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EMPOWERMENT OF FARM WOMEN IN TOBACCO CULTIVATION (GENDER PERSPECTIVE)

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(ICAR-NATIONAL INSTITUTE FOR RESEARCH ON COMMERCIAL AGRICULTURE)
(An ISO 9001 : 2015 Certified Institute)
RAJAHMUNDRY - 533 105, ANDHRA PRADESH, INDIA

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Preface

Women play a significant and crucial role in agricultural development and allied fields. They make essential contributions to the agricultural and rural economies in all developing countries. In India, women's participation plays a very important role in the agricultural development of the country where most of the agricultural operations are done by women laborers. Women comprise 33% of the overall agricultural labor force and 65% in tobacco. But regardless of these variations, women are actively involved in tobacco crop, starting from nursery management, harvesting and post harvest operations.

This technical bulletin provides quantitative data and qualitative information of women's role in tobacco farming, drudgery and occupational health hazards and the role of CTRI in women empowerment activities viz., training, capacity building, skill up-gradation, sensitization programs etc. implemented through Govt. Flagship programs viz., Tribal sub-plan, SCSP, NFSM, sponsored (DBT and NICRA) projects etc. The drudgery reducing devices recommended by ICAR-CTRI and occupational safety measures have enhanced the occupational health of farm women and helpful in improving their technological know-how which in turn made them self reliant towards comprehensive / holistic development over a period of time. The efforts of CTRI on women empowerment have received several awards and recognitions during the past two decades.

I am confident that the analysed and documented data in this publication on 'Empowerment of Women in Tobacco' will provide a holistic view about the impact in changing the livelihood opportunities and empowerment of rural and tribal farm women. I wish to complement the authors for their sincere effort to bring the useful piece of work. I hope this would serve an important source of evidence-based information for tobacco control advocates, policy makers, and extension functionaries and other relevant organizations to develop gender-sensitive programs for the improvement of livelihood of women farmers.

Date: 09.12.2023

(M. SHESHU MADHAV)
DIRECTOR

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Role of Farm Women in Tobacco Cultivation

Tobacco provides livelihood security to 45.7 million people including 6 million farmers and 20 million farm labourers engaged in tobacco farming besides 8.5 million people working as bidi/factory workers, 4 million in tendu leaf pluckers, and 7.2 million in the trade and retail sector in India. Bidi rolling provides employment to 4.4 million people, exclusively women workers. About 2.2 million tribal farmers, exclusively women are involved in tendu leaf collection. The production and processing costs of tobacco are quite low in India, which can be attributed to low paid wages to the women labourers working in the tobacco sector.

The architect of the Indian Green Revolution, M.S. Swaminathan, describes that it was women who first domesticated crop plants, and thereby initiated the art and science of farming. While men went out for hunting in search of food, women started gathering seeds from the native flora and began cultivating them to meet their food, fiber, and fuel requirements. Women make essential contributions to the agricultural and rural economies in all developing countries. In India, Women's participation plays a very important role in the agricultural development of the country where most of the agricultural operations are done by women laborers. Indian women are bestowed with great zeal and intelligence to tackle farm management based on the socio-economic structure of the family. Women play multifarious roles in agriculture and work for long hours. A large contingent of labour force involving men and women are engaged in tobacco cultivation starting from nursery to grading and baling. All these operations involve labour with varied skills. Management of nurseries, fields, planting, priming, curing, grading, baling, and marketing offer employment to farm women. The cultivation of tobacco in different zones has brought tremendous change in the working patterns and their socio-economic conditions over a period of time.

The following projects have been implemented at ICAR-CTRI during the past decade based on which the technical data is presented in the bulletin.

- Appropriate Agricultural and Allied Technologies for Rural Farm Women (ICAR)
- Post Harvest Technologies for Empowerment of Farm Women (ICAR)
- Critical Analysis of the Empowerment of Farm Women in Tobacco Growing Agency Area of East Godavari District (ICAR)
- Nutritional Security in Tribal Areas of Andhra Pradesh Through Community Based Approaches (DBT)
- Gender Specific Adaptation Programmes in Response to Climate Change in Coastal Eco Systems (Sponsored by NICRA, ICAR)

In tobacco cultivation, women play a crucial role starting from the selection of seeds to nursery bed raising, transplanting, harvesting, curing, stringing, grading, packing, etc. These operations are time-consuming, and they require a lot of patience and skill. The participation of farm women in tobacco cultivation can be divided into four geographical locations namely tribal, northern light soil, southern light soil, and black soil areas.

In Andhra Pradesh, FCV tobacco production is divided into three zones based on the type of soil where tobacco is grown *viz.*, the black soil tobacco grown under rainfed conditions in the black soils of Guntur, Krishna, East Godavari, West Godavari and parts of Khammam districts, 2) Irrigated tobacco, grown in the light soils in East Godavari and western parts of Khammam districts and popularly known as Northern Light Soil tobacco (NLS); 3) Tobacco grown in southern light soils of Andhra Pradesh comprising Nellore and Prakasam districts and popularly known as Southern Light Soil tobacco (SLS). Besides FCV Tobacco, burley crops are grown in the tribal tract of East Godavari, especially in the Kharif season as a monsoon crop and now shifted to the Vinukonda region of AP.

Tobacco cultivation comprises three major components viz., 1. Nursery management 2. Main field management 3. Post-harvest product management operations. Nursery operations offer livelihood to majority of women labourers. The main field operations comprising transplanting and intercultural operations also offer employment to both the above categories. The harvesting of leaves forms a major scientific operation by the labour, which involves the correct identification of ripe leaves. This operation is normally carried out by experienced and efficient farm women as the harvest of immature leaves spoils the final quality of tobacco.

