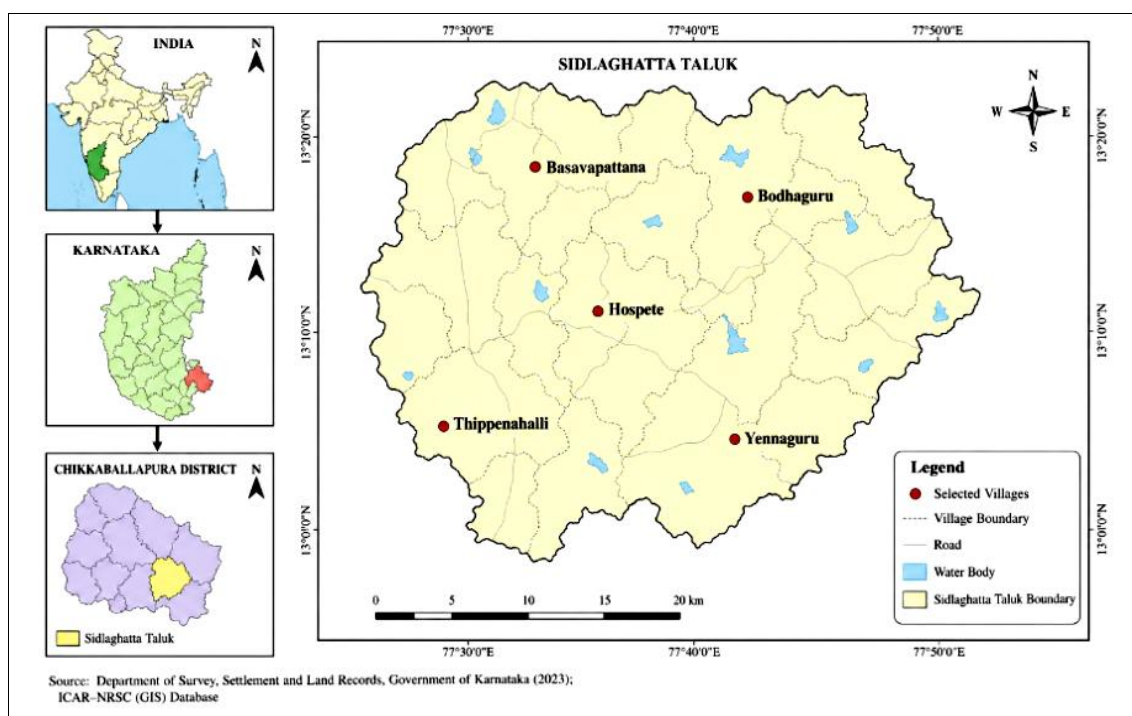


Fig 1: Geographical Location of the Study Area

Research Design

The study followed an ex-post facto research design to assess the impact of nutrition-sensitive agricultural interventions implemented under the Nutri-Smart Village (NSV) approach. The design enabled evaluation of changes in production, household consumption behaviour, and livelihood outcomes from nutri-rich crops following implementation of interventions.

Selection of Respondents

A total of 150 farm families were purposively selected for intervention under the Nutri-Smart Village programme based on their interest and willingness to adopt one or more nutrition-sensitive agricultural practices such as homestead

nutrition gardens, millet cultivation, backyard poultry rearing (Giriraja birds), beekeeping, and mushroom cultivation.

Nutri-Smart Village Interventions

The major interventions included promotion of diversified cropping systems with emphasis on millets and other nutrient-rich crops; establishment of homestead nutrition gardens to ensure year-round availability of diverse foods, along with promotion of beekeeping and mushroom cultivation; and introduction of Giriraja poultry birds as a subsidiary income-generating activity to enhance household nutrition and livelihood security.

