

Gender Sensitive Agri-Horti Cropping System Model for addressing Livelihood, Nutrition and Entrepreneurship

Lipi Das | Gayatri Moharana | Ankita Sahu | Praveen Jakhar
Rabi Sankar Panda | Subrat Pattanaik | Soumya Ranjan Pradhan

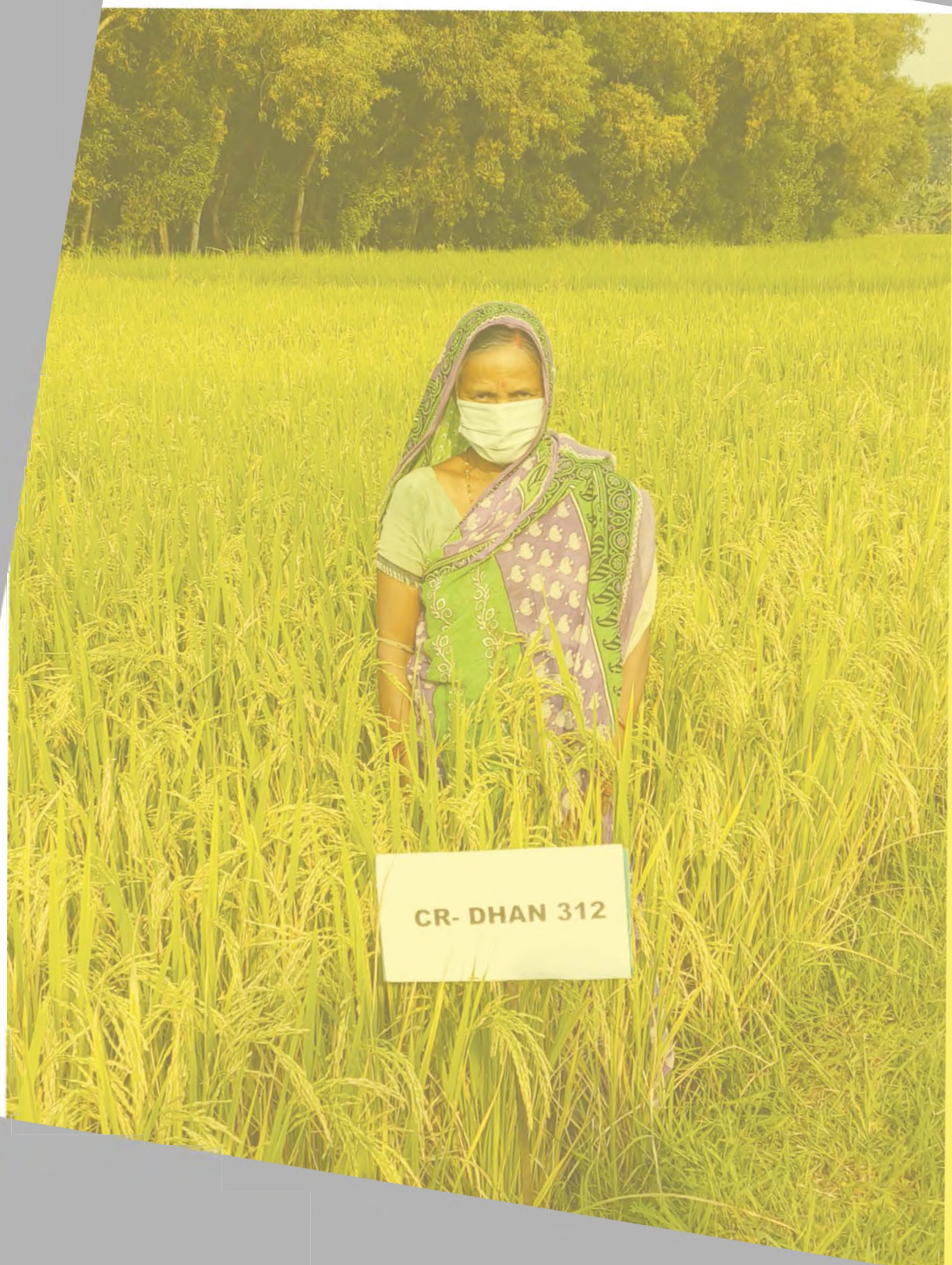


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PREFACE

Women farmers are one of the major stakeholders of the agriculture sector and play a predominant role in various on-farm and off-farm activities. They shoulder many responsibilities and can play an instrumental role in transforming the face of agriculture. However, the prevailing societal rules and taboos create a perceptible gender gap which prevents women to achieve their potential contribution in agriculture. In India, farm women comprise 33 per cent of agricultural labour force and 48 per cent of self-employed farmers. Nearly, 85 per cent of rural women are engaged in agriculture but on an average only 13 per cent of them own land (OXFAM 2018). The magnitude of women's work participation in agriculture is often curtailed by prevailing socio-cultural taboos which create perceptible gender disparity. The traditional patriarchal customs, norms and taboos have relegated women to a secondary status within the household and workplace which has resulted in a huge gender gap. As a matter of concern, India despite of achieving high rates of economic growth in recent year was ranked at 112th position among 153 countries in Global Gender Gap Index in 2020 as against 108th rank in 2017. Its global Gender Parity Score is 0.668, which represents an 'extremely high' level of gender inequality thereby resulting in its poor performance on gender related assessments despite being a large geographical entity with enormous natural resources.

According to FAO, if women farmers are given equal access to productive resources as men, the agricultural production could increase by 20-30 per cent, which could raise total agricultural output in developing countries by 2.5-4 per cent and in turn would reduce the number of hungry people in the world by 12-17 per cent or 100 to 150 million people. Realizing the profound significance of women farmers, it is obvious to improve their work efficiency by providing them an encouraging environment for better work performance. The 17 Sustainable Development Goals (SDGs) which are intended to achieve a better and more sustainable future have prioritized the significance of reducing the gender gap and have designated Gender Equality as the 5th SDG (UNDP, 2015). Considering the significance of holistic development of agriculture, ensuring gender equality and equity is important. Hence, it is imperative to identify and assess critical gender gaps which will serve as a fundamental basis on which gender-sensitive programs and approaches can be designed. Closing the gender gap in agriculture would generate significant economic outcomes not only in the agriculture sector but also for the society as a whole by ensuring nutrition and livelihood security. I appreciate the efforts of the authors in bringing this publication which will be immensely useful to the researchers, academicians, bureaucrats, extension workers, farming community and other relevant stakeholders.



(Anil Kumar)
Director

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APPROACH OF THE RESEARCH PROJECT

Women Empowerment and Gender Sensitization-Developing a Model for Bridging Gender Gap is a NASF funded project intended for reducing the gender gap in rural areas for promoting gender sensitization and women empowerment in agriculture with the I.C. College of Home Sciences, CCS Haryana Agricultural University, Hisar, Haryana as the lead centre and ICAR-Central Institute for Women in Agriculture, Bhubaneswar as the cooperating centre.

The traditional patriarchal customs, norms and taboos have relegated women to a secondary status within the household and workplace which has resulted in a huge gender gap. As a matter of concern, India despite of achieving high rates of economic growth in recent year was ranked at 112th position among 153 countries in Global Gender Gap Index in 2020 as against 108th rank in 2017. Its global Gender Parity Score is 0.668, which represents an 'extremely high' level of gender inequality there by resulting in its poor performance on gender related assessments despite being a large geographical entity with enormous natural resources.

With the strategy to reduce the gender gap and to boost women's empowerment, the Government of India has initiated a number of policies, programmes and schemes in last five decades including the most recent '*Beti Bachao Beti Padhao*' scheme. Despite all attempts, a considerable gender gap still exists and is continuously widening. These gaps are rather more prevalent in rural areas. This implies that there is additional research needs on these issues with a focus on region specific solutions. Present existing strategies need to be refined and strengthened for ensuring gender sensitization and in promoting women empowerment.

Women contribute an enormous workforce in Indian agriculture, comprising of an average 43 percent of the agricultural labour force. Women as farmers, workers and entrepreneurs face severe constraints than men in accessing productive resources, markets and services. This “gender gap” hinders their efficiency, reduces their contributions in agriculture sector and to the overall achievement of broader economic and social development goals. Closing the gender gap in agriculture would generate significant economic outcomes not only in agriculture sector but also for the society as a whole by ensuring nutrition & livelihood security thereby promoting the overall economic growth. This research project will help in achieving advanced scientific knowledge in the field of gender issues in agriculture by providing the following outcomes:

- A database depicting the true picture of existing gender gaps among agrarian population in relation to prevailing educational attainment, nutritional level, economical independence etc.
- Statistically supported gender gap profile in agriculture which will serve the basis for developing solution oriented work plan specific for the region.
- Documented experiences of experts in this field among different stakeholders from different regions to strengthen the strategies to overcome gender issues and bridge gender gap in agriculture.
- A model for reducing gender gaps in rural families and Gender Sensitive Extension Model for researchers, academicians and policy makers.
- Implications for designing gender friendly technologies and suitable inputs for formulating gender sensitive Govt. schemes and policies.

Objectives

1. To identify and assess gender gap indicators for analyzing gender disparity in rural areas.
2. To design and develop a Gender Sensitive Schematic Extension Model for addressing social and technological issues.
3. To optimize technological interventions for drudgery reduction and promoting empowerment of rural women.
4. To assess the impact of the interventions in bridging the gender gap.

RESEARCH ACHIEVEMENTS

ICAR-Central Institute for Women in Agriculture, Bhubaneswar being the cooperating centre, conducted the proposed study in a cluster of two villages viz., Sankilo and Tentulpur villages under Nischintakoili block of Cuttack district of Odisha. The villages span its geographical area of 107 ha. and 100 ha., respectively at latitude 20.286092 N and longitude 86.41507 E. The areas are characterized by hot, dry, sub-humid ecosystem with hot summer and mild winter. The mean annual rainfall is 1434 mm with majority of total annual rainfall is received during July-October. Soil type prevailing in the village include of sandy loam and loam.

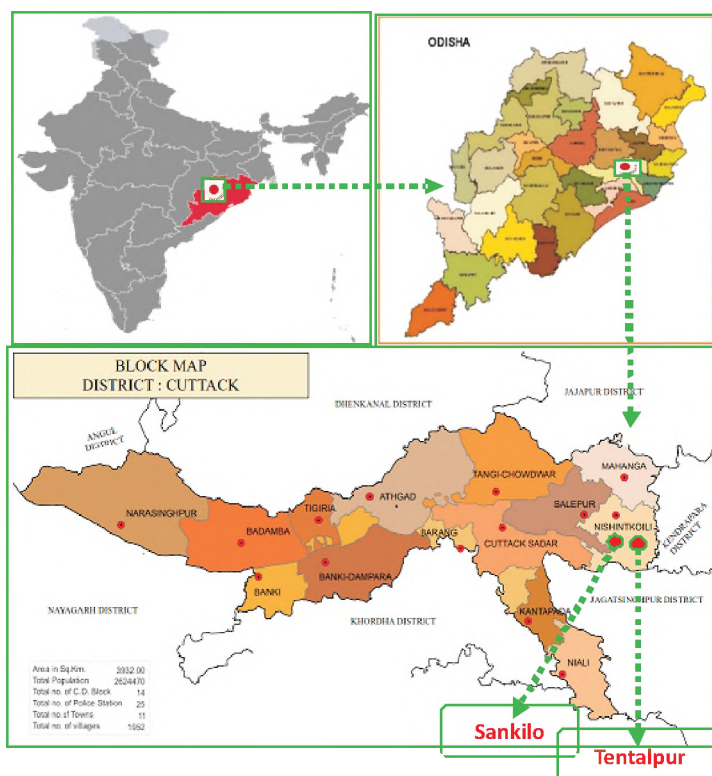


Fig 1: Locale of the Study (Village-Sankilo and Tentulpur)

Sources of Data

The qualitative and quantitative data related to socio-economic determinants, level of farm mechanization in agriculture, pronounced drudgery of farm women, information pertaining to social aspects, health & nutrition well-being, environment, economic and technological aspects were collected through a semi-structured interview schedule based upon SHEET module followed by concurrent farmers-scientists' interface, personal interaction, brainstorming sessions, focused group discussion from a sample comprising of 40 farm families in the selected villages through home and farm survey. The gender angle was analyzed based upon Gender-Sensitive, Gender-Based and Gender-Aware approach of analysis.