Andhra Pradesh comprises almost equal male and female population. The female population is higher in East Godavari followed by Krishna, West Godavari, Prakasam, and Nellore districts.The cropping pattern of these areas also offers great potential for the employment of the agricultural labour force. The highest agricultural labour force was recorded in Guntur District with 6.74 lakhs (1990). Nursery management and post-harvest management offer potential employment to women folk while field operations are carried out by men folk.

Nursery Management

Nursery raising involves women folk availability in that particular location. The women travel 2-4 km per day to seek employment in the nursery season. On an average, in the nursery, five women are engaged per every man's day of work. In general, approximately 1583 male workers and 2860 female workers are engaged over a period of 90-100 days. Based on the nature of farm operations, the involvement of male and female labour varies widely. The major contribution of women workers in tobacco nurseries is towards weeding (46.5%) closely followed by watering (25.5%), seedling pulling and bundling (12.5%), mulching and de-mulching with paddy straw (5.5%),weeding and thinning (5%) seedbed preparation (3%), seed sowing (2%) and tobacco nurseries are watered with rose cans daily six times at regular intervals from the beginning of nursery rising until completion of nursery operations. These nurseries are also frequently fertilized after every pulling. The increased nutrition and water availability in the tobacco nurseries offer a lot of weed growth and thereby weeding in nurseries forms a major role of work after watering. It is closely followed by seedling pulling and bundling which comprises 12.5% of the time. The rest of the plant protection, mulching, and de-mulching operations comprise 5.5 % time each. The remaining operations of weeding, sowing, and seedbed preparation account for 10% of the time of farm women.

Preparatory Cultivation

Two or three ploughings followed by one or two harrowings in July-August months at proper moisture level are sufficient in early crop cultivation during the months of August - September. In the preparatory cultivation, men to men-to-woman ratio was found as 1:5 in terms of their involvement in work. However, on an average two men and ten women are engaged in per hectare of land preparation.

Manures and Fertilizers

In tobacco heavy soils like vertisols and red clay loams, fertilizers are applied in the Plant Row Plough Furrow (PRPF) method, in the open furrows by women workers while men workers open the furrow with a plough in the planting row and close the same after fertilization. This ratio normally comes to 2:5 for men to women. The actual men and women employed for this purpose happened to be 2 and 5 per hectare of crop respectively. In light soils

of tobacco, fertilizers are applied in two or three splits by dollop method. While the men dig holes with bamboo sticks at both sides of the plant, women apply manure in the ditches and close the pits.

Transplanting and Gap-filling

Planting is done by hand setting. The ratio of involvement of women to men was found to be 4:1 as 32 females for 8 males had to do the transplanting operation in an area of one hectare. The transplanting operation involves careful planting of seedlings with little skill in placing the seedlings in the pre-marked locations with equal gaps. In NLS, SLS, and SBS areas, furrows are made in the planting row which requires the skill of women labourers as the perfect plant populationhas to be maintained. It requires the skill of selecting healthy and vigorous seedlings, with the right spacing of 100 x 60 cm (Northern light soils with a recommendation of 16,666 plants per ha). After the final preparation of the land, the position of the plant is marked by the men by running a marker in cross directions while planting is done by women manually. Planting is done at the edge of the small furrows in NLS after giving a light irrigation. The women perform gap-filling within 10 days after planting.

Cultural Operations

The cultural operations include interculture with plough/ harrow and weeding. Normally the weeding process is extended over the crop period in NLS tobacco while it is restricted in black soils and SLS tobacco to the early stages of crop growth. Besides weed removal, a large number of women folks were employed in the removal of root parasite, *Orobanche* before flowering. On an average ten women workers are engaged per man a day. The number of men may go up based on the weed intensity and rainfall. Normally 2.5 men and 25 women are required to remove weeds and root parasites from one hectare of tobacco crop.

Plant Protection

There was an uneconomical use of human energy due to long hours of work, task postures deleterious to the body, and exposure to pesticides. Women folk help their counterparts/ farmers in the preparation of insecticidal solutions whereas the liquid spraying is attended by men. Normally 6-8 workers are sufficient to carry out this operation per one hectare of tobacco crop.

Topping & Sucker Control

Removal of flower buds (topping) is an important operation in tobacco to control the apical dominance to hinder the reproductive capabilities and to increase the quality and improve the root growth. In the case of light soil irrigated conditions, women top the plant at the button stage itself. Topping and the removal of subsequent suckers form a very important operation done by women workers alone. If suckers are not properly removed, there is no use of topping and hence women work longer time in topping and de-suckering activities. Women apply neem oil emulsion or fatty alcohol emulsions to control the suckers effectively on the top 4-5 leaf axils of plants for effective control of suckers considerably. Generally, eight women are sufficient to do this operation for one hectare of land.

Harvesting and Stringing

Harvesting/ priming at the right maturity stage is done by women labourers and was decided by the leaf colour (slightly yellowish), appearance, and texture at the bottom of the plant. Immature leaves are gummy and on

curing may turn out thick, close-grained, and poor in combustibility and filling power. On the other hand, over-mature leaves may become scrappy and less elastic. Hence, only intelligent and well-experienced women can do this operation. The women have to carry these leaves to the stringing hall with the loads on their backs. The ratio of female to male workers was found to be 3:1 in this operation with the actual number of nine and three per hectare of land respectively. This operation is repeated 5-6 times during the crop period until all the crop is harvested. The harvested leaf is tied or strung on the sticks by skilled women workers. The women-to-men ratio in stringing operations was found to be 2:1.

Curing

Curing FCV tobacco involves the destruction of chlorophyll, conversion of starch to simple sugars, and leaf proteins to soluble nitrogenous constituents. In the curing process, while the men place the sticks of unripe leaves on top tiers, the women place the over-ripened, well-matured yellow leaves at the bottom tiers. loading the leaf into the barns while the actual curing operation is managed by trained men only. The unloading and bulking of cured leaves were carried out by experienced women. After bulking the leaves are graded based on the colour, aroma, and physical structure of the individual leaf. This process involves a good deal of patience and intelligence in grading each leaf. Since this is a strategic point in deciding the price of tobacco at the auction platforms.