List of vegetables and crops distributed under intervention

Season	Vegetables (Varieties)	Major Nutrients Present
Leafy Vegetables (All Seasons)	Amaranthus, Palak (Spinach), Dill/Sabbasige, Coriander, Methi (Fenugreek leaves), Harive	Iron, Calcium, Vitamin A, Folic acid, Dietary fibre
Summer Season Vegetables	Bhendi (Okra), Chilli, Tomato, Brinjal, Beans	Iron, Vitamin C, Anthocyanins, Fibre
Root Vegetables (Winter Season)	Radish, Carrot	Vitamin A (Beta-carotene), Anthocyanins, Fibre, Potassium
Creepers Vegetables (Rainy/Summer Season)	Yard Long Beans, Ridge Gourd, Bitter Gourd, Bottle Gourd	Vitamin A, Vitamin C, Anthocyanins, Dietary fibre, Minerals
	Millets	fibre, iron, calcium, and complex carbohydrates
	Bee keeping and Mushroom	Protein, B vitamins, and minerals
Fruit crops	Papaya, Guava, Lime, Fig fruit	Vitamins and minerals
Potential grains	Grain Amaranthus and Vegetable soyabean	Protein, dietary fibre, vitamins and minerals

Data Collection

Primary data were collected from beneficiary households using a pre-tested structured interview schedule. Baseline and post-intervention information was obtained through personal interviews and field observations.

Data were collected on:

- Area under diversified crops
- Production of nutrient-rich food groups
- Household consumption patterns
- Marketable surplus of produce
- Income generated from agricultural and allied activities

Variables and Measurement

Independent Variable

Participation of farm households in nutrition-sensitive agricultural interventions implemented under the Nutri-Smart Village programme.

Dependent Variables

The impact of the interventions was assessed using the following indicators:

1. Area under diversified crops (m²)
2. Production of nutrient-rich food groups (kg/year)
3. Household consumption of food groups (kg/year)
4. Marketable surplus (quantity sold) (kg/year)
5. Income generation from agricultural and allied activities (Rs./year)

Statistical Analysis

The collected data were analyzed using appropriate statistical tools, including percentage analysis, mean and standard deviation, percentage change analysis, and paired comparison of pre and post intervention values to assess the impact of the interventions.

Results and Discussion

Area under nutrition sensitive crops before and after intervention

Figure 1 presents the area under nutrition-sensitive crops and allied units before and after the interventions. The findings indicate a substantial increase in the cultivation of diversified and nutrition-rich crops following the intervention.

Prior to the intervention, the area under green leafy vegetables was 3.11 m², which increased to 9.28 m² after the intervention, indicating a considerable expansion in the cultivation of nutrient-rich leafy vegetables. Similarly, the area under other vegetables increased from 3.48 m² to 10.34 m², reflecting greater adoption of vegetable cultivation practices among the respondents. The cultivation area of roots and tubers also increased from 3.34 m² to 7.45 m², suggesting improved diversification in the cropping pattern. A notable improvement was observed in the cultivation of fruit crops, which increased from 0.24 m² before the intervention to 3.46 m² after the intervention, indicating enhanced awareness and adoption of fruit-based nutrition sources at the household level.

The intervention also facilitated the introduction of several new nutrition-sensitive crops that were not cultivated earlier. Chia seeds and grain amaranth, which were not grown before the intervention, recorded cultivation areas of 11.01 m² and 167.47 m², respectively, after the intervention. This highlights the successful promotion and adoption of these highly nutritious crops among the beneficiaries.

Similarly, millet cultivation was introduced after the intervention, with an average area of 0.53 acres, demonstrating increased emphasis on climate-resilient and nutrient-dense crops. In addition, allied nutrition-supporting activities such as beekeeping (0.29 units) and mushroom

cultivation (2.22 kg) were also initiated after the intervention, contributing to improved household nutrition and livelihood diversification. Further, vegetable soybean cultivation, which was absent before the intervention, was adopted with an average area of 1.52 m² after the intervention. The observed improvement is in line with the findings of Birdi and Shah (2015) ^[11], reported that the kitchen gardens in a specific area around the house increased from 52 per cent at baseline to 95 per cent at end-line. Similarly, kitchen gardens established in the field increased from 51 per cent to 87 per cent, while cultivation along walls and rooftops showed a substantial rise from 45 per cent to 96 per cent.

Table 2 illustrate the changes in household production, consumption, and sale of different food groups before and after implementation of the intervention programme.