Approach of the Study

The fundamental concept of the project is to promote Women Empowerment and Gender Sensitization by bridging the gender gap. Therefore, it was essential to assess the existing gender sensitivity and identify the critical areas where gender disparity exists which would serve as the vital gender gap indicators and help in designing a suitable Gender Sensitive Extension Model as well as guide in formulating a schematic work plan for action research in bridging the gender gap for promoting Women Empowerment and Gender Sensitization.

The following approach for conducting Gender Analysis was adopted:

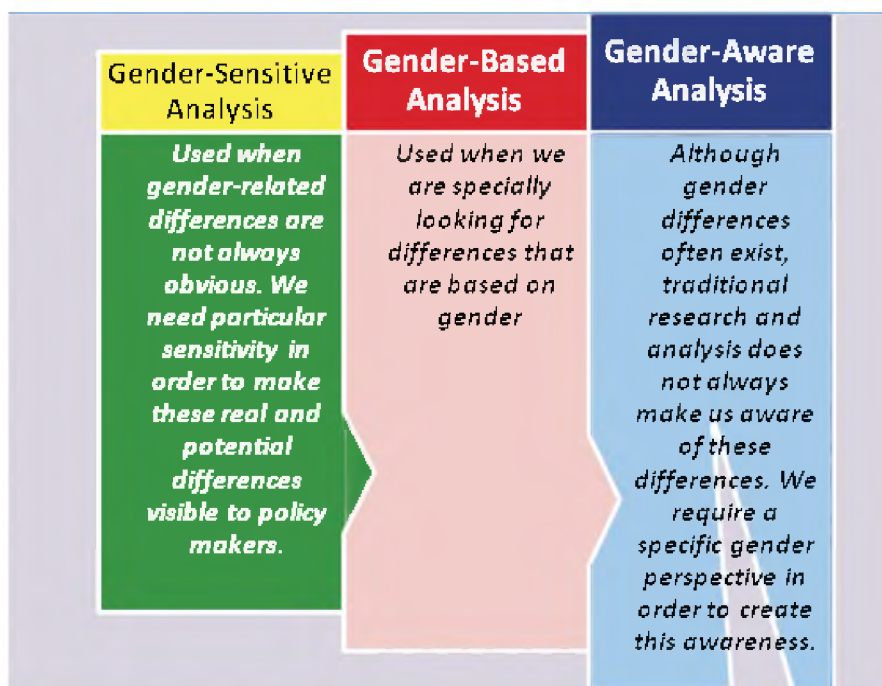


Fig 2: Gender Analysis Approach

Each of these terms emphasizes a different aspect of gender analysis, but they are often used interchangeably. The following approach is highly effective in identifying the Gender-sensitive indicators which provides measurement of gender-related changes over time.



Research Design

The Random Sampling method was adopted and 40 farm families were selected from the two villages.

Socio-Technological Gaps, Problems Identification & Prioritization, Priority Areas and Outcomes:

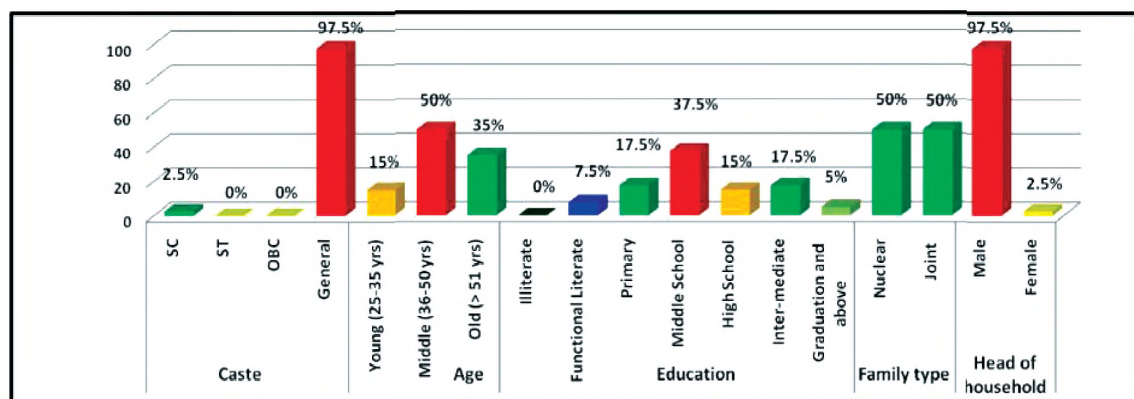
As a part of the strategy to reduce the gender gap and to boost women's empowerment in agriculture the following socio-technological gaps, problems, priority areas and outcomes have been identified which are given in the following tabular form.

S. No.	Socio-Technological Gaps	Problems	Priority Areas Undertaken	Outcomes
1.	Existing widening gender gap among the agrarian population	Poor status of rural farm women with respect to health, nutrition, educational attainment, social, political, economic and technological aspects.	Workshop, interface meetings and brainstorming sessions to assess and finalize the critical gender gap indicators with respect to Social, Health & nutrition, Environmental, Economic and Technological (SHEET Framework)	Implication of the identified gender gap indicators in designing Gender Sensitive Extension Model, policy framework, Govt. schemes and policies.
2.	Negligible degree of Gender Sensitivity in existing extension models	Wide gender disparity in rural areas Lower access of women farmers to Govt. schemes, financial aids, subsidies and other extension services Less exploitation of available resources, lack of marketing facility and locale-based cropping pattern	Workshops, brain storming sessions, interface etc. SWOT analysis of women farmers, existing extension models PESTLE analysis (political, economic, social, technological, legal and environmental) of village and prevailing extension services through gender lens	Gender Sensitive Extension Model for researchers, academicians and policy makers
3.	Poor nutritional security and livelihood opportunities of rural women	Low nutritional status of farm families and less income of rural farm women	Agro-horti-enterprise based model to be demonstrated and implemented in farmer's field through participatory action research Training on health, nutrition and well-being to rural families	Nutritional Security and livelihood improvement of farm families through Gender Sensitive Agri-horti Cropping System Model

S. No.	Socio-Technological Gaps	Problems	Priority Areas Undertaken	Outcomes
4.	Immense drudgery of women farmers	Poor level of mechanization in agriculture Pronounced drudgery of farm women Lack of timely availability of women friendly farm tools and implements	On-farm demonstration of Women friendly tools and equipments in paddy and horticultural crops. Development of women centric custom hiring centres for various small tools & implements	Improved work efficiency and reduced drudgery of rural women
5	Poor self-employment skills and economic empowerment of women	Lack of awareness, lower levels of skill and technical competency of rural women	Skill based training programmes, capacity building, on-farm trials and demonstrations on women friendly technologies in primary and secondary agriculture	Enhancement in skill level of women farmers to initiate new ventures in agriculture and allied sectors
6.	Lower degree of gender sensitivity in rural families	Poor status of rural women in farm and non-farm sectors	Gender sensitization workshops in rural areas	Improved gender sensitivity level of rural families

Socio-economic Profile

The study was conducted in Sankilo and Tentapur villages of Nischintakoili block under Cuttack district of Odisha. The socio-economic data was collected from 40 farm families. The findings revealed that majority (97.5%) of respondents belonged to general caste; middle age (36-50 years) category (50%); having education level up to middle school level (37.5%); majority (97.5%) had male headed family and as per family size is concerned 40 percent respondents had more than 6 no. of family members size. The major family occupation are farming (95%); majority (52.5%) had land holding of 1-2 acres and belonged to annual income category of Rs. 50,000-1 lakh (45%).



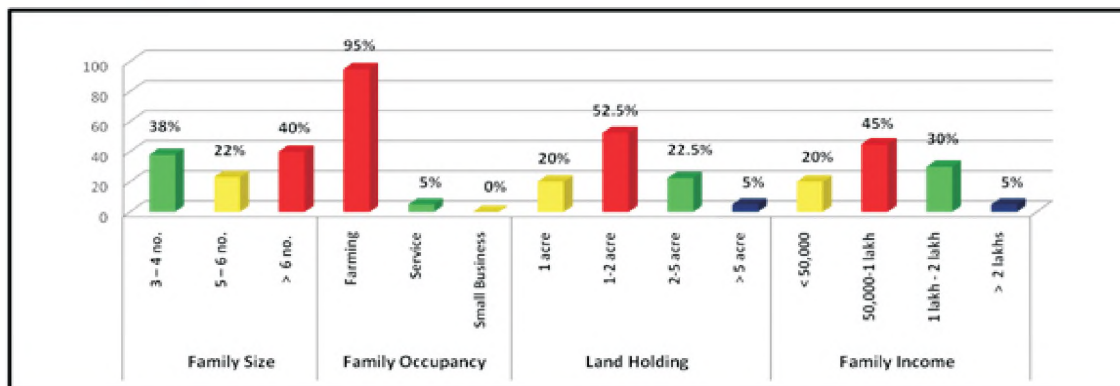


Fig 3: Socio-economic Profile of Farm women

Table-1: Socio-economic Profile of Farm women (N=40)

Sl. No.	Variable	Category	Frequency	Percentage
1.	Caste	SC	1	2.5
		ST	0	0
		OBC	0	0
		General	39	97.5
2.	Age	Young (25-35)	6	15
		Middle (36-50)	20	50
		Old (> 51)	14	35
3.	Education	Illiterate	0	0
		Functional literate	3	7.5
		Primary	7	17.5
		Middle school	15	37.5
		High school	6	15
		Intermediate	7	17.5
		Graduation and above	2	5
4.	Family Type	Nuclear	20	50
		Joint	20	50
5.	Head of Household	Male	39	97.5
		female	1	2.5
6.	Family Size	3-4 no.	15	38
		5-6 no.	9	22
		> 6 no.	16	40
7.	Family Occupation	Farming	38	95
		Service	2	5
		Small business	0	0
8.	Land Holding	1 acre	8	20
		1-2 acre	21	52.5
		2-5 acre	9	22.5
		> 5 acre	2	5
9.	Family Income	<50,000	8	20
		50,000-1 lakh	18	45
		1 lakh – 2 lakh	12	30
		>2 lakh	2	5

1. Identifying and Prioritizing the Critical Gender Gap Indicators for analyzing gender disparity in rural areas using the SHEET Module

The critical gender gaps in five fundamental pillars to holistic development viz., Social, Health, Economic, Environmental and Technological (SHEET) facets have been identified and prioritized.

a. Socio-cultural Aspects

The critical examination of the societal issues in the studied area provides an understanding of some major prevailing gender gap pertaining to Social aspects, amongst which, the prioritized gap is wage rate issue, which scored the least mean score. Nearly (82.5%) of the population realized that sometimes male and female get equally paid for same amount of work done. The other prioritized gender gap in social aspect highlighted the lack of leadership position of women in society and issues of equal access to education by men and women. Substantial gender gaps in access and control continue to exist because of social taboos with respect to six fundamental resources and inputs for agriculture: land, labour, credit, information, extension, and technology.

Table-2: Existing gender gap and associated constraints in socio-cultural aspects (N=40)

S. No.	Aspects	Sometimes (< 30%) (1 score)	More Frequently (30-60%) (2 score)	Always (> 60%) (3 score)	Mean Score	Ranking*
1.	Women are exclusively meant for shouldering all domestic activities	5 (12.5)	7 (17.5)	28(70.0)	2.58	VI
2.	Women are at par with men in participating social activities	4 (10.0)	24 (60.0)	12 (30.0)	2.20	V
3.	Male and female have equal access to education	6 (15.0)	28 (70.0)	6 (15.0)	2.00	III
4.	Women are at par with men in holding leadership position in the society	23 (57.5)	13(32.5)	4 (10.0)	1.53	II
5.	Taking Care of children should be shared equally by both men and women	11 (27.5)	14 (35.0)	15 (37.5)	2.10	IV
6.	Male and female get equally paid for same amount of work done	33 (82.5)	4 (10.0)	3 (7.5)	1.25	I

(The numbers in the parentheses indicate percentage; *Lower Mean Score indicates higher Ranking which reflects the existing gender gap is more in that particular aspect)



b. Health & Nutrition Security Aspects

In the context of Health and nutrition security aspect, the dominant gender gap assessed was BMI (Body Mass Index) related issue, wherein the majority of farm women (92.5%) reported that sometimes the BMI (Body Mass Index) of a female is at par with the recommended BMI, followed by higher nutritional deficiency-related problems among them.