Bulking

Bulking is an operation where tobacco is heaped as per their primings and covered with thick gunny bags or tarpaulins for improving the colour, texture, and aroma. This process is repeated twice or thrice as per the requirement. Here experienced and skilled women can judge the completion of the fermentation process by way of its texture, colour, and aroma. However, this ratio comes to 4:1 with respect to female and male workers. The bulks have to be covered with polythene sheets and compacted without any exposure to moisture.The women judge the correct condition of the leaves by pressing them tight in the palm fist. If they spring back after release of pressure, they judge that the leaves have good elasticity, and the process has been completed.

Grading and Marketing

Grading individual tobacco leaves into a standard grade based on plant position, colour, blemish, texture, leaf length, and ripeness is an intelligent job. A well-experienced woman can judge the leaf based on the colour, texture, aroma, and maturity as per the quality requirement. A woman can grade 3-4 kg of leaf per day for 8 hours into specified grades. In one hectare of land, 2500 -3000 kg of the leaf is produced which requires grading leaf-wise. The female to male ratio happened to be 13:1 the highest in this operation. The intensive employment potential is exploited here in tobacco cultivation. Many of the lower and middle-class women folk are experts in grading and are restricted to this grading work alone during the entire season. Hence this tobacco offers seasonal employment to the women folk.

Conclusion

Women comprise 33% of the agricultural labor force and 65% of the tobacco labour force in India. In tobacco cultivation, women need strengthening of social services, creating health awareness, ensuring women's access to basic services, land control, property inheritance, and financial inclusion is the way forward to achieving sustainable agriculture. Women need the knowledge and technical support to grow and market their produce as well as access to loans and cooperatives to support those endeavors. Improving their livelihood, training,capacity building, knowledge, and technological know-how, providing communication and assertive skills as well as better access to resources has improved the livelihoods of these farm women with the concerted efforts of ICAR-CTRI and its Research Stations over a period of time.

Occupational Health Hazards of Farm Women in Tobacco and Interventions for Occupational Safety

Ministry of Health and Family Welfare, Government of India has identified occupational health as one of the important areas and launched a scheme entitled National Programme for Control and Treatment of Occupational Diseases in 1999. The Ministry suggested National Institute of Occupational Health (NIOH), Indian Council of Medical Research (ICMR), Ahmedabad compiled documents on the National Programme for Control and Treatment of occupational diseases. As a first step of this activity during 1998-99, the Ministry sponsored 9 projects, out of which occupational health problems of tobacco harvesters and their prevention is one among them.

In India, women workers play an essential role in tobacco cultivation starting from sowing through manuring, weeding, harvesting, and other post-harvest operations. However, arduous work, an unwelcoming environment, and poor socioeconomic conditions all contribute to chronic morbidity. Hoque, A. (2018) explains that in West Bengal's Malda area, bidi workers are exposed to poisonous tobacco vapours, resulting in serious health concerns (major and minor). Workers engaged in tobacco cultivation suffer from an occupational illness known as green tobacco sickness (GTS). Green tobacco sickness is an illness resulting from dermal exposure to dissolved nicotine from wet tobacco leaves. Nicotine being an alkaloid is easily absorbed through the skin. GTS was first reported among tobacco workers in Florida in 1970. India was the country to report GTS as green symptoms among Indian tobacco harvesters in 1977.

According to the report of NIOH, ICMR, the women labourers in tobacco farming are being exposed to certain occupational health hazards. A comprehensive attempt was made to study the health hazards faced by these workers. Human health and safety indications for workers involved in production, handling, storage, processing or otherwise have contact with various agricultural inputs or products.There are adverse implications on health and safety that result from constant contact and exposure to pesticides, toxicity, insect bites, infection, congestion, and other inputs and outputs.

Tobacco is a labor-intensive crop employing around 45.7 million people depend on tobacco for livelihood in its various operations directly or indirectly in the total supply chain. In tobacco cultivation, women play a critical role

starting from seed selection, nursery bed raising, transplanting, harvesting, stringing, curing, bulking, grading, and baling, etc. These operations are time-consuming, and they require a lot of patience and skill. The long hours of productive physical labour and feelings of exhaustion may sometimes cause drudgery among farm women. However, very little literature has been published documenting the human health and safety implications for workers.

A study on 'Occupational health hazards of women' was taken up in 2005 by the Institute. The health hazards of women in tobacco crop were analyzed in FCV (Flue Cured Virginia) tobacco-growing regions of Andhra Pradesh.The research was carried out among growers in NLS, SLS, and SBS regions of Andhra Pradesh. Growing and handling FCVtobacco poses some risks due to the humidity content present in the wet leaves, and nicotine absorption. Green Tobacco Sickness (GTS) is a type of work-related toxicity that people manage who nurture or manage FCV tobacco at any phase, resulting in morning sickness, vomiting, nausea, headache, muscle spasms, and blurry vision.

Occupational Health hazards of farm women in Tobacco cultivation

The occupational health of women in tobacco cultivation was studied under the following three phases namely nursery management, field crop management, and post-harvest product management.

Nursery management (90-100 days)

The health hazards of women in tobacco are related to the operations of watering, weeding, manuring, pulling, bundling, mulching, and de-mulching. In watering activity, shoulder pains, body aches, low back pain, and pain in arm joints are common physical hazards in weeding; low back pain, discoloration, and tanning of palms are the common physical hazards in manuring, pulling, and bundling operations. In tobacco nurseries, the crop is very tender and more prone to fungal contaminations namely damping off, anthracnose, and frog eye spot as the crop is highly exposed to water and moisture. The women are in constant contact with pesticides as they regularly weed the nursery beds which results in toxicity, infection, congestion, and other respiratory disorders.