Production of protective foods

Production of green leafy vegetables increased significantly from 10.58 kg/year at baseline to 46.41 kg/year after the intervention ($t = 18.92^*$), indicating improved adoption of nutrition garden practices and enhanced vegetable cultivation. Likewise, production of other vegetables increased substantially from 18.60 kg/year to 201.79 kg/year ($t = 13.59^*$), reflecting greater availability of inputs, improved management practices, and enhanced farmer participation. Production of roots and tubers also showed a significant rise from 12.37 kg/year to 62.32 kg/year ($t = 11.46^*$), highlighting diversification toward nutrient-rich crops. Fruit crop production increased from 8.86 kg/year to 33.55 kg/year ($t = 3.60^*$), suggesting gradual incorporation of horticultural crops into farming systems. Several potential crops such as chia seeds, grain amaranth, vegetable soybean mushroom cultivation and bee farming were absent prior to the intervention but recorded measurable production afterward. This indicates successful introduction and adoption of nutrition-sensitive and income-generating enterprises. Millet production exhibited a remarkable increase from 2.63 kg/year to 146.53 kg/year ($t = 15.36^*$), emphasizing renewed cultivation of traditional nutri-cereals. The findings of Ferdous (2016) ^[12] are in agreement with the results of the present study. The study reported that seasonal production was highest during the Rabi season, recording outputs of 224.6, 269.6, and 271.6 kg per farm among landless, marginal, and small farmers, respectively. This was followed by the Kharif-II season, with production levels of 121.9 kg per farm for landless farmers, 136.1 kg for marginal farmers, and 141.6 kg for small farmers.

Consumption Pattern

Utilization of green leafy vegetables grown in nutri garden for household consumption increased from 8.52 kg/year to 36.17 kg/year ($t = 17.95^*$), indicating improved dietary diversity and awareness regarding balanced nutrition. Consumption of other vegetables rose considerably from 13.11 kg/year to 153.41 kg/year ($t = 8.71^*$), while roots and tubers consumption increased from 10.44 kg/year to 49.26 kg/year ($t = 8.92^*$). Increased household production appears to have contributed directly to enhanced consumption. Fruit consumption improved from 4.28 kg/year to 20.06 kg/year, demonstrating gradual positive dietary behaviour change. Newly introduced food groups such as chia seeds, grain

amaranth, honey, mushroom, and vegetable soybean also showed significant increase in consumption from zero baseline levels, reflecting successful acceptance of diversified and nutritious foods. Millet consumption increased notably from 1.13 kg/year to 59.43 kg/year ($t = 11.84^*$), strengthening household nutritional security. Comparable findings were reported by Kumari *et al.* (2019), who observed that vegetable consumption increased from 53 to 87 per cent following the introduction of a nutri-garden. Similarly, Patil (2020) ^[13] reported a significant improvement in the percentage adequacy of average food consumption after nutri-garden implementation, with consumption levels across different food groups increasing by 4 to 34 per cent. In line with these findings, Chikkanna (2022) ^[14] documented a marked enhancement in vegetable consumption after the nutri-garden intervention. The intake of green leafy vegetables increased from 1.45 to 3.16, tuber crops from 3.75 to 5.56, and other vegetables from 5.54 to 7.25, reflecting improved availability and regular utilization of diverse vegetables in household diets. This contributed to enhanced dietary diversity and nutritional security among farm families.

Consistent results were also reported by Birdi and Shah (2015) ^[11], who found that the consumption of green leafy vegetables increased from 33.6 g in winter 2011 to 80.5 g in winter 2012, although intake declined during summer seasons (15.1 g in 2012 and 17.6 g in 2013), indicating seasonal variations in availability. Similarly, roots and tubers consumption improved from 46.8 g to 69.7 g during winter but decreased in summer, while the intake of other vegetables rose from 53 g to 97.8 g in winter with relatively stable summer consumption patterns. The findings of Bushamuka *et al.* (2005) ^[15] also support the present study, reporting significantly higher vegetable consumption among active households (85 kg) compared to control households (38 kg) ($p < 0.001$), indicating improved household access to nutritious foods. Further, Ferdous (2016) ^[12] observed that vegetable consumption was highest among small farmers (316.2 kg/year), followed by marginal farmers (296.9 kg/year) and landless farmers (218.2 kg/year). A similar trend was noted in per capita intake, with small farmers consuming 79.1 kg/year, marginal farmers 59.3 kg/year, and landless farmers 54.6 kg/year. Overall, vegetable consumption declined with decreasing farm size, likely because landless farmers marketed a larger share of their produce to meet household financial needs, resulting in lower quantities retained for home consumption.