Table-3: Gender gap in context of Health & Nutrition Security aspects (N=40)

S. No.	Aspects	Sometimes (< 30%) (1 score)	More Frequently (30-60%) (2 score)	Always (> 60%) (3 score)	Mean Score	Ranking*
1.	Male and female get equal information on health from Anganwadi/primary health workers	1(2.5)	2 (5.0)	37 (92.5)	2.90	VI
2.	Women get support with several facilities of maternity related aids	4 (10.0)	4 (10.0)	32(80.0)	2.70	V
3.	Women face higher nutritional deficiency related problems (viz., calcium, iron, iodine deficiency etc.) than men	8 (20.0)	30 (75.0)	2 (5.0)	1.85	II
4.	Women are at par with men in dietary pattern	10 (25.0)	21(52.5)	9(22.5)	1.98	III
5.	Female participation is more important than male in vaccination of their children	9 (22.5)	7 (17.5)	24 (60.0)	2.38	IV
6.	BMI (Body Mass Index) of female is at par with recommended BMI	37 (92.5)	3(7.5)	0 (0.0)	1.08	I

(The numbers in the parentheses indicate percentage; *Lower Mean Score indicates higher Ranking which reflects the existing gender gap is more in that particular aspect)

c. Environmental Aspects

In the facet of Environmental aspects, the prioritized gender gap was equal access, control over land and water, where the majority of respondents (72.5 %) reported that hardly men and women have equal access and control over these resources. Following the access and control over land and water, the next ordered gender gap pertain to knowledge and participation in waste management, which is emerging as a critical global issue. The gap implies the significance of women's participation in waste management practices which can be strengthened with knowledge enhancement and skill-up gradation.

Table-4: Gender disparity in context of Environmental aspects and related prioritized constraints.
(N=40)

S. No.	Aspects	Sometimes (< 30%) (1 score)	More Frequently (30-60%) (2 score)	Always (> 60%) (3 score)	Mean Score	Ranking*
1.	Men and women have equal access & control over forest & its products (fire wood, bamboo, timber, fodders, etc.)	4 (10.0)	26 (65.0)	10 (25.0)	2.15	VI
2.	Conservation of primitive varieties and landraces of agricultural crops is done solely by women	10 (25.0)	25 (62.5)	5 (12.5)	1.88	III
3.	Men and women have equal awareness towards harmful effects of chemical fertilizers & pesticides	6 (15.0)	28 (70.0)	6 (15.0)	2.00	V
4.	Both men and women understand the importance of sustainable agriculture	10 (25.0)	24 (60.0)	6 (15.0)	1.90	IV
5.	Men and women have equal knowledge and participation in waste management	10 (25.0)	27 (67.5)	3 (7.5)	1.83	II
6.	Men and women have equal access, control over land and water	29 (72.5)	6 (15.0)	5 (12.5)	1.40	I

(The numbers in the parentheses indicate percentage; *Lower Mean Score indicates higher Ranking which reflects the existing gender gap is more in that particular aspect)

d. Economic Aspects

With reference to the Economic aspects, a major gender gap prevailed in availing loans from financial institutions, wherein the majority (87.5%) of farm women reported that they merely are able to get their loan sanctioned from banks and other supporting agencies. Following this, ownership of agricultural land is the next ranked gap, in which a meager number of respondents (5%) reported to always have possession authority over farm lands. The studied gap reflects a very narrow degree of financial empowerment among farm women and an arising unfelt need among the women formers to enrich their livelihood dimensions.



Table-5: Gender disparity in Economic aspects and prioritized constraints

(N=40)

S. No.	Aspects	Sometimes (< 30%) (1 score)	More Frequently (30-60%) (2 score)	Always (> 60%) (3 score)	Mean Score	Ranking*
1.	Access to capital and family/farm assets	3 (7.5)	5 (12.5)	32 (80.0)	2.73	VIII
2.	Control over capital and family/farm assets	26 (65.0)	9 (22.5)	5 (12.5)	1.48	IV
3.	Ownership of livestock (viz., Cow, Goat, & Poultry)	32 (80.0)	5 (12.5)	3 (7.5)	1.28	III
4.	Access to employment/ wage source (Informal sector)	4 (10.0)	4 (10.0)	32 (80.0)	2.70	VII
5.	Account at a formal financial institution	23 (57.5)	11 (27.5)	6 (15.0)	1.58	V
6.	Ownership of agri. land (1-5 ha.)	34 (85.0)	4 (10.0)	2 (5.0)	1.20	II
7.	Access to market and supply chains	22 (55.0)	11 (27.5)	7 (17.5)	1.63	VI
8.	Getting loan from financial institutions	35 (87.5)	3 (7.5)	2 (5.0)	1.18	I

(The numbers in the parentheses indicate percentage; *Lower Mean Score indicates higher Ranking which reflects the existing gender gap is more in that particular aspect)

e. Technological Aspects

Empirical evidences in the context of technological aspect highlights the gender gap relating to the knowledge level of men and women farmers in carrying primary and secondary agricultural practices, followed by receiving equal opportunities in acquiring knowledge and practising agri-innovations. It was also observed that men are technically sounder than women.

Table-6: Existing gender gap and associated constraints in Technological aspects (N=40)

S. No.	Aspects	Sometimes (< 30%) (1 score)	More Frequently (30-60%) (2 score)	Always (> 60%) (3 score)	Mean Score	Ranking*
1.	Women practice traditional/ conventional farming & men prefer to practice commercial farming by adoption of improved agri- technologies	4 (10.0)	8 (20.0)	28 (70.0)	2.60	VI
2.	Getting equal opportunities in acquiring knowledge and practising agri-innovations	12 (30.0)	14 (35.0)	14 (35.0)	2.05	II
3.	Both men and women have equal knowledge in carrying out crop production and post-harvest activities	23 (57.5)	13 (32.5)	4 (10.0)	1.53	I

S. No.	Aspects	Sometimes (< 30%) (1 score)	More Frequently (30-60%) (2 score)	Always (> 60%) (3 score)	Mean Score	Ranking*
4.	Men have better knowledge and participation in use of farm machineries than women	4 (10.0)	7 (17.5)	29 (72.5)	2.63	VII
5.	Men are technically more sound than women farmers in practicing Good Agricultural Practices/ Agri-innovations in farming	6 (15.0)	10 (25.0)	24 (60.0)	2.45	III
6.	Men have more participation than women in various training & capacity building programmes	5 (12.5)	8 (20.0)	27 (67.5)	2.55	V
7.	Societal taboos affect in enhancing the technical competencies of women	6 (15.0)	9 (22.5)	25 (62.5)	2.48	IV

(The numbers in the parentheses indicate percentage; *Lower Mean Score indicates higher Ranking which reflects the existing gender gap is more in that particular aspect)

Correlation Studies

There existed a strong correlation ($r=0.863$) between the mean score of social aspects and level of gender sensitization of the respondents, thus indicating that gender gap in social issues can be narrowed through gender sensitization approaches among the studied sample. A higher degree of correlation ($r=0.862$ and 0.859) existed between Health and Nutrition aspects of respondents with awareness level and access to nutri-food thus underlying the significance for implementing nutri-farming model for increasing the responsiveness and reach to nutritious dietary items. The need for sustainable farming approaches could be implicated by observing a significant co-efficient of determination (0.764) between climate resilient farming practices and mean score of environmental aspects. Significant correlation ($r=0.875$) between economic aspect and access to credit implies that a holistic economic empowerment of women farmers could be sustained by increasing the availability of credit facilities to initiate new ventures in agriculture. A strong correlation ($r=0.854$) between the mean score of technological aspects and the degree of skill-upgradation programs attained by respondents, thus signifying the potential skill improvement in agri-practices as a key to successful farming. With high level of gender sensitization the skill upgradation of farm women is enhanced ($r=0.701$) as well as the technological knowledge aspect ($r=0.803$). Adoption of climate resilient farming practices is reflected through high degree of correlation between technological aspect ($r=0.808$) and degree of skill upgradation ($r=0.847$), respectively.

**Table-7: Correlation among different determinants of SHEET module**

Variables	Social aspect	Gender sensitisation level	Health and nutrition	Awareness to nutri-food	Access to nutri food	Economic aspect	Access to credit	Technological aspect	Degree of skill upgradation	Environment aspect	Climate resilient farming
Social aspect											
Gender sensitisation level	0.863**										
Health and nutrition	0.855**	0.713**									
Awareness to nutri-food	0.822**	0.724**	0.862**								
Access to nutri food	0.838**	0.661 ^{NS}	0.859**	0.828**							
Economic aspect	0.904 ^{NS}	0.723**	0.797**	0.799 ^{NS}	0.862**						
Access to credit	0.733**	0.637 ^{NS}	0.490**	0.568 ^{NS}	0.702**	0.846**					
Technological aspect	0.875 ^{NS}	0.803**	0.904 ^{NS}	0.822**	0.767 ^{NS}	0.732 ^{NS}	0.478**				
Degree of skill upgradation	0.781 ^{NS}	0.701**	0.898 ^{NS}	0.913 ^{NS}	0.780 ^{NS}	0.757**	0.494 ^{NS}	0.854**			
Environment aspect	0.880 ^{NS}	0.811**	0.862**	0.922**	0.856 ^{NS}	0.865 ^{NS}	0.690 ^{NS}	0.839 ^{NS}	0.892 ^{NS}		
Climate resilient farming	0.847 ^{NS}	0.725 ^{NS}	0.815 ^{NS}	0.849 ^{NS}	0.822 ^{NS}	0.821**	0.687 ^{NS}	0.808**	0.847**	0.875**	

2. Designing and developing a Gender Sensitive Schematic Extension Model for addressing Social and Technological Issues

Gender Sensitive Extension Model

The Gender Sensitive Extension Model, as described in Figure 4 was designed to promote gender friendliness to the existing extension services. The model focuses on Gender Sensitive Extension as the central core of any developmental programme. Here, gender sensitive means extending the extension services through a gender lens i.e., considering women farmers as significant as men and extending the extension services by considering the strength, weakness, opportunity and threat (SWOT analysis) of women farmers of the region. The adoption of technologies and tools should be women friendly, inputs and training programmes should be as per the interest and suitability of both men and women. The pillars of the model are 'Women farmers & farming community, R & D Organizations in a convergence mode and Market/ Commercialization'. It is essential to link all the pillars for holistic development keeping in mind to meet the basic needs viz. 'Nutritional Security, Livelihood enhancement and Environmental Sustainability'.