Field Crop Management (150-160 days)

Field crop management involves preparatory cultivation, manuring, transplanting, cultural operations (weeding, topping, and de-suckering), and plant protection operations. Cuts, wounds, injuries, backache, and fatigue are common in preparatory cultivation; poisoning and toxicity are prevalent in manuring and fertilizer operations. Back pain and body aches in the transplanting of seedlings, topping of flowering buds and axillary buds (suckers), Green Tobacco Sickness (GTS), skin problems, dermatitis, and urinary infections exist in cultural operations. Tobacco workers remove the flowering buds and axillary buds from the growing plants to increase the leaf volume, leaf weight, and nicotine content.

During these operations, hands get smeared with thick gummy plants' sap and other parts of their body also come into contact with tobacco leaves which leads to the absorption of nicotine through dermal pores, which is called trans-dermal absorption. Nicotine is small molecule soluble both in water and lipids. Nicotine as a free base easily crosses the dermal barrier. Nicotine is a chemical that can pass through the skin and enter the bloodstream causing GTS, a form of nicotine poisoning.Overall tobacco harvesters absorb approximately 0.8 mg of nicotine daily based on the duration of contact with skin.Plant protection involves both men and women in the plant Row Plough Furrow (PRPF) method in vertisols and the dollop method in alfisols. While the men dig holes with bamboo sticks beside the plant, women apply manure in the ditches without taking any protective and safety measures. Hence skin problems and dermatitis are common.Congestion and respiratory problems are commonly observed in plant protection operations. Lack of proper safety devices, inhalation of certain volatile vapours, long hours of working under the scorching sun, parasitic infections, improper use of implements, and ignorance about the use of pesticides are the main causative factors.

Post Harvest Product Management (20-30 days)

Post Harvest Product Management (PHPM) involves a series of operations *viz.*, harvesting, stringing, grading, baling, and packing. While carrying out these operations, skin infections, nausea, vomiting, allergies, and dermatitis are common during harvesting and stringing operations. Leaves cured in barns were collected and kept in grading halls. The cured leaf has a lot of pungent aromas. This in turn has a lot of dust particles and sand too. Due to the presence of dust, sand, and other non-tobacco-related material, respiratory disorders, strain, and irritation of the eyes arise in women workers. The study revealed that the inhalation of tobacco dust causes respiratory diseases such as asthma and bronchitis.

Respiratory problems are also observed in baling and packing operations due to dust, pollen grains, and other contaminants in the grading halls. A group of women grades tobacco in grading halls compacted with tones of cured tobacco leaf. GTS occurs in tobacco harvesters during the handling of green tobacco leaves. However, its severity depends on factors *viz.*, variety of tobacco, humidity, ambient temperature, type of work, and due deposition on the plant. Health effects due to absorption of nicotine during various processes of tobacco cultivation can be considered as acute nicotine toxicity. Headache, nausea, vomiting, giddiness, fatigue, and ECG fluctuations in rare cases were found to be the acute effects of nicotine toxicity.

In India, most of the farm women work throughout their reproductive stages in almost all the crops and tobacco is not an exception. Hence women are also involved in the above operations during pregnancy and lactating stages. During pregnancy, if women are exposed to certain nicotine substances, they are highly prone to morning sickness, vomiting, headache, and diarrhoea because of green symptoms. In lactating mothers when they are in close contact with the tobacco leaf certain nicotine gets absorbed into the body. After returning from the farm, many of the women feed their babies with breast milk, where the babies are prone to vomiting and diarrhoea.

Strategies and Interventions for Sustainable Tobacco Production

The health hazards expressed by the farm women in all the operations of tobacco were collected, the causative factors were analyzed, and the type of hazard was noticed. Plant protection operations and post-harvest operations like harvesting, stringing, and packing were found to be highly hazardous. Manuring and other cultural operations were found to be moderately hazardous. By using protective clothing like gloves, aprons, and shoes, the hazards can be avoided to a moderate extent. Results of many studies were in accordance with the present study indicating that certain operations in tobacco are hazardous for farm women (Ghosh et al, 1985). Personal Protective Equipment (PPE) have been recommended by ICAR- CTRI in tobacco cultivation. PPE not only helps protect farm women from occupational health hazards but also boosts farm productivity.

1. Hand gloves: Hand gloves are meant to preventgummy plant sap on the palm surface and abrasion and peeling of skin around the nails. Thus, they prevent transdermal nicotine absorption. However, the use of gloves does not affect the speed and quality of work. Farm women expressed their work-related symptoms like headache, giddiness, and green symptoms were reduced and the women expressed their work satisfaction. Gloves prevent hazards and offer protection and shield the hands from abreasions, slips, cuts and exposure to chemicals.

2. Face Masks: Farm women are exposed to dangerous particulates and extreme odors, dust, sand, and other non-tobacco-related material in grading halls and curing barns. Respiratory disorders *viz.*, bronchitis, and asthma arise in farm women. Good quality, easy, and comfortable to wear face masks were recommended to reduce respiratory disorders. The masks with effective filtration technology and air purifying masks are effective in protecting the lungs and throat of farm women workers.

3. Aprons: Thick cotton long-sleeved aprons are recommended for preventing the gummy plant sap from entering the body and preventing trans-dermal nicotine absorption in farm women in tobacco. In addition, they also protect the farm women from scorching sun and heat. Farm women expressed their work satisfaction that wearing quality aprons has reduced body itching and

skin allergies. Aprons or long-sleeved shirts, long pants, and water-resistant clothing protect against nicotine absorption.