Sale of Produce

The intervention also facilitated marketable surplus and income enhancement. Sale of green leafy vegetables increased from nil to 1.13 kg/year ($t = 4.28^*$), and sale of other vegetables increased from 1.47 kg/year to 17.11 kg/year ($t = 2.28^*$). Similarly, sales of roots and tubers increased from zero to 3.01 kg/year ($t = 3.40^*$), while fruit crop sales rose from 3.40 kg/year to 7.67 kg/year ($t = 1.74^*$). Newly introduced enterprises such as chia seeds, grain amaranth, honey, and mushroom cultivation generated additional income opportunities through surplus marketing. Millet sales showed a substantial increase from 0.93 kg/year to 77.43 kg/year ($t = 14.64^*$), indicating growing economic importance of nutri-cereals. Honey and mushroom

enterprises further contributed to diversification of livelihood options among rural households.

Economic value of production, consumption and net income of the family before and after the intervention

The figure 2 indicate the economic value of production, consumption and net income of the family after the intervention. The economic value of production increased markedly from Rs.2844.19 before the intervention to Rs.26123.81 after the intervention, indicating a significant enhancement in the productivity of nutrition garden crops and other introduced enterprises. Similarly, the economic value of consumption increased from Rs.2077.92 to Rs.16242.09, suggesting that the families were able to consume more of the produce from their nutrition gardens, thereby improving household food and nutritional security while reducing market dependency. The net income of the family also showed a remarkable increase from Rs.2501.25 before the intervention to Rs.23131.24 after the intervention, reflecting the positive economic impact of the intervention. Overall, the findings reveal that the intervention significantly enhanced the economic returns of the households by increasing production, promoting self-

consumption and generating higher net income for the families. The findings of Bushamuka *et al.* (2005) ^[15] support the results of the present study, reporting that nearly 64 per cent of active households generated a median garden income of 347 taka, which was primarily spent on food expenses, compared to only 25 per cent of control households earning about 200 taka. This highlights the positive contribution of homestead gardening to household food security and income generation. Similarly, Bhavani (2024) ^[15] reported that vegetable production under the nutri-garden generated a total net income of ₹30, 592.09 during the Kharif season with an average net income of ₹611.84, while the Rabi season recorded a total net income of ₹26, 604.78 with an average net income of ₹532.10, indicating relatively higher economic returns during the Kharif season. In another study, Karuppaswamy (2021) ^[16] reported that the total net income generated from demonstrated vegetable crops was ₹2, 76, 600. Likewise, Kumari *et al.* (2019) ^[2] documented that vegetables grown in nutri-gardens generated an annual net income of ₹10, 756.48, demonstrating the economic viability of nutri-garden interventions in enhancing household livelihoods.

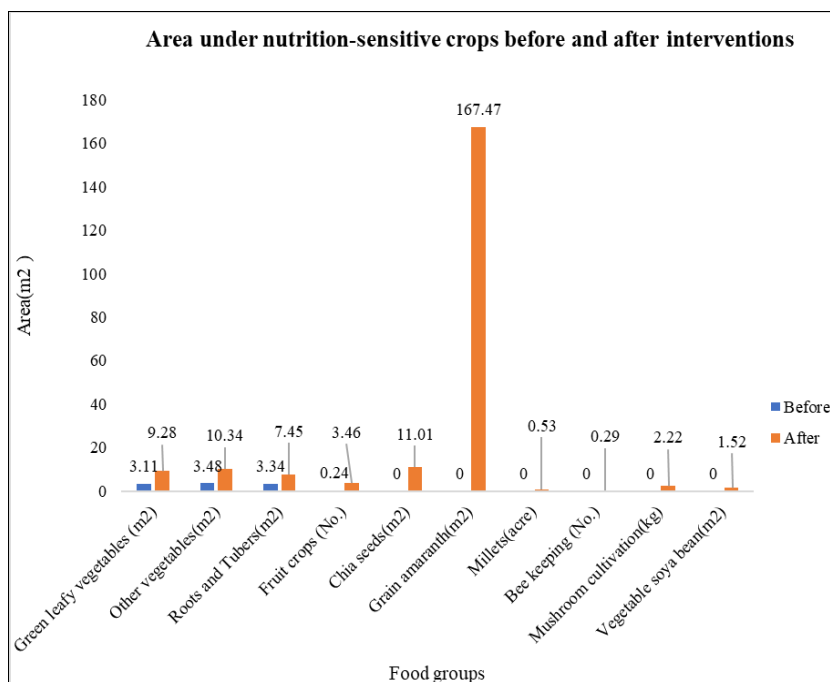


Fig 1: Area under nutrition-sensitive crops before and after interventions

Table 2: Production, consumption and sale of potential grains, fruits and vegetables before and after interventions