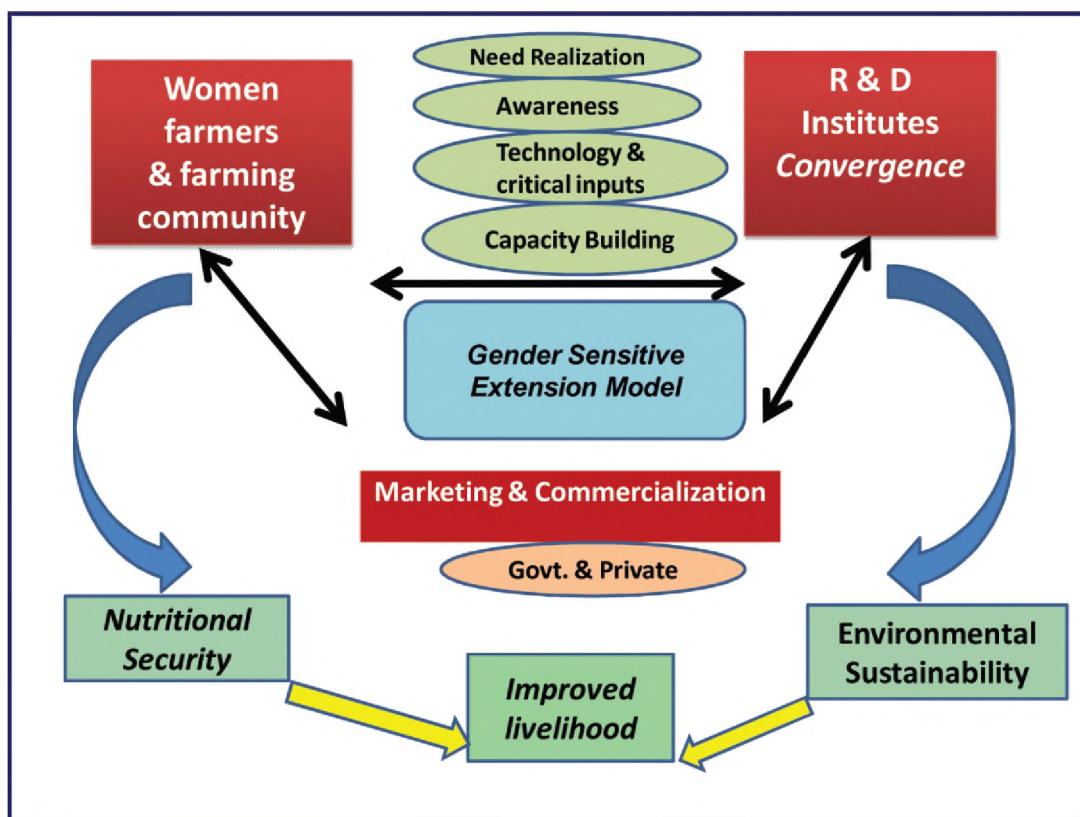


Fig 4: Gender Sensitive Extension Model



Schematic work plan for promoting 'Gender Friendly-Nutritional Enhancement, Livelihood Upliftment and Entrepreneurship Development

With the objective to optimize gender friendly technologies for promoting empowerment of rural women, the following technological module was developed. A *three-tier approach* for addressing all farming income groups, the following frame work was framed for conducting action research as per the needs of the farming community, available resources and market preferences. The small and marginal women farmers who have limited resources and often face the issues of extremely low income generated from their farming were addressed with 'Gender Sensitive Agri-Horti Cropping System Model', in order to enhance their annual income from farming through popularization of profitable cropping system model. The next tier comprised of medium women farmers, who were addressed with their requirement of enhancing their annual income in addition to nutritional enrichment in their diet through the concept of 'Nutri-Farms'. In this approach nutritional security of women farmers, which is a pertinent gender gap indicator was attempted to be mitigated. The last tier emphasized on empowering women farmers through promotion of 'agri-entrepreneurship'.

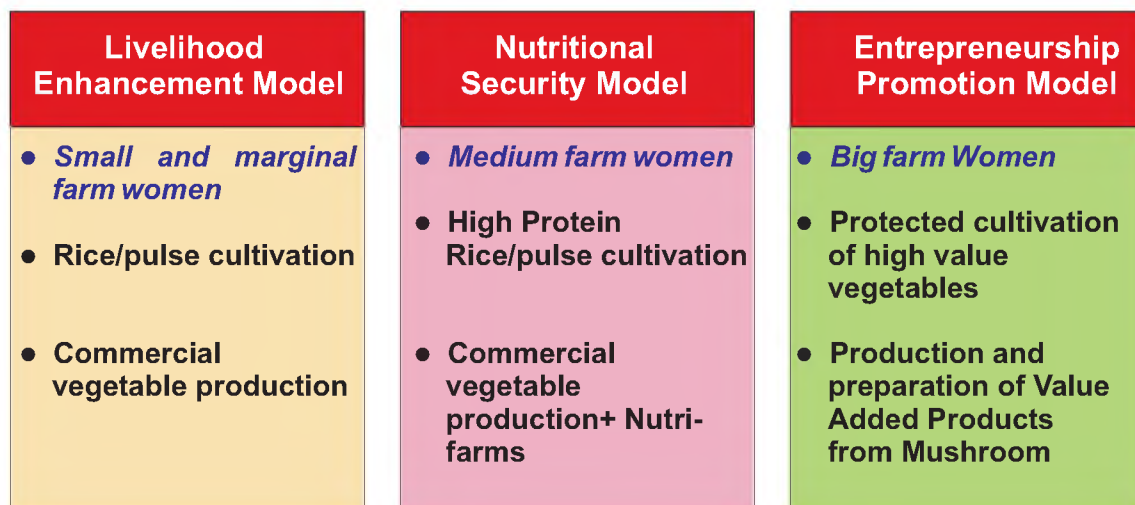


Fig 5: Schematic Agri-Horti Cropping System Model for addressing Livelihood, Nutrition and Entrepreneurship

The concept adopted was gender sensitive and a whole family approach as in most cases women farmers did not have their own land. Hence, the technological interventions were formulated as per the need, constraints and interest of women farmers in agreement with their male counterparts. It was a whole family approach as there was division of labour as per their expertise and convenience. SWOT analysis of women farmers was also considered in formulating the various cropping system models. The following technological framework was adopted for action research. The detailed technological module for each tier is as follows.

3. Optimizing Technological Interventions for Drudgery Reduction and Promoting Empowerment of Farm women

I. Livelihood Enhancement Model

S. No.	Technologies	Problems	Priority Areas
1.	Improved high yielding rice varieties	Poor yield from local traditional varieties due to several biotic and abiotic factors	Method demonstration on improved production technologies of paddy following the package of practice for various rice varieties
2.	Varieties for value addition in paddy	Poor market demand and low return from rice	Demonstration and popularization of high value rice varieties preferable for making secondary products/ value added products (VAPs)
3.	Rice - pulse cropping system (Paira cropping) in rainfed condition	Lower productivity and profitability due to unavailability of quality pulse seeds	Demonstration of high yielding pulse varieties Training and capacity building on improved package of practices (POPs)
4.	Rice-vegetable production under irrigated patches	Lower profitability due to lack of suitable varieties and standard POPs in vegetable crops	Demonstration of HYV and hybrid varieties of vegetables to grow in rabi season viz., cole crops (cauliflower, cabbage, broccoli), French bean, capsicum, carrot, garden pea etc. Which have economic potential Skill based training on POPs of vegetable crops
5.	Commercial vegetable production • Off season production in shade-nets • River bed cultivation of Cucurbits	Lower profit of farmers in vegetable farming	Demonstration of early production of vegetables in shade-nets Popularization of extra early and early varieties of vegetables (IIVR and IIHR varieties with profitable yield potential)



a) Vegetable Production Status

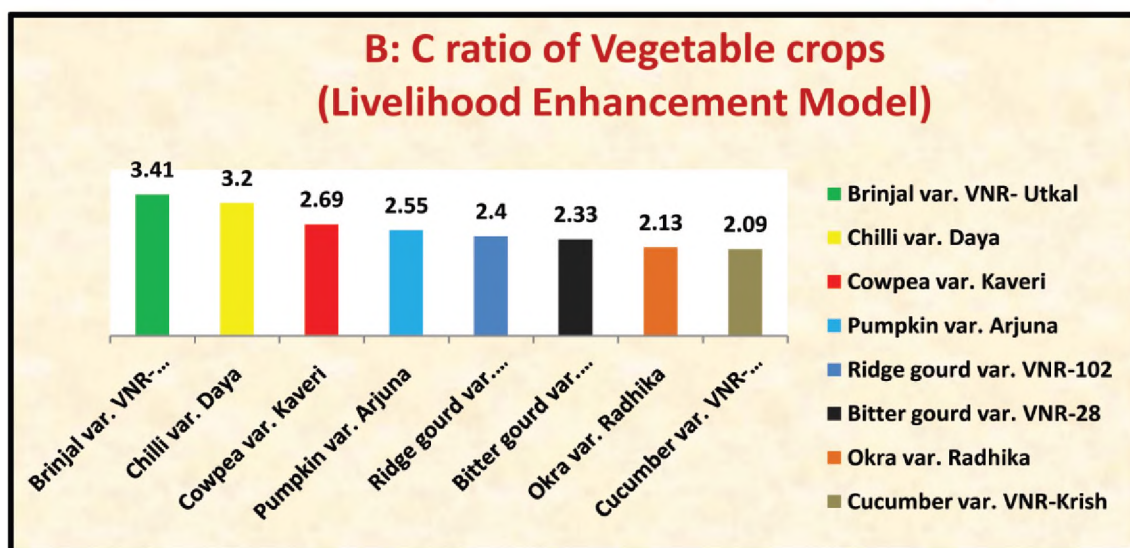
To promote livelihood enhancement through the Livelihood Model seeds of HYVs and Hybrid varieties of vegetable crops varieties, having good production potential viz., cowpea (*var.* Kaveri), pumpkin (*var.* Arjuna), bitter gourd (*var.* VNR-28), brinjal (*var.* VNR-Utkal), ridge gourd (*var.* VNR-102), okra (*var.* Radhika), cucumber (*var.* VNR-Krish), chilli (*var.* Daya) along with minor field tools and equipments viz., rose cane, spade, weeder, secateurs, sprayer & ring cutter etc. were distributed to 20 farm families in Tentalpur village. Several skill-based training and capacity building programmes, demonstrations of improved package of practices of vegetable crops were provided to the adopted women farmers of the village to conduct on-farm field trials for Livelihood Enhancement Model.

It was observed that the adopted farm women of Tentalpur village produced vegetables by adopting the conventional methods but after the project's intervention, knowledge was imparted to them on improved scientific methods of vegetable cultivation. They were trained on raising vegetable seedlings using pro-trays and also given critical inputs such as pro-tray, coco-peat and improved varieties of vegetable seeds. Handholding by the project team, farm advisories regarding nutrient management as well as disease and pest management were provided to them. With this support under the project, the production potential of vegetables has increased to a greater extent with low disease pest infestation than conventional methods they followed. In case of vegetable production in Tentalpur village they produced 36 q brinjal this year from their 0.24 ha. of land which was 30 percent higher than their previous year yield *i.e.* 25.2 q with a income of Rs. 75,600/- indicating an enhanced income of 30 percent *i.e.* Rs. 1, 08,000/. In case of chili the yield was 10.8 quintals from 0.16 ha. of land which was 27 percent higher than their previous year yield *i.e.* 7.9 q with a income of Rs. 63,200/- reflecting an enhanced income of 26.8 percent *i.e.*, Rs. 86,400/-. Similarly 25 percent increased in production was observed in cowpea, pumpkin, ridge gourd cultivation and 22 percent increased in production was observed in bitter gourd, okra and cucumber cultivation in the village which significantly enhanced the livelihood upliftment of the farm women of Tentalpur village. The highest B:C ratio of vegetable crops observed in Brinjal (3.41) followed by Chili (3.20), Cowpea (2.69), Pumpkin (2.55), Ridge gourd (2.40), Bitter gourd (2.33), okra (2.13) and cucumber (2.09), respectively.

The group approach in vegetable farming under this model has generated profits and awareness among the women group and motivated them to replicate this model in different location of the cluster.