4. Gum Boots: A number of workplace hazards can be prevented or reduced by high-quality agricultural gumboots. High-quality PVC or rubber gumboots protect against chemical hazards and animal bites. They are the best solution for the farm women working in the cultural operations of tobacco cultivation. Gumboots have multiple uses; they keep legs and feet safe and dry. They are waterproof footwear that works even in moist southern black soils and central black soils by keeping the legs and feet dry, thus avoiding damage, burns, slips, snakes, and scorpion bites. Many pesticides and herbicides used in farming can cause chemical burns. These boots offer protection against all types ofchemicals.

Strategies for improvement of working conditions for women in tobacco cultivation

The farm women bear the triple burden of low income, gender discrimination, and health problems in rural India. They have the least access to technologies and training. Agricultural operations are time-consuming and to perform these operations, they require a lot of patience and skill. Based on the reports of ICAR-CTRI, some of the strategies have been suggested for their improvement as follows:

- Use of protective clothing *viz.*,footwear, head cover, gloves, mask, etc.
- Information on various kinds of health hazards and protection against chemicals, insecticides, and pesticides should be properly available and accessible to the farm women in the local languages.
- Training and education of farm women in preventive measures and health hazards and up-gradation of existing skills
- Provision of toilets and adequate washing facilities in the working areas
- Periodical medical health checkups should be taken up
- Health, nutrition education, and supply of supplementary diets to the farm women
- Combating malnutrition in vulnerable groups through health policies and programs through various schemes
- Air-purifying respirators are made available for filtering the contaminants from the air in special circumstances *viz.*,extremely polluted atmosphere.
- Training and information about the use of PPE.

Eco-Friendly Drudgery Reducing Technologies for Farm Women in Tobacco Cultivation

Tobacco is one of the important high-value cash crops in India. The country ranks second in world tobacco production after China. Tobacco is cultivated in an area of 4.33 lakh ha, covering 15 states, with a production of about 758 M kg (FAOSTAT, 2023). Tobacco, often quoted as a golden crop, is an integral part of commerce and a symbol of economic prosperity to millions of farmers. Tobacco production is an important source of livelihood and provides direct and/or indirect employment to the millions of people in India. India produces different styles of FCV tobacco, which vary in their physical and chemical characteristics under diverse climatic conditions and it is exported to over 114 countries across the globe. A unique feature of tobacco production in India is that myriad styles of tobacco are cultivated under widely diverse agro-ecological situations. Flue-cured Virginia (FCV), bidi, hookah, chewing, cigar wrapper, cheroot, burley, oriental, HDBRG, Lanka, Pikka, Natu, etc., are the main tobacco types grown in the country, with FCV and burley tobacco being the main exportable types.Women play a significant and crucial role in tobacco farming. They undertake various activities in tobacco such as sowing, field preparation, nursery raising, manuring, pulling, mulching, de-mulching, transplanting, intercultural practices, weeding, harvesting, and post-harvest operations. But it is unfortunate that they remain invisible workers. However, their involvement as decision-makers and leaders in tobacco production technology is very low. There are about 0.7 million growers, 0.5 million curers, and 34.8 million agricultural and tobacco industry workers out of which 50% are women workers engaged in tobacco cultivation.

Involvement of farm women in Tobacco

Based on the previous studies and reviews and the extent of farm women's involvement in tobacco, an attempt was made to analyze the drudgery faced by farm women in tobacco cultivation. Farm women work for long hours in the squatting position under the scorching sun in a bending posture constantly for long hours without any safety tools or implements during transplanting, weeding, manuring, topping, and various post-harvest operations in tobacco production. They inhale a lot of tobacco dust, exposed to various poisonous substances and hazardous environments while working during important operations.The drudgery faced by the farm women was quantified and calculated for all the activities of crop management in tobacco farming. The drudgery index was calculated based on the linear combination method

using the scores obtained from the degree of difficulty experienced in the work, body posture difficulty, handling difficulty, time spent on the activity, and frequency of operation. The respondents were asked to rate their answers against a three-point continuum of scores 1, 2 and 3 indicating easy, moderate, and difficult. The mean scores were calculated based on the formula given below.

Drudgery score (in each operation): The total score of the respondents / total number of respondents.

Drudgery Index:Linear average of drudgery scores of the respondents

Drudgery index of the activities was highly significant for weeding, and watering followed by harvesting and stringing. The activities of preparatory cultivation, manuring, transplanting, and plant protection were also significant, but the average drudgery index score was low because of less time required and low frequency of work. The energy requirement is higher because of the time spent on the activities. The drudgery index of farm women was high for watering (2.67), weeding (2.84) activities of nursery management; preparatory cultivation (2.24), manuring (2.24) transplanting (2.17) and plant protection (2.13) in field crop management; harvesting (2.44) and stringing (2.4) of post-harvest product management operations in tobacco.To reduce the drudgery for improving the work efficiency among farm women in different phases of tobacco cultivation, need-based user-friendly drudgery-reducing technologies were developed and introduced by the Institute.

Nursery Management:

Women are primary users of water for domestic purposes and irrigation in many communities. Generally, tobacco nurseries are grown on sandy or sandy loam soil. Nurseries are generally grown on raised beds of sandy to gravelly loams. Nursery raising involves a series of activities with a lot of women folk. The ratio of men to women involvement in nursery operations of watering, weeding, manuring, pulling, bundling, plant protection, and mulching is found to be 1: 5. The physical stature and working strength of the women are not on par with men. Therefore, the machinery/equipment which are developed keeping in view of males need further modification/ development. The seeds are sown on raised beds of 10-15 cm in height and watered daily 6 times with rose cans. Before sowing the seeds, they are mixed with fine sand in 1:15 ratio to 1:20 ratio for their proper and uniform distribution of seeds.Thinning of seedlings after germination to prevent them from damping off and other fungal diseases is the main activity of the women.