#	Food groups	Production			Consumption			Sale		
		Before (kg/year)	After (kg/year)	t-value	Before (kg/year)	After (kg/year)	t-value	Before (kg/year)	After (kg/year)	t-value
1	Green leafy vegetables	10.58	46.41	18.92*	8.52	36.17	17.95*	0.00	1.13	4.28*
2	Other vegetables	18.60	201.79	13.59*	13.11	153.41	8.71*	1.47	17.11	2.28*
3	Roots and Tubers	12.37	62.32	11.46*	10.44	49.26	8.92*	0.00	3.01	3.40*
4	Fruit crops	8.86	33.55	3.60*	4.28	20.06	0.80*	3.40	7.67	1.74*
5	Chia seeds	0.00	1.41	4.77*	0.00	0.56	10.41*	0.00	0.59	4.78*
6	Grain amaranth	0.00	5.45	9.71*	0.00	2.94	9.96*	0.00	1.74	6.39*
7	Millets	2.63	146.53	15.36*	1.13	59.43	11.84*	0.93	77.43	14.64*
8	Honey	0.00	1.70	6.24*	0.00	0.92	18.84*	0.00	0.22	41.64*
9	Mushroom cultivation	0.00	2.73	12.76*	0.00	1.97	15.15*	0.00	0.27	4.24*
10	Vegetable soya bean	0.00	0.47	16.33*	0.00	0.31	18.55*	0.00	0.00	0

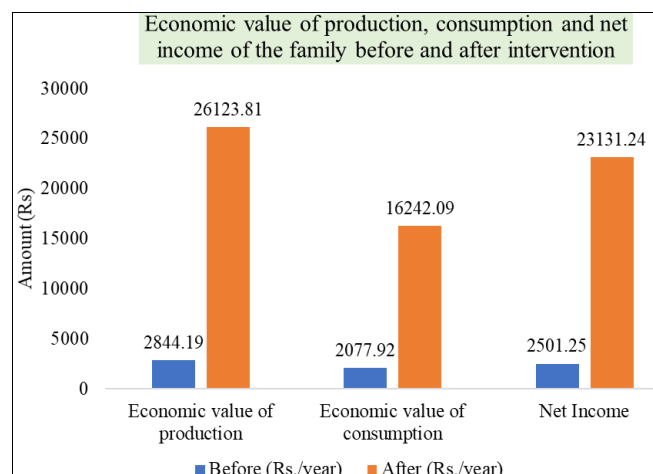


Fig 2: Economic value of production, consumption and net income of the family before and after intervention

Conclusion

The findings of the study indicated that nutrition-sensitive agricultural interventions implemented under the Nutri-Smart Village approach significantly improved household food consumption and livelihood security. Promotion of homestead nutrition gardens and diversified farming systems enhanced the cultivation of nutrient-dense crops, resulting in increased production, improved consumption patterns, and greater dietary diversity among participating farm families. The introduction of millets, green leafy vegetables, fruits and allied enterprises such as beekeeping and mushroom cultivation not only strengthened household nutritional intake but also generated additional income through marketable surplus. The substantial increase in economic value of production, household consumption, and net income highlights the effectiveness of integrating agriculture with nutrition and livelihood interventions. The study emphasizes the critical role of farm women as agents of change in linking agricultural production with household nutrition outcomes. Continuous capacity building, technical support, and community participation were key factors contributing to successful adoption and sustainability of the interventions. Overall, the Nutri-Smart Village model emerges as a scalable and sustainable strategy for addressing malnutrition, enhancing dietary diversity, and improving rural livelihoods. Wider replication of such nutrition-sensitive agricultural programmes can contribute significantly toward achieving national nutrition targets and the Sustainable Development Goals related to zero hunger and improved well-being.