Table-8: Demonstration of Vegetables at Tentalpur Village (N=20)

Vegetable Crop	Variety grown	Area (hectare)	Total Yield (quintal)	Sale Price (Rs. per Kg)	Total Income (Rs.)	Value of vegetables used for household consumption (Rs.)	Sale to open market (Rs.)
Cowpea	Kaveri	0.20	15.60	40/-	62400/-	9360/-	53040/-
Pumpkin	Arjuna	0.40	110.00	10/-	110000/-	16500/-	93500/-
Brinjal	VNR-Utkal	0.24	36.00	30/-	108000/-	16200/-	91800/-
Bitter gourd	VNR-28	0.36	28.00	40/-	112000/-	16800/-	95200/-
Okra	Radhika	0.28	40.00	15/-	60000/-	9000/-	51000/-
Ridge gourd	VNR-102	0.20	20.00	30/-	60000/-	9000/-	51000/-
Chilli	Daya	0.16	10.80	80/-	86400/-	12960/-	73440/-
Cucumber	VNR-Krish	0.16	24.20	25/-	60500/-	9075/-	51425/-
Total	--	2.00	284.60	--	6,59,300/-	98,895/-	5,60,405/-



(Fig 6: Benefit-Cost Ratio of Vegetables Crops (Livelihood Enhancement Model))

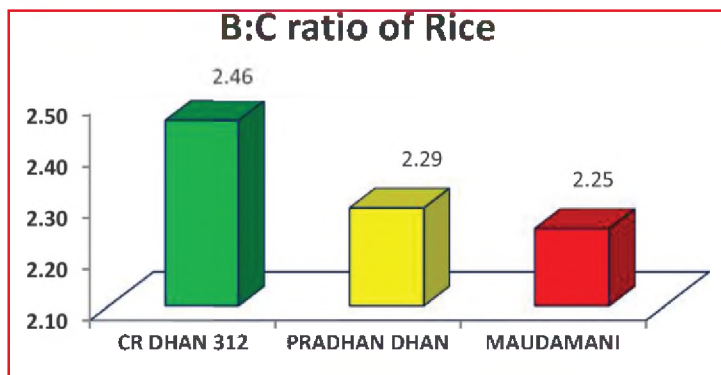
b) Rice Production Status**Table-9: Demonstration of Rice at Tentulpur Village**

(N=20)

Name of the crop	Variety grown	Total cultivated area in hectare	Total production in tons
Rice	CR DHAN 312	2.30	16.00
	PRADHAN DHAN	1.00	6.45
	MAUDAMANI	0.70	4.45
	Total	4.00	26.90

To promote livelihood enhancement through the Livelihood Model, seeds of HYVs and Hybrid varieties of paddy viz., CR-Dhan 307 (Maudamani), CR-Dhan 409 (Pradhan Dhan) and CR- Dhan 312 were distributed to 20 farm families in Tentulpur village. Several skill-based training and capacity building programme, demonstrations of improved package of practices of paddy were provided to 20 adopted farm women of the village to conduct on-farm field trials. It was observed that the selected farm women of Tentulpur village were cultivating paddy by following conventional methods. But after the project's intervention, knowledge was imparted to them on improved scientific methods of paddy cultivation. Handholding by the project team, farm advisories regarding nutrient management as well as disease and pest management were provided to them. With this support under the project, the production potential of paddy has increased to a greater extent with low disease pest infestation than conventional methods they followed.

In case of rice production the highest yield of 6.96 t/ha was observed in case of rice variety CR- Dhan 312 followed by 6.45 t/ha in rice variety Pradhan Dhan and 6.36 t/ha in case of variety Maudamani, respectively. Highest B:C ratio of paddy was observed in var:CR-Dhan 312 (2.40) followed by var: Pradhan Dhan (2.23) and var: Maudamani (2.20), respectively.



(Fig 7 : Benefit-Cost Ratio of Rice -Livelihood Enhancement Model)

c) On-Farm Field Trials on Black gram

Under Livelihood Enhancement Model field trials were conducted on Black gram (*var.* PU-31) in a total area of 4 ha. The average yield was 2.85 t/ha observed in Tentalpur village.

d) On-Farm Field Trials on Pineapple (Fruit Crop)

The on farm trial of improved Pineapple variety Queen was conducted for 20 farm families in Tentalpur village in a total area of 0.025 acres.

II. Nutritional Security Model

This model included the following interventions to address the economic enhancement of farm families in addition 'Nutri-Farms' were popularized in small patches in their homestead areas to ensure nutritional fortification of farm families.

S. No.	Technologies	Problems	Priority Areas
1.	High protein rice cultivation	Poor nutritional level of farm families but the degree of severity is more prevalent among the farm women	Demonstration and popularization of high protein rice varieties..
2.	Rice - pulse cropping system (Paira cropping) in rain fed condition	Lower productivity and profitability due to unavailability of quality pulse seeds	Demonstration of high yielding pulse varieties Training and capacity building on improved package of practices (POPs).
3.	Nutri-Farms	Poor nutritional level of farm families but the degree of severity is more prevalent among the farm women. Provision of crops yielding produce rich in carbohydrate, protein, vitamins, minerals, dietary fibres and anti-oxidants	Inclusion of root crops (rich in carbohydrate and dietary fibres), leguminous vegetables (rich in protein), leafy vegetables (rich in minerals), short duration fruit crops (banana, papaya, lemon, pineapple etc. that are rich in vitamins, minerals and anti-oxidants) in their existing farms in a planned manner to ensure frequent production throughout the year. Training on nutritional well- being to farm families

a) Vegetable Production Status

To ensure nutritional fortification of farm families through Nutrition Security Model, seeds of HYVs & Hybrid varieties of vegetable crops, having high nutritional values viz., cowpea (*var. Kaveri*), pumpkin (*var. Arjuna*), bitter gourd (*var. VNR-28*), Amaranthus (*var. Local*), Okra (*var. Radhika*), Drumstick (*var. Dwarf Moringa*), short duration fruit crops like culinary banana (*var. Bonthal*), Dessert banana (*var. Grand Naine*), papaya (*var. Red lady*) along with minor field tools and equipments viz., rose cane, spade, weeder, secateurs, sprayer and ring cutter etc. were given to 20 farm families in Sankilo village. Skill-based training and capacity building programmes, demonstrations of improved package of practices of vegetable Crops were provided to 20 Women Farmers of the village to conduct on-farm field trials under Nutrition Security Model.

It was observed that earlier farm women of Sankilo village were involved in vegetables and short duration fruit crops cultivation by adopting the conventional methods but after this project's intervention, knowledge was imparted to them on improved scientific methods of vegetable and fruit crop cultivation. They were trained on raising vegetable and fruit crop seedlings.

Hand holding by the project team, farm advisories regarding nutrient management as well as disease and pest management were provided to them. With this support under the project, the production potential of vegetables and short duration fruit crops has increased to a greater extent with low disease pest infestation than conventional methods they followed.

The group approach in vegetable farming under Nutritional security model has generated a total income of Rs. 8,45,750/- out of which a value of vegetables of Rs. 6,76,600/- used for household consumption and Rs. 1,69,150/- of vegetables sold in open market. Also it enhanced the nutritional status of farm women and generated lot of awareness among the women group which motivated them to replicate this farming in different location of the cluster.

The nutritional benefits of the horticultural crops indicated that the intake of cowpea, amaranthus, pumpkin and papaya being rich source of protein, dietary fibre, calcium and vitamin A provide essential nutrients to the family members. Hence, by adoption of cultivation of these highly nutritious vegetables and fruits can help in increasing the nutrition of the farm families.

Table-10: Demonstration of Vegetables at Sankilo Village (N=20)

Crop	Variety grown	Area (hectare)	Total Yield	Sale Price (Rs./kg) (quintal)	Total Income	Value of vegetables used for (Rs.) household consumption (Rs.)	Sale to open market (Rs.)
Cowpea	Kaveri	0.20	16.00	40/-	64000/-	51200/-	12800/-
Pumpkin	Arjuna	0.52	140.80	10/-	140800/-	112640/-	28160/-
Amaranthus	Local	0.20	14.20	20/-	28400/-	22720/-	5680/-
Bitter gourd	VNR-28	0.40	31.20	40/-	124800/-	99840/-	24960/-
Okra	Radhika	0.20	28.50	15/-	42750/-	34200/-	8550/-
Papaya	Red lady	0.16	100.00	12/-	120000/-	96000/-	24000/-
Banana (Culinary)	Bonthal	0.16	50.00	35/-	175000/-	140000/-	35000/-
Banana (Dessert)	Grand Naine	0.16	50.00	30/-	150000/-	120000/-	30000/-
Total	--	2.00	460.70	--	8,45,750/-	6,76,600/-	1,69,150/-



Table-11: Nutritional Benefits of Horticultural Crops at Sankilo Village (N=20)

Crop	Household consumption (kg)	Unit consumption (kg)	Nutritional benefits per person/per day*						
			Carbohydrate (g)	Dietary Fibre (g)	Protein (g)	Calcium (mg)	Iron (mg)	Vitamin-A (µg)	Vitamin-C (mg)
Cowpea	1280	12.80	14.81	3.66	6.40	131.66	4.57	1020.34	25.60
Pumpkin	11264	112.64	39.18	25.07	8.23	225.87	3.53	1459.42	78.75
Amaranthus	1136	11.36	2.88	5.57	4.15	416.53	5.86	10795.79	105.45
Bitter gourd	2496	24.96	6.40	8.58	3.27	48.47	2.61	276.83	105.58
Okra	2280	22.80	6.88	7.75	3.95	163.63	1.60	131.29	42.77
Papaya	8000	80.00	15.37	9.43	1.40	50.07	0.77	2313.33	143.63
Plantain Banana	4000	40.00	23.44	4.80	1.57	18.40	0.45	4.01	31.04
Dessert Banana	4000	40.00	31.51	2.59	1.64	6.76	0.37	75.71	6.35
Total		344.50	140.46	67.45	30.61	1061.38	19.75	16076.72	539.17

(* Estimated according to NIN, 2017)

b) Rice Production Status

Under Nutritional Security Model, field trials were conducted on HYVs of paddy having high nutritional value viz., CR-Dhan 307 (Maudamani), CR-Dhan 409 (Pradhan Dhan) and CR-Dhan 312. It was observed that the farm women of Sankilo village cultivating paddy by adopting the conventional methods but after the project's intervention, knowledge was imparted to them on improved scientific methods of paddy cultivation. With this support under the project, the production potential of paddy has increased to a greater extent with low disease pest infestation than conventional methods. This also significantly enhanced the nutritional requirements of the farm women of Sankilo village with some addition to their annual farm income.

Table-12: Demonstration of Rice at Sankilo Village (N=20)

Name of the crop	Variety grown	Total cultivated area in hectare	Total production in tons
Rice	CR DHAN 312	2.00	14.22
	PRADHAN DHAN	0.70	4.50
	MAUDAMANI	1.30	7.35
	Total	4.00	26.07

In case of rice production the highest yield of 7.11 t/ha was observed in case of rice variety CR- Dhan 312 followed by 6.43 t/ha in rice variety CR-Dhan 409 and 5.65 t/ha in case of variety CR-Dhan 307, respectively.

c) On-Farm Field Trials on Black Gram

To promote Nutritional security through pulses, Black gram variety (var. PU-31) having high nutritional value were given to 20 farm families in a total area of 4 ha. in Sankilo village. Several skill-based training & capacity building programme were conducted for demonstrations of improved package of practices of black gram. The average yield was 3.06 t/ha observed in Sankilo village.

Among the major perceived constraints in adoption of HYV Green gram among farm women, infestation of

yellow mosaic virus in HYV of green gram was found to be the top most constraint followed by yield of HYV is less than local variety and HYV susceptible to IPD as of local variety.

Constraints and Severity analysis of adoption of HYV Green gram among farm women

In the project implemented area, after the harvest of paddy, pulses are the most suitable crop for family-women nutrition, livelihood improvement, soil fertility improvement as well best utilization of farm land. Green gram and black gram are the two most important pulse crop that are raised in the villages. However due to use of local variety and less yield, the pulse crops are not showing good results. In order to address the issue, HYV of black gram (PU -31) and green gram (PDM 139) were introduced. The HYV of black gram crop (PU-31) showed good adoption however there was very poor adoption of green gram HYV. The reasons of this poor adoption were explored using different extensions methods. A survey was conducted by using RBQ and severity tools to identify the constraints and severity in adoption of green gram HYV among 40 farm women of Sankilo and Tentalpur villages. The results of which are described as follows:

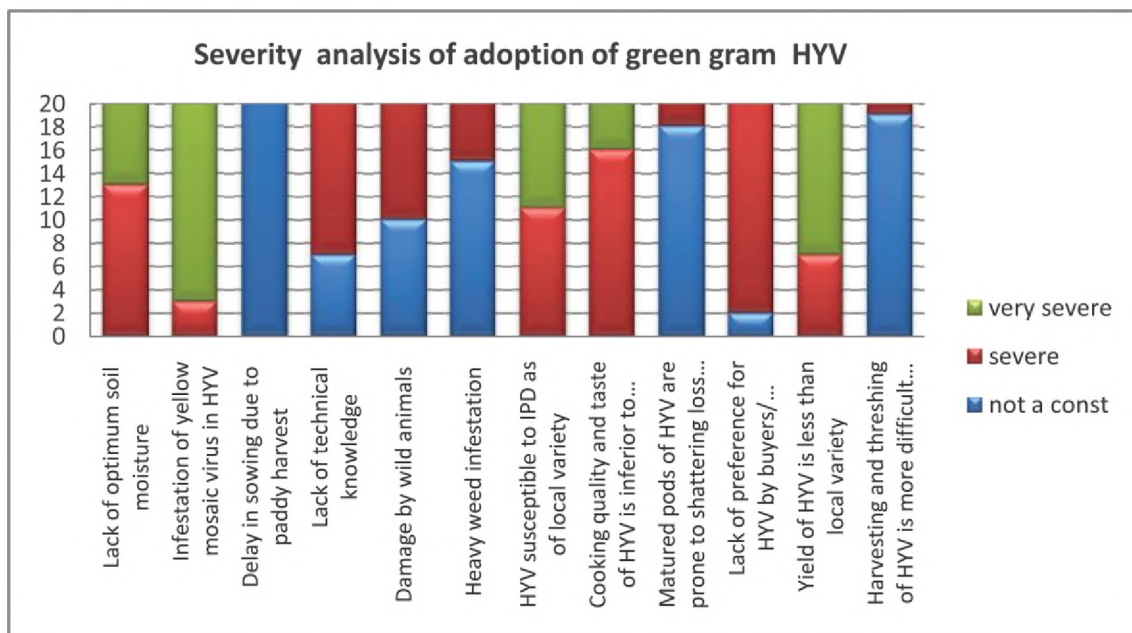
Among the major constraints, Infestation of yellow mosaic virus in HYV of green gram (50.00) followed by Yield of HYV is less than local variety (44.27), HYV susceptible to IPD as of local variety (40.21), Lack of optimum soil moisture (34.27) and Cooking quality and taste of HYV is inferior to local variety (34.17).