1. Rose Cans: Traditionally women used water pots to irrigate the tobacco nurseries and these women had to carry water-filled pots from long distances. ICAR-CTRI introduced these cans in tobacco nurseries during the 1960s by incorporating small modifications by reducing their weight and adjusting the angle as per the requirement and convenience. The use of rose cans has become the most common irrigation practice in the nursery management of tobacco crop. Ideal rose cans have a capacity of 5 liters, made with aluminum, and are light in weight. The small rose-like sprinkler is arranged at the top of the nozzle to sprinkle water uniformly and reduce excess water deposition and stagnation in nurseries. After using these rose cans, watering in tobacco nurseries has become easier, and was found to be efficient during the first decade of tobacco inception.

2. Micro Sprinklers: Planting tray seedlings proved advantageous compared to conventional seedlings in terms of early establishment, uniformity of growth, duration, and productivity. Irrigation in tobacco nurseries is an essential point, as tobacco crop is very sensitive to excess humidity or lack of water. Hence, irrigation with sprinklers was recommended in nurseries with adequate handling, as the speed of water application is normally slower by avoiding water stagnation and flooding the nursery beds.

Generally, water is applied 5-6 times/day through rose cans manually, which is labour intensive and involves high-scale drudgery. To improve the water and nutrient use efficiency, and to reduce the labour cost in tobacco nursery raising, micro irrigation systems were introduced by ICAR-CTRI. Sprinkler irrigation in tobacco crop demonstrates many advantages *viz.*, the possibility to wash the surface of the leaves through irrigation, durability and efficiency, easiness of maintenance, thus improving the irrigation. It works like natural rain and allows it to fight against frosts to reduce the temperature from the leaves, and pests simply with the application of irrigation or even by adding fertilizers to the irrigation water as per the crop demands. Sprinklers reduce the drudgery of farm women during nursery operations to an extent of

50 to 60 percent. Thus, with the use of sprinklers, the drudgery of carrying heavy loads of water is reduced.

3. Poly Nursery Trays: The polytray medium pressing device is fitted with rubber corks which exactly fit in the poly trays was designed and developed by the institute to reduce drudgery and increase time efficiency. In polytrays, coir pith growth medium is filled manually by women workers, which is time-consuming, labor-intensive, and involves drudgery. The polytray medium pressing device offers several advantages over conventional plants. The chief advantage is the reduction of labor costs at the stage of setting. Growth of tobacco seedlings in polytrays is recommended to produce uniform and disease-free healthy seedlings. Polytray medium pressing tool reduces time and drudgery of women by 47% with good density of the medium, which facilitates better root growth.

4. Farm Ponds The water requirement is high in tobacco nurseries as it requires six irrigations per day. During the first week after emergence, the seedlings require 3 to 5 liters/m^2 daily. Hence, water storage tanks/ puddles dug in burley growing remote areas are highly suitable for tobacco nurseries as well as field crop management.

ICAR-CTRI has recommended these small concrete water tanks in the nursery area towards the northeast side. 4-5 small ponds measuring 5x5x5 feet of water are essential for providing water throughout the season in tobacco nurseries. In the case of small and marginal farmers, digging small pits of 5x5x5 feet in size accommodates 1000 liters of water by arranging pebbles, and gravel stones as edging material to the pond for preventing water absorption by the edges.The women workers in the burley tobacco region adopted this technology and benefitted from this technology, which avoided carrying water from long distances.

I. Field Crop Management

In field crop management, the women are involved in the operations of weeding, inter-culture, ridging, topping, and de-suckering. The following drudgery-reducing technologies were recommended by ICAR-CTRI.

a. Dry-land Spiked Weeders for Farm Women

Weeding activity is a strenuous, time-consuming, and tedious process in dryland agriculture. Women have to remain in bending and squatting postures for 6-7 hours per day putting all the pressure on knees and back, thus leading to drudgery in farm women. ICAR-CTRI has introduced this technology to the farm women of rainfed light soils to weed the tobacco fields as it is simple, portable, cost-effective, and easy to handle and designed to suit the ergonomic posture of the farm women. It reduces drudgery by distributing the workload on both shoulders.

When the weeder is pushed forward, the spiked reel rotates in the soil and the v-blade penetrates to a depth of 6-8 cm in the soil which in turn cuts the roots of the weeds. The spiked reel mulches the weeds in the soil with the forward and backward movement of the weeder. The mulched weeds act as organic manure in the soil. Eight women together can weed a hectare of land in a day. The weeding efficiency was found to be 89% with low plant damage. It reduces the labour from 15 to 8 members per hectare per day.

b. Drip Irrigation Technology

Drip irrigation technology in tobacco enables efficient use of waste and leads to enhanced crop growth and yield. This is due to the maintenance of a uniform soil moisture regime in the crop root zone by way of frequent irrigations at shorter intervals. Balanced application of fertilizers through drip fertigation, ensures the efficient use of nutrients, and fertilizer conservation and aids in profitable tobacco production. In addition, fertigation with tray seedlings for healthy and uniform seedlings will enhance the yield and quality of FCV tobacco apart from higher water and nutrient use efficiency.

A total of 15 percent of farmers adopted this technology in an area of 4000ha. The area under drip irrigation-fertigation is steadily increasing. Within the next couple of years, drip irrigation and fertigation systems will be the prevailing irrigation system in the region.

c. Battery-Operated Hand-Topping Tool for Women

Topping refers to the removal of the flower bud along with some of the uppermost leaves to stimulate the growth and development of the remaining leaves. When left untopped or topped late, tobacco plants put energy into flowers, which leads to seed production rather than leaf production, resulting in substantial yield losses. Topping removes the dominant influence of the terminal bud over lateral buds or "suckers," stimulating vigorous sucker growth that must be controlled by the suckericide. Topping also stimulates root growth, which increases nicotine production in the roots and translocation to the leaves.Topping is a unique cultural operation in tobacco, arrests the apical dominance, which aids in increasing the size and weight of leaves and thereby overall yield (20-25%) per hectare. Farmers generally top the crop manually, which is tedious and time-consuming. To replace manual topping, ICAR-CTRI has developed battery operated hand-topping tool. The machine works for 8 hours with 3 hours of charging. The tool is found to be effective in terms of easy handling and saves labour and time in tobacco topping.