Acknowledgement

The authors sincerely acknowledge the financial support, guidance, and technical assistance provided by the ICAR-Central Institute for Women in Agriculture (ICAR-CIWA), Bhubaneswar, for facilitating the conduct of this study. The authors also express their gratitude to the University of Agricultural Sciences, Bengaluru, for providing the necessary facilities and institutional support for carrying out the research successfully. The cooperation and valuable information provided by the farm women respondents of the study area are gratefully acknowledged.

Conflict of interest: None

References

- Food and Agriculture Organization of the United Nations. Guidelines for assessing nutrition-related knowledge, attitudes and practices. Manual 473. Rome: FAO; 2014.
www.fao.org/docrep/019/i3545e/i3545e00.htm.
- Kumari P, Mustafa MD, Somvanshi SPS, Singh C, Kumar P. Nutri-garden for sustainable food security and nutritional diversity in Hamirpur district of Bundelkhand Region (UP). 2019;55(4):107-113. doi:10.48165/.
- Food and Agriculture Organization of the United Nations. The state of food security and nutrition in the world. Rome: FAO; 2022.
<https://www.fao.org/emergencies/resources-repository/videos/detail/state-of-food-security-and-nutrition-in-the-world-2022/en>.
- World Health Organization. Monitoring health for the SDGs, sustainable development goals. Geneva: WHO; 2022.
<https://www.who.int/publications/i/item/9789240051157>.
- Kaur P, Borah PK, Uike PV, Mohapatra PK, Das NK. Non-communicable diseases as a major contributor to deaths in 12 tribal districts in India. Indian Journal of Medical Research. 2022. doi:10.4103/ijmr.ijmr_3332_21.
- International Institute for Population Sciences, ICF. National Family Health Survey (NFHS-5), India, 2019-21. Mumbai: International Institute for Population Sciences; 2021.
- Salam S. Nutrition sensitive agriculture: extension's contribution to public health. Extension Vistas: Advances in Agriculture Extension. 2024;161.
- Kolekar DV, Bhavana A, Yamuna N. Nutri garden: approach to enhance food and nutritional security of farm families. Mysore Journal of Agricultural Sciences. 2025;59(1):139-149.
- Mangai R, Meena BL, Sahu MP. Model nutrition garden: an approach for nutritional security of farm families. International Journal of Plant and Soil Science. 2021;33(24):253-259. doi:10.9734/ijpss/2021/v33i2430715.
- Birdi TJ, Shah SU. Implementing perennial kitchen garden model to improve diet diversity in Melghat, India. Global Journal of Health Science. 2015;8(4):10-22. doi:10.5539/gjhs.v8n4p10.
- Ferdous Z, Datta A, Anal AK, Anwar M, Khan AMR. Development of home garden model for year-round production and consumption for improving resource-poor household food security in Bangladesh. NJAS-Wageningen Journal of Life Sciences. 2016;78:103-110. doi:10.1016/j.njas.2016.05.006.
- Patil P. Nutri garden: a low cost sustainable approach to improve nutritional security of farm families. International Journal of Current Microbiology and Applied Sciences. 2020. doi:10.20546/ijcmas.2020.911.440.
- Chikkanna GS, Shashidhar KR, Jyothi K, Ambika DS. Development of organic nutri-gardens to enhance food and nutritional security in farm families. 2022.

14. Bushamuka VN, de Pee S, Talukder A, Kiess L, Panagides D, Taher A, *et al.* Impact of a homestead gardening program on household food security and empowerment of women in Bangladesh. *Food and Nutrition Bulletin*. 2005;26(1):17-25.
doi:10.1177/156482650502600102.
15. Bhavani G, Anitha R, Syed SAQA. Economic benefit from nutrigarden to farmwomen of Wanaparthy District, Telangana, India. *Archives of Current Research International*. 2024;24(4):203-211.
doi:10.9734/acri/2024/v24i4680.
16. Karuppasamy P. Nutriguarden – a way forward for enhancing farmer's income and household nutritional security. *Journal of Krishi Vigyan*. 2021;9(2):159-162.
doi:10.5958/2349-4433.2021.00030.1.