Similarly in case of severity analysis of adoption of green gram HYV the major severity are Infestation of yellow mosaic virus in HYV of green gram (Rank I) followed by Yield of HYV is less than local variety (Rank II), HYV susceptible to IPD as of local variety (Rank III), Lack of optimum soil moisture (Rank IV) and Cooking quality and taste of HYV is inferior to local variety (Rank V).

Table-13: Constraints in adoption of HYV green gram (N=40)

Sl. No.	Constraints in adoption of HYV green gram	RBQ*	Rank
1.	Infestation of yellow mosaic virus in HYV	50.00	I
2.	Yield of HYV is less than local variety	44.27	II
3.	HYV susceptible to IPD as of local variety	40.21	III
4.	Lack of optimum soil moisture	34.27	IV
5.	Cooking quality and taste of HYV is inferior to local variety	34.17	V
6.	Lack of preference for HYV by buyers/ consumers	29.38	VI
7.	Lack of technical knowledge	25.94	VII
8.	Damage by wild animals	23.23	VIII
9.	Heavy weed infestation	17.60	IX
10.	Matured pods of HYV are prone to shattering loss in the main field	12.19	X
11.	Harvesting and threshing of HYV is more difficult over local variety	9.38	XI
12.	Delay in sowing due to paddy harvest	4.38	XII

(* Mean value of two adopted villages)



(Fig. - 8. Severity analysis of adoption of green gram HYV)

d) On-Farm Field Trials on Pineapple and Ivy Gourd

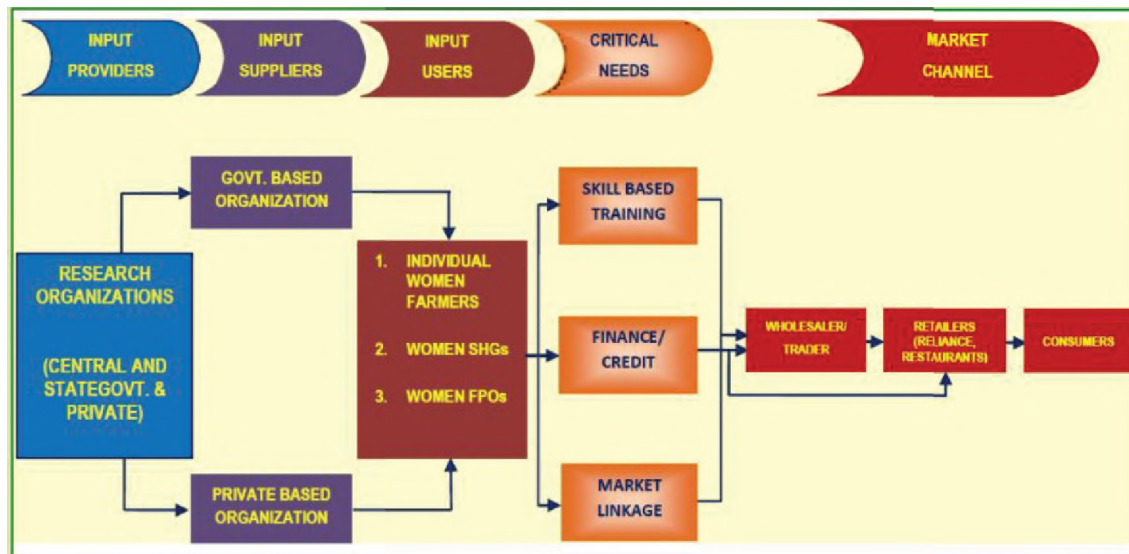
Improved Pineapple variety (Queen) and Ivy gourd variety (*Arka Neelachal Sabuja* & *Arka Neelachal Kunki*) having high nutritional value were demonstrated for 20 farm families in Sankilo village. On farm field trials of Pineapple (var. Queen) is in progress at Sankilo village in a total area of 0.025 acres and 0.075 acres under Ivy gourd are in progress under this model.

III. Entrepreneurship Promotion Model

Entrepreneurship was encouraged among the women farmers through the mushroom farming along with designing of entrepreneurship promotion model in to be implemented in conversion mode of Institute-Industries-stakeholder's linkages.

S.No.	Technologies	Problems	Priority Areas
1.	Mushroom farming	Lower profitability from mushroom farming on account of lower productivity and poor market	Demonstration and skill- based training on improved mushroom production technologies and its Value Added Products (VAPs) Strengthening market opportunities through interface between producer organizations and relevant stakeholders

Entrepreneurship Promotion Model in Mushroom Farming



(Fig.9: Entrepreneurship Promotion Model in Mushroom Farming)

The above flowchart has five components critically important in their own position, while this flow chart suggests entrepreneurship promotion in mushroom farming, the components and their roles are described.

Input Providers: This component includes research organizations and other central, state or private entities associated with mushroom cultivation. Their main role is to provide input in terms of knowledge, training, capacity building and hand holding while market is established in establishing the market linkages.

Input Suppliers: This component includes the entities which supply the raw material for mushroom cultivation be it central, state or private bodies. Their role is to provide spawn, base material, polythene sheets and bags, packaging material etc.

Input Users: This component may include an individual or a group/SHG/FPOs whose role is to put into the knowledge, training, capacity building given to them by input providers and accordingly use the materials provided by input suppliers.

Critical Needs: While all of the above mentioned components have their definite roles to execute, Input providers also here need to play the role of facilitators for skill based trainings, financial institutions and market for business acceleration.

Market Channel: Once all the components in the model have done their part, Market channel has to come into play here the individual or the group/SHG/FPOs need to reach their ready product to the consumer directly or through wholesalers or retailers. It will give the producers choice to enhance their profits.

a) Field Trials of Paddy Straw Mushroom

To promote Entrepreneurship Promotion Model, Paddy Straw Mushroom spawn bottles (400 nos.) were provided to 40 farm families in both Sankilo and Tentapur villages. Demonstrations of improved cultivation practices of Paddy Straw Mushroom were provided to 40 Women Farmers of both the villages.



Field trials of paddy straw mushroom are in progress at both Sankilo and Tentapur villages under Entrepreneurship Promotion Model.

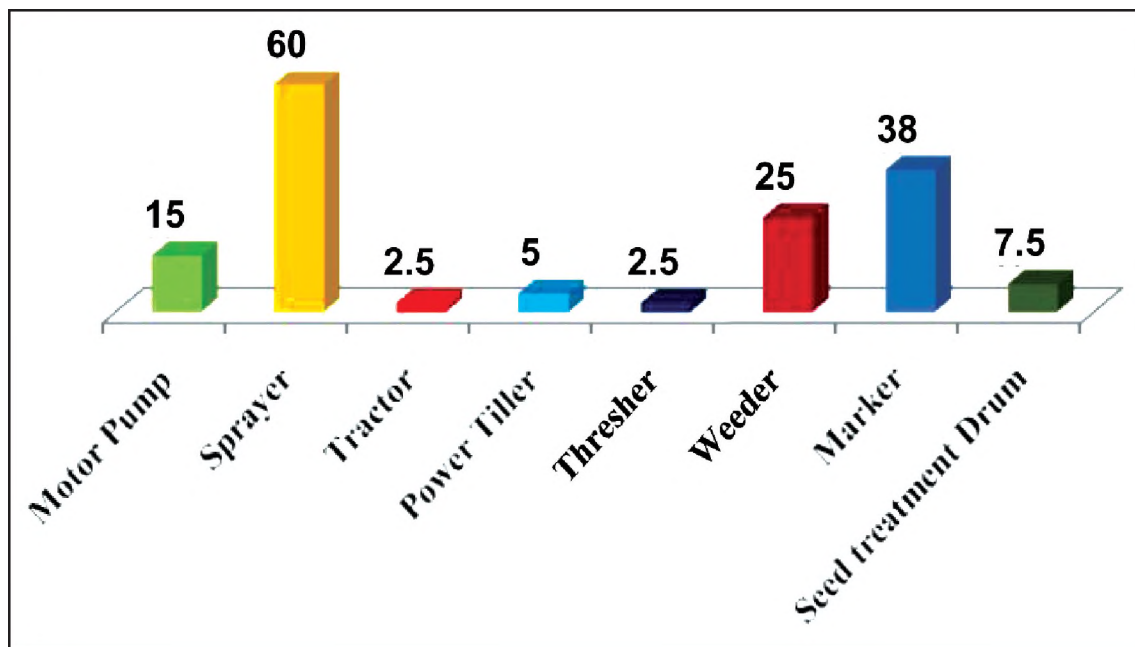
IV. *Drudgery Alleviation through Promotion of Women friendly Tools and Implements*

A study was conducted to identify the drudgery of women farmers in the selected cropping pattern (Rice+ Pulses+ vegetables). It was found that women participated in 16 activities among which 12 activities are carried out by women alone and 4 activities by both men and women. About 65 percent women belong to 40-60 age group, 38 percent are anaemic and spent 7-8 hours in farm activities. Data were also collected to study the status of farm mechanization and prevalence of drudgery and occupational health hazards among women farmers.

a) Status of farm mechanization in adopted villages

❖ Implements/Machine Owned (N=40)

The findings indicated that 60 percent respondents had hand sprayer followed by 37.5 percent respondents had marker, 25 percent respondents possess manual weeder, 15 percent respondents acquire motor pump, 7.5 percent respondents possesses seed treatment drum, 5 percent respondents had power tiller, 2.5 percent respondents own tractor & thresher. Most of the activities carried out manually and the status of mechanization in selected villages are below 5% caused more expenditure in hiring implements



(Fig.10 - Implements/Machine owned in the adopted villages)

Table-14: Implements/Machine Hired-out

Sl.No	Implements/machine Hired-out	Sankilo (N=20)	Tentalpur (N=20)	Total (N=40)
1.	Motor Pump	0	0	0
2.	Sprayer	0	1 (5%)	1 (2.5%)
3.	Tractor	0	1 (5%)	1 (2.5%)
4.	Power Tiller	1 (5%)	0	1 (2.5%)
5.	Thresher	1 (5%)	0	1 (2.5%)
6.	Weeder	0	0	0
7.	Marker	0	0	0
8.	Seed treatment Drum	0	0	0

It can be revealed that 2.5 percent respondents had hired-out sprayer, tractor, power tiller and thresher whereas no one had hired-out motor pump, weeder, marker and seed treatment drum.

Table-15: Implements/Machine Hired-in

Sl. No.	Implements/machine Hired-in	Sankilo (N=20)	Tentalpur (N=20)	Total (N=40)
1.	Motor Pump	15 (75%)	17 (85%)	32 (80%)
2.	Sprayer	3 (15%)	4 (20%)	7 (17.5%)
3.	Tractor	20 (100%)	19 (95%)	39 (97.5%)
4.	Power Tiller	19 (95%)	19 (95%)	38 (95%)
5.	Thresher	20 (100%)	19 (95%)	39 (97.5%)
6.	Weeder	0	0	0
7.	Marker	0	0	0
8.	Seed treatment Drum	0	0	0

The findings indicated that 97.5 percent respondents had hired-in tractor and thresher followed by 95 percent respondents hired-in power tiller, 80 percent motor pump, 17.5 percent respondents hired-in sprayer whereas no one had hired-in weeder, marker and seed treatment drum.

a) Problems and Needs of Women Farmers during Different Activities

The problems and needs of women farmers while performing different farming activities were studied through structured interview schedule.