II. Post Harvest Product Management in Tobacco

In post-harvest product management, the women are involved in the operations of stringing, curing, bulking, grading, and baling. The following drudgery-reducing technologies were recommended by ICAR-CTRI.

a. Leaf Stitching Machines

The stringing operation of tobacco leaves is a skillful activity and involves the tying of leaves to sticks by women workers. About three leaves are tied in a bunch, back-to-back, with a jute twine loop on a stick. The leaves are distributed uniformly all over the length of the stick to avoid overcrowding. This activity is done by 20-25 women per barn and requires a lot of patience, time, and skill.

To save time and increase production efficiency, ICAR-CTRI has introduced a Leaf Stitching Machine to stitch green tobacco leaves with special threads. About 90-100 such leaves are tied in separate bunches with a series of loops on a stick with a length of 100-130 cm.

The tobacco leaf stitching machine is equipped with a mobile stitching machine that can adjust the length of the stitch, for a layer of tobacco leaves with a maximum thickness of 4-5 cm. It is equipped with a 0.75 HP single-phase electric motor with adjustable mechanical speed by means of a lever. It is easy to use and produces up to 700 meters of strings of tobacco leaves per hour of work. This machine improves the working efficiency of women workers and saves time without damaging the leaf.

b. Tobacco Bale Pressing Machines

After completing the curing process, tobacco farmers compress the cured tobacco in the form of cubes with a standard measurement of 1x1x1 meters weighing about 100-110 kgs. This process is generally done by women workers who tightly compact and compress with the help of wooden planks. These bales are packed airtightly and transported to auction platforms for sale. This is a cumbersome process and involves a lot of time and patience.

The low-cost Bale Pressing Machine was designed and developed by ICAR-CTRI which consists of a Steel plate (30x30") fixed on a cement platform. A manually operated adjustable iron plate (29 x 29") fixed with the help of a screw handle to the Iron frame of 43" size fixed over the steel plate on the ground. The wooden box is placed on the steel plate and the cured leaf is packed periodically in a systematic manner with the help of the adjustable iron plate fixed to the Iron frame. After packing the required cured leaf (110-150kg), the wooden boards of the bale boxes are removed, and the bale is packed with gunny bags and ropes. This particular machine is a modified version of the previous machine to reduce the cost for easy portability and assembly. Baling of the graded cured leaf through a bale pressing machine reduces labour, and drudgery and improves the efficiency of women workers. This machine reduces 25% labor charges apart from improving uniformity in baling.

c. NTRM Baskets

In a competitive market environment, non-tobacco-related materials can inflict lasting damage on a brand and causea reduction in export prices in the international markets. Tobacco is a natural material that always contains non-tobacco-related materials (NTRMs) along with the leaf.

NTRMs such as sand/soil, weeds, plastics, feathers, hessian cloth, gunny bag pieces, cigarette butts, grass, metal, nails, bolts, gutkha sachets, dust, paper bits, broomsticks, etc. In the tobacco trade, bales are an issue of concern mainly in tobacco exports. The presence of NTRMs reduces the quality of tobacco, hence they must be removed to prevent their inclusion in the end products, which could have serious consequences for consumers. Precautions need to be taken to avoid these NTRMs during harvesting, curing, and baling the tobacco leaves. One ton of raw tobacco is expected to contain about 100 grams of foreign material and an average of 1,000 non-tobacco particles.

NTRM Baskets were introduced by the institute in the grading halls of tobacco, collecting and throwing the foreign material to keep the tobacco safe, hygienic, and free from NTRMs. Grading is the manual sorting of cured leaves into homogeneous lots by women workers according to the plant position styles and involves a lot of patience and skill as these operations are gender specific.Farm women were instructed to observe the NTRM in grading halls. This helps growers to realize better prices and income for tobacco produce in the market.

Strategies for Reducing Drudgery of Farm Women in Tobacco

Important strategies were proposed to save the drudgery of farm women in tobacco.

- Development of appropriate cost-effective and location-specific technology suitable to women's body stature and ergonomics. The development and standardization of tools in terms of comfort, quality, and efficiency by keeping in view of ergonomics of women.
- Functional training and education of farm women in the use of tools, implements, and machinery may be emphasized.
- Provision of wash rooms and adequate washing facilities in the working places
- Periodical medical checkups and supervision. Improvement of health & nutrition through various schemes.
- Combating malnutrition in vulnerable groups through health policies and programs.
- Upgradation of existing skills in the use of tools and implements.
- Women should be freed from wage and sex discrimination, and exploitation.
- Self-help groups can also be formed as cooperative sectors for more coordination in terms of functional operation.
- Information and training about nicotine hazards, GTS prevention, and appropriate personal protective equipment (PPE) before letting the workers handle tobacco leaves.

Capacity Building and Skill Training of Farm Women during Lean Period of Tobacco Cultivation

Agriculture employs about 80% of rural women in India. Women play a critical and potentially transformative role in agricultural growth in India, but they face persistent obstacles and economic constraints limiting further inclusion in agriculture and allied sectors. Women in agriculture continue to be vastly underrepresented in the decision-making and leadership roles of the agricultural sector. They have the least access to resources, lack control over their income, and lack a role in leadership and decision-making about agricultural production. Empowering and mainstreaming rural women's workforce in agriculture can bring a paradigm shift towards economic growth. It will enhance food and nutrition security for achieving Sustainable Development Goals by 2030.The concentrated efforts were made by ICAR-CTRI to ensure that the benefits of training, extension, and various programs will reach the women in proportion to their number. It is imperative to adopt gender-responsive strategies to address the specific needs of women in agriculture. This includes ensuring access to resources such as credit, training, and technology, enhancing women's participation in decision-making processes, and developing policies that promote equitable adaptation and resilience-building efforts.

The training programs for farm women in tobacco were designed to improve cropping intensity (diversification of cropping system) and promote allied enterprises like dairy/poultry/goat farming etc. and through rural non-farm income generation activities. The training and capacity building in soil conservation, social forestry, dairy development, and other occupations allied to agriculture like backyard poultry, dairy units, fisheries, goat rearing, kitchen gardening, and homestead units like fruit and vegetable processing, soya milk production, palm products, palm fiber production, adda leaf plate making, coir based products, sea shell processing, tailoring, jute bag making etc. Socio-economic survey was carried out by using PRA techniques to analyze the scenario of Gender related problems during 2005-2006. The constraints were identified through PRA techniques viz. social map, resource map, agro-ecology map, transect, and ranking in agro-eco system analysis. During discussions, important existing problems expressed by the women groups were analyzed through ranking of constraints, and the same was depicted in the table.

Table 1:Ranking of Constraints Expressed by the Women (N= 2500 women)

S. No.	Constraint	Intensity (%)
1	Low family income	91
2	Non-remunerative agriculture and low net returns	89
3	Indebtedness	78
4	Lack of Employment during the lean period	87
5	Lack of opportunity for Decision Making	75
6	Non-utilization of natural resources	85
7	Unreached welfare Programmes	65
8	Poor health and Nutritional status	78
9	Occupational Health Hazards	82

The major problems were identified, and the interventions were proposed based on the analysis of PRA techniques.

1. Training and Capacity Building
2. Promotion of Homestead units and Micro Enterprises
3. Value addition to natural resources
4. Establishment of marketing avenues
5. Linkages with NABARD, State Line Departments,and NGOs
6. Empowering women in knowledge, abilities, and skills
7. Enhancement of nutritional status
8. Safety and drudgery-reducingdevices.

The entrepreneurship programs were promoted among farm women in tobacco farming in a phased manner.

Phase 1: In the first phase, professional extension services were offered through the concept of training and visit programs for motivating farm women. The heads of villages have taken an active part in the motivation of women in the areas *viz.*, infrastructure facilities, capital investment, and skill development based on the type of activity.

Phase 2: To increase the success rate, homogenous group activities were taken up with the available raw material, low-cost equipment, division of labour, competency in productivity and quality, and easy access to marketability.

Phase 3: The group activity got tremendous mobilization among rural women towards entrepreneurship activities which resulted in the establishment of

several homestead units in the villages. The group discussions organized with the bankers, and financial agencies facilitated the homestead enterprises to utilize different schemes of Government.

Phase 4: The selected trainees were given skill up-gradation training and multiple skills for the sustenance of the income throughout the year. To avoid market difficulties the trainee trader concept was introduced by avoiding the mediators.

The strategies used in the implementation of women empowerment activities are furnished below.

1. Group Approaches
2. Master Trainer Concept
3. Multiple Skill Concept
4. Ex trainees Meet
5. Trainee Trader Concept
6. Direct Linkage with the Market
7. Linkages with Financial Institutions
8. Follow-up Visits
9. Refresher Programmes

The following homestead/ micro enterprises promoted for empowerment of women during the lean period of tobacco crop cultivation.

Backyard Poultry

Local poultry breed was upgraded with the introduction of high egg-laying capacity breeds like vanaraja, giriraja, gramapriya, kadaknath, and turkey birds,etc. which in turn improved the productivity of egg-laying from 80 to 150 in a year. The institute has promoted 75 backyard poultry units under IVLP, TSP,and SCSP in the districts of East Godavari, West Godavari,and Prakasam tobacco areas.

Dairy Units

The farm women were encouraged to establish backyard dairy units, which would not only upgrade their local cattle breeds but also be useful for supplementing their family income. In interior rural

and tribal areas, lack of artificial insemination facilities, lack of awareness, lack of storage facilities of semen (cattle breeds), lack of technical expertise, and location of hamlets far from the insemination centers are the major problems.To increase their family income, a high-yielding breed of male Murrah buffaloes was introduced in the interior areas of burley tobacco. Due to this activity, new calves of the Murrah breed were born in the adopted villages and surrounding hamlets. The tribal families benefitted by improving their family income of Rs.10,000/- per month per family both by sale and consumption of the milk. The Andhra Pradesh co-operative dairy society of ChekkaNimmalapalem village, Addategala Mandal, East Godavari district benefitted by introducing this buffalo in their dairy unit. Nearly 32% percent of the total buffalo population in this dairy was conceived. Awareness regarding the murrah breed was also created among the tribal farmers.The above dairy units were established under the financial assistance of the DBT Project. Further, health camps were also carried out in FCV tobacco areas with the help of KVK staff under the IVLP project.

Goat Rearing

Improved varieties *viz.*, Ram and Jodipi sheep were introduced by which the meat and fur yield was increased significantly, whereasthe Black Bengal goat variety introduced has improved the goat population significantly (80%) and reduced the mortality rate. As a homestead unit, introducing the said improved variety along with the local breeds has resulted in improving the family income to an extent of Rs. 5 lakhs per annum.

Kitchen Gardening: The regular diets of farm families were low in protein, calcium, iron, zinc, A and C vitamins. The backyard kitchen garden component implemented through the farming system approach has enhanced the nutritive values of foods. High-yielding varieties of vegetables (tomato, bush beans, drumstick, ladies fingers, brinjal, pumpkin, ridge guard, bottle guard, cauliflower, etc., green leafy vegetables *viz.*,palak, methi, amaranthus, spinach, cabbage; and fruits *viz.*,papaya, banana, guava, were introduced. In addition to this, the supplementary diets and weaning foods *viz.*,soya products cereal

+pulse+ oilseed powders, millets