Table: 16 Problems and Needs of Women farmers during Different Activities (N=40)

Sl. No.	Physical Activities	Quantum of work Undertaken in the reference year (Area/Quantity)	Specify the difficulties encountered	Needs (specify)
1.	Land Preparation	1 acre- 2 acre- 28 (70 %)	Un availability of tractor in time-16 (40%)	Needs tractor- 39 (97.5 %)
		2.1 acre- 3 acre- 6 (15 %)		
		3.1acre – 4 acre- 2 (5%)	NO difficulties to hire tractor-24 (60 %)	No Needs-1 (2.5 %)
		Above 4 acre- 4 (10 %)		
2.	Seed selection and treatments	10kg-20kg- 18 (45 %)	Allergic reaction in palms - 38 (95 %)	Need gloves & Seed treatment drum-38 (95 %)
		21kg-30kg- 13 (32.5 %)		
		31kg-40kg- 3 (7.5 %)	No difficulties encountered-2 (5 %)	NO Needs-2 (5%)
		Above 40kg- 6 (15 %)		
3.	Sowing seeds	0.1acre – 0.2 acre-16 (80 %)	NO difficulties encountered- 20(100 %)	NO Needs-2 0(100 %)
		0.2 acre-0.3 acre-2 (10 %)		
		0.3 crae-0.4 acre-0 (0 %)		
		Above 0.4 acre-2 (10 %)		
4.	Nursery raising	0.1acre -0.2 acre-28 (70 %)	NO difficulties- 40 (100 %)	No Needs-40(100 %)
		0.2 acre-0.3 acre- 9 (15 %)		
		0.3 acre-0.4 acre- 1 (5 %)		
		Above 0.4 acre- 2 (10 %)		
5.	Transplanting	1 acre- 2 acre- 28 (70 %)	Hand and back pain- 40 (100 %)	Need transplanter-40 (100 %)
		2.1 acre- 3 acre- 6 (15 %)		
		3.1acre – 4 acre- 2 (5 %)		
		Above 4 acre- 4 (10 %)		
6.	Weeding	1 acre- 2 acre- 28 (70 %)	Hand and back pain- 37 (92.5 %)	Need weeder-37 (92.5 %)
		2.1 acre- 3 acre- 6 (15 %)		
		3.1acre – 4 acre- 2 (5 %)		
		Above 4 acre- 4 (10 %)		
7.	Thinning & gap filling	1 acre- 2 acre- 28 (70 %)	No difficulties- 40 (100 %)	No Needs- 40 (100 %)
		2.1 acre- 3 acre- 6 (15 %)		
		3.1acre – 4 acre- 2 (5 %)		
		Above 4 acre- 4 (10 %)		

Sl. No.	Physical Activities	Quantum of work Undertaken in the reference year (Area/Quantity)	Specify the difficulties encountered	Needs (specify)
8.	Irrigation	1 acre- 2 acre- 28 (70 %)	Hiring motor pump- 35 (87.5 %) NO difficulties-5(12.5 %)	Need motor pump and LI point- 35(87.5 %) No Needs-5 (12.5 %)
		2.1 acre- 3 acre- 6 (15 %)		
		3.1acre – 4 acre- 2 (5 %)		
		Above 4 acre- 4 (10 %)		
9.	Fertilizer application	1 acre- 2 acre- 28 (70 %)	Hand pain and allergic reaction in palm-40 (100%)	Need fertilizer broadcaster & gloves- 40 (100 %)
		2.1 acre- 3 acre- 6 (15 %)		
		3.1acre – 4 acre- 2 (5 %)		
		Above 4 acre- 4 (10 %)		
10.	Pesticide application	1 acre- 2 acre- 28 (70 %)	Hand and back pain-12 (30 %) No difficulties-28(70 %)	Need sprayer- 12 (30 %) Need gloves and protection clothes - 40 (100 %)
		2.1 acre- 3 acre- 6 (15 %)		
		3.1acre – 4 acre- 2 (5 %)		
		Above 4 acre- 4 (10 %)		
11.	Harvesting	1 acre- 2 acre- 28 (70 %)	Hand and back pain- 40 (100 %)	Need Machinery-40 (100 %)
		2.1 acre- 3 acre- 6 (15 %)		
		3.1acre – 4 acre- 2 (5 %)		
		Above 4 acre- 4 (10 %)		
12.	Threshing	Total farm produce- 40 (100 %)	Hiring thresher-39 (97.5 %) No difficulties-1(2.5 %)	Need thresher- 39 (97.5 %) No need-1 (2.5%)
13.	Winnowing	Total farm produce- 40 (100 %)	Hiring winnower-39 (97.5 %) No difficulties-1(2.5 %)	Need winnower-39 (97.5 %) No need-1 (2.5 %)
14.	Drying & cleaning	Total farm produce- 40 (100 %)	Hand and back pain- 38 (95 %) NO difficulties- 2 (5 %)	Need grain cleaner- 38 (95 %) No Needs- 2 (5%)
15.	Storage	0-5ton- 35 (87.5 %)	NO difficulties- 40(100 %)	No Needs- 40(100 %)
		5-10 ton- 3 (7.5 %)		
		10- 15 ton- 2 (5 %)		
16.	Value addition	10-20 kg- 2 (5 %)	NO difficulties- 40 (100 %)	No Needs- 40(100 %)
		20-40 kg- 0 (0 %)		
		40-60 kg- 11 (27.5 %)		



In Quantum of work undertaken by farm women, it can be revealed that the majority of farm women participated in activities such as land preparation for 1 acre-2 acre (70%), seed selection and treatments for 10kg-20kg (45%), sowing seeds for 0.1acre – 0.2 acre (80%), nursery raising for 0.1acre – 0.2 acre (70%), transplanting for 1 acre- 2 acre (70%), weeding for 1 acre- 2 acre (70%), thinning and gap filling for 1 acre- 2 acre (70%), irrigation for 1 acre- 2 acre (70%), fertilizer application for 1 acre- 2 acre (70%), pesticide application for 1 acre- 2 acre (70%), harvesting for 1 acre- 2 acre (70%), threshing for total farm produce (100%), winnowing for total farm produce (100%), drying and cleaning for total farm produce (100%), storage for 5 ton (87.5%) and value addition for 40 kg-60 kg (27.5%).

In case of major difficulties encountered by the farm women during different activities are unavailability of tractor in time (40%) for land preparation, allergic reaction in palms (95%) during seed selection and treatments, hand and back pain (100%) during transplanting, hand and back pain (92.5%) during weeding, hiring motor pump (87.5%) during irrigation, hand pain and allergic reaction in palm (100%) during fertilizer application, hand and back pain (30%) during pesticide application, hand and back pain (100%) during harvesting, hiring thresher (97.5%) for threshing, hiring winnower (97.5%) for winnowing and hand and back pain (95%) during drying & cleaning operation.

In case of need of farm women for different activities are need tractor (97.5%) for land preparation, need gloves & seed treatment drum (95%) for seed selection and treatments, need transplanter (100%) for transplanting, need weeder (92.5%) for weeding, need motor pump and LI point (87.5%) for irrigation, need fertilizer broadcaster & gloves (100%) for fertilizer application, need sprayer (30%) and hand gloves, protection clothes (100%) for pesticide application, need machinery (100%) for harvesting, need thresher (97.5%) for threshing, need winnower (97.5%) for winnowing and need grain cleaner (95%) for drying and cleaning operation.

b) Factors Responsible for Drudgery and Occupational Health Hazards of Women Farmers

Problems related to drudgery and occupational health hazards were identified with standard scale (Borg scale, Strain Index, ILO Checklists for Ergonomic Assessment). Posture adopted by women while doing major activities are squatting, bending (at knee, lower back, shoulder, neck) standing create musculoskeletal injuries, pain in body parts. Body pain-lower back, shoulder, hand, neck (100%) is reported in case of transplanting, harvesting and fertilizer application followed by weeding, threshing and winnowing (97.5%). Most of the farm women reported pain in lower back (100%) and upper back (78%), knee (65%) which prevented them from carrying out normal activities.

Occupational hazards such as skin allergy and burning in eyes observed in seed treatment, application of fertilizer and pesticide application, respectively.

Table-17: Factors responsible for drudgery and occupational health hazards of farm women

Sl. No.	Parameters	Percentage (N=40)
1	Awkward Postures for long duration	100.00
2	Physical and Psychological stress due to family burdens	90.00
3	Lack of knowledge and skill on improved technologies	82.50
4	Less access to women friendly tools	77.50
5	Musculoskeletal problems and Injuries due existing health conditions	72.50
6	Environmental Impact	47.50

Table-18: Assessment of Drudgery-Body Parts Discomforts during Different Activities

Physical Problems	Body parts	Frequency	Percentage (N=40)
Had trouble (such as ache, pain, discomfort etc.) at any time during the last twelve months	Neck	14	35.00
	Shoulders	35	87.50
	Upper Back	33	82.50
	Elbows	18	45.00
	Wrists/Hands	23	58.00
	Lower Back	40	100.00
	Hips/Thighs	31	77.50
	Knees	38	95.00
	Ankles/Feet	17	43.00

Table-19: Assessment of Rate of Perceived Exertion -Borg Scale (Rating 1-10) (N=40)

Activities	1 Really easy	2 Easy	3 Moderate	4 Sort of hard	5 Hard	6 Hard	7 Really hard	8 Really hard	9 Really really hard	10 Maximal
Land Preparation				37.5%	45%	17.5%				
Seed selection & treatments				10%	40%	10%				
Sowing seeds					17.5%	57.5%	10%			
Nursery raising			5%	7.5%	82.5%					
Uprooting						15%	30%	35%	20%	
Transplanting (Manual)						7.5%	30%	45%	17.5%	
Weeding						10%	60%	30%		
Thinning and gap filling					7.5%	35%	37.5%	15%		
Ridge and furrow making					12.5%	62.5%	17.5%	7.5%		
Irrigation			55%	27.5%	12.5%					
Fertilizer application					15%	55%	15%	15%		
Pesticide application					15%	57.5%	15%	12.5%		
Harvesting						10%	30%	35%	20%	
Threshing						30%	52.5%	17.5%		
Winnowing					40%	42.5%	6%	2.5%		
Drying and Cleaning				32.5%	35%	27.5%	5%			
Storage				25%	45%	30%				
Value addition			5%	20%	37.5%	12.5%				

The perceived rate of exertion by farm women in different activities in rice and vegetable farming were also studied. It was found that more than 96 percent reported an exertion range 4-7 indicated hard work in case of sowing, seed treatment, nursery raising, drying and cleaning, storing. Whereas more than 95% reported exertion range of 6-9 indicated really hard work in case of uprooting, thinning, weeding, ridge making, transplanting, harvesting, threshing and winnowing. These indicated that immediate action and intervention

of drudgery reducing women friendly tools are required to improve the work efficiency, work output and decrease drudgery and health hazards. A total of 30 tools were identified for intervention. A tool kit comprising of improved sickle, hand hoe, khurpi, secateurs, ring cutter, sprayer, trowel, rose cane were demonstrated to the adopted farm women.

Table-20: Participation of farm women in the project activities

Sl. No.	Project Activities	Frequency of Activities (f)	Extent of Participation			
			Very high attendance (80-100%)	High attendance (60-80 %)	Moderate attendance (40-60 %)	Poor attendance (< 40%)
1.	Training programme	13	35 (87.50)	4 (10.00)	1 (2.50)	0 (0.00)
2.	Meeting with experts (online/offline)	10	32 (80.00)	4 (10.00)	2 (5.00)	2 (5.00)
3.	Demonstration	9	33 (82.50)	2 (5.00)	3 (7.50)	2 (5.00)
4.	Field Visit	20	26 (65.00)	6 (15.00)	4 (10.00)	4 (10.00)
5.	Monthly group meeting among members	12	30 (75.00)	5 (12.50)	3 (7.50)	2 (5.00)

(*Figures n the parentheses indicate percentage)

(** Nobody was found complete absent in any of the above activities)

Also information was collected relating to the participation of farmwomen in the project activities during 2020-21. The findings revealed that the participation level was very high(80- 100%) in case of training programme (86.5%) followed by demonstrations (82.5%), meeting with experts (80%), monthly group meeting among members (75%) and field visit (65%), respectively.



CAPACITY BUILDING PROGRAMMES

I. Demonstrations /Field Visits

Sl. No.	Demonstration/Field Visit Details	Date	Place	No. of Participants
1.	On farm demonstrations & provided farm advisory on vegetable production	20.08.2020	Sankilo, Tentalpur	40
2.	Vegetable field visit & Monitoring programme	08.09.2020	Sankilo, Tentalpur	40
3.	On farm demonstrations & provided farm advisory on paddy production	14.10.2020	Sankilo, Tentalpur	40
4.	Paddy field visit & Monitoring programme	05.11.2020	Sankilo, Tentalpur	40
5.	Collection of yield assessment data of paddy	17.11.2020 - 18.11.2020	Sankilo	20
6.	Collection of yield assessment data of paddy	23.11.2020 – 24.11.2020	Tentalpur	20
7.	Crop cutting of paddy	07.12.2020- 08.12.2020	Sankilo	20
8.	Crop cutting of paddy	16.12.2020- 17.12.2020	Tentalpur	20
9.	Field visit of Black gram	19.01.2021	Sankilo, Tentalpur	40
10.	Field visit of Black gram	03.02.2021	Sankilo	20
11.	Demonstration of pineapple	04.02.2021	Sankilo, Tentalpur	40
12.	Field visit of Black gram & pineapple	11.02.2021	Sankilo	20
13.	Field visit of Black gram & pineapple	19.02.2021	Tentalpur	20
14.	Field visit of Black gram & pine apple	03.03.2021	Sankilo	20
15.	Field visit of Black gram & pine apple	04.03.2021	Tentalpur	20
16.	Demonstration of Ivy gourd, field visit of Black gram & pineapple	10.03.2021	Sankilo, Tentalpur	40
17.	Field visit of Black gram	20.03.2021	Sankilo, Tentalpur	40
18.	Demonstration of Paddy Straw Mushroom	27.03.2021	Sankilo, Tentalpur	40
19.	Collection of Yield Assessment Data of Black Gram	08.04.2021	Sankilo	20
20.	Collection of Yield Assessment Data of Black Gram	09.04.2021	Tentalpur	20
21.	Crop cutting of Black Gram	17.04.2021	Sankilo, Tentalpur	40



I. Trainings Organized

Sl. No.	Training Details	Date	Place	No. of Participants
1.	Gender Sensitization Workshop	09.01.2020	Sankilo Tentalpur	40
2.	Pre Kharif training Workshop	13.03.2020	Sankilo Tentalpur	40
3.	Training and Capacity building programme on Drudgery reducing farm tools & implements	13.03.2020	Sankilo Tentalpur	40
4.	Training and Capacity building programme on improved package of practices of Vegetable production	02.06.2020	Sankilo Tentalpur	40
5.	Training and Capacity building programme on improved package of practices of Vegetable production	05.06.2020	Sankilo Tentalpur	40
6.	Training and Capacity building programme on improved package of practices of paddy production	20.08.2020	Sankilo Tentalpur	40
7.	Training and Capacity building programme on improved package of practices of Black gram production	29.12.2020	Sankilo Tentalpur	40
8.	Training and Capacity building programme on improved package of practices of pineapple production	04.02.2021	Sankilo Tentalpur	40
9.	Workshop-cum-training programme on "Improved package of practices of vegetable crops & farm mechanization"	10.03.2021	Sankilo Tentalpur	70
10.	Training and Capacity building programme on improved package of practices of Ivy gourd cultivation	20.03.2021	Sankilo	20
11.	Training and Capacity building programme on improved package of practices of Black gram cultivation	20.03.2021	Sankilo Tentalpur	40
12.	Pre-Kharif Rice Workshop & Skill Upgradation Programme on Paddy Straw Mushroom Cultivation	27.03.2021	Sankilo Tentalpur	70

THREE MAJOR OUTPUTS

Sl. No.	Major Output	Practical Relevance
1.	Identified Critical Gender Gap Indicators	Implication for policy makers, researchers, academicians and extension workers
2.	Gender Sensitive Extension Model	Relevant for achieving higher inclusive development
3.	Schematic Agri-Horticulture Model for addressing Livelihood, Nutrition and Entrepreneurship	Gender sensitive cropping system models of practical significance

Workshop details :

(1) Workshop organized on Improved Package of Practices of Vegetable Crops and Farm Mechanization

A one day Training-cum-Workshop on "Improved Package of Practices of Vegetable Crops and Farm Mechanization" under ICAR-NASF project was organized by ICAR-CIWA, Bhubaneswar on 10th March, 2021 in Sankilo village of Nischintakoili block, Cuttack district, Odisha. The Training-cum-Workshop was attended by about 70 participants including scientists of ICAR-CIWA, farm women, farmers, representatives from NGO, mass media like Doordarshan, DD-Krushi Darshan and officers from line departments of Government of Odisha.

At the outset, Dr. Lipi Das Principal Scientist (Agril. Extension) and PI of the Project welcomed all participants and described about objective of the project to empower the farm women based on 'SHEET' Module i.e., Social, Health and Nutrition, Environment, Economic and Technological aspects. She also stressed upon 3E's concept for women that is equity, entrepreneurship and empowerment. She briefed up about the significant achievements made during the last two years by the adopted farm women in this project under the three tier Agri-Horti Cropping system model for addressing Livelihood, Nutrition and Entrepreneurship.

Then, Dr. Ankita Sahu, Scientist, Horticulture highlighted about improved package of practices of vegetable cultivation and discussed about the livelihood enhancement of farm women by adopting proper scientific guidelines for vegetable cultivation so that farm women could get maximum benefits. Dr. Praveen Jakhar, Senior Scientist, Agronomy stressed about improved package of practices of Black Gram cultivation and also discussed about the importance of seed treatment for better cultivation. Dr. Biswanath Sahoo, Principal Scientist, Animal Nutrition explained about livelihood security and economic empowerment of women farmers through dairy farming and discussed about the necessity of giving proper vaccination and nutrient rich cattle feed for getting maximum milk production.

The Block Veterinary Officer, Livestock Inspector, Block Technical Manager, SMS Horticulture Department, KVK Cuttack also discussed various aspects for livelihood security of farm women. The workshop was followed by demonstration and distribution of women friendly farm tools and equipment viz., Improved Sickle, Trench Hoe, Battery Operated Sprayer, Rose cane, Hand Operated Sprayer, Improved variety of Ivy gourd cuttings, Mineral mixture etc. among farm women. The programme was covered by the Doordarshan, DD-Krushi Darshan for wide publicity.



(2) Pre-Kharif Rice Workshop & Skill Upgradation Programme on Paddy Straw Mushroom Cultivation

A one day Workshop on "Pre-Kharif Rice Workshop & Skill Upgradation Programme on Paddy Straw Mushroom Cultivation" under ICAR-NASF project was organized by ICAR-CIWA, Bhubaneswar on 27 March, 2021 in Sankilo village of Nischintakoili block, Cuttack district, Odisha. The Workshop was attended by 70 participants including scientists of ICAR-CIWA, farm women, representatives from mass media like Doordarshan, DD-Krishi Darshan, Retd. District Agriculture Officer and Secretary of Nigam, NGO.

At the outset Dr. Lipi Das Principal Scientist & Project Investigator welcomed all participants and described about objectives of the project i.e., to empower the farm women based on the identified gender gap on social, health and nutrition, environmental, economical and technological aspects. She also stressed upon 3E's concept for women that is equity, entrepreneurship and empowerment. She briefed up about the importance of rice cultivation, preparation of value added products from rice and mushroom cultivation in Gender Sensitive Farming System Model for addressing Livelihood, Nutrition and Entrepreneurship of farm women.

Dr. S.K. Mishra, Principal Scientist ICAR-NRRI, Cuttack described about the improved package of practices of rice cultivation in which he highlighted the importance of seed treatment, cultivation of climate smart varieties and protein rich varieties of rice for both livelihood security and nutrition enrichment of farm women. Dr. P. Jakhar, Senior Scientist highlighted about improved package of practices of rice cultivation and also discussed about the use of straw from rice cultivation in paddy straw mushroom cultivation for entrepreneurship development of farm women. Also the improved package of practices of vegetable cultivation was discussed by Dr. Ankita Sahu, Scientist talked about livelihood enhancement of farm women by adopting proper scientific guidelines for vegetable cultivation to get maximum benefits. Dr. Biswanath Sahoo explained about livelihood security and economic empowerment of women farmers through dairy farming and focussed about the necessity of giving proper vaccination and nutrient rich cattle feed for enhancing productivity of dairy animals. Mr. Suresh Ch. Jena, Retd. District Agriculture officer also discussed various aspects for livelihood security of farm women. During this programme various technologies intervened under three modules were exhibited and also a brochure on 'women empowerment and gender sensitization- developing a model for bridging the gender gap' was also released.

The workshop was followed by demonstration of paddy straw mushroom cultivation and distribution of improved varieties of vegetable seeds and mushroom spawn, improved sickle, pesticides, fungicides, mineral mixture etc. among farm women. The programme was thoroughly covered by the Doordarshan, DD-Krishi Darshan for wide publicity. At the end of the workshop, Rabi Sankar Panda, SRF of the project offered vote of thanks to all scientists, media personnel, officials from line departments and participating farm women.

Photographs of Activities in the Adopted Villages



Workshop on Improved Package of Practices of Rice, Vegetable Crops and Farm Mechanization



Vegetable Farming by Women Groups



Rice Farming by Women Groups



Demonstration of Pineapple (Var. Queen)



Demonstration of Black gram (Var. PU-31)



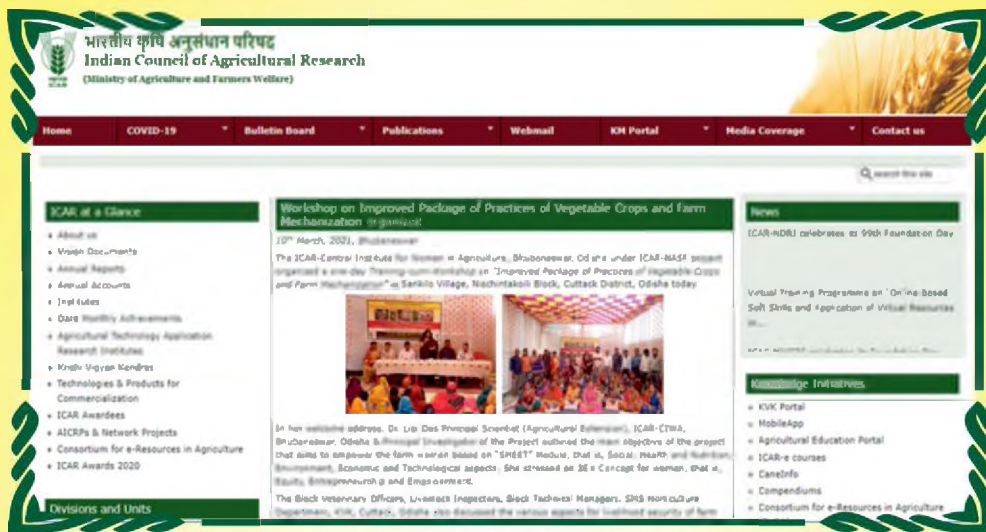
Demonstration of Ivy gourd (Var. Arka Neelachal Sabuja) for Nutritional Security Model



Demonstration on Mushroom Farming



Demonstration of Drudgery Reducing Farm Tools



(Workshop on Improved Package of Practices of Vegetable crops and Farm Mechanization Organized by ICAR-CIWA, Bhubaneswar at Sankilo and Tentalpur villages of Nischintakoili block, Cuttack on 10th March, 2021)



(Pre-kharif Rice Workshop & Skill Upgradation Programme on Paddy Straw Mushroom Cultivation Organized by ICAR-CIWA, Bhubaneswar at Sankilo and Tentalpur villages of Nischintakoili block, Cuttack on 27th March, 2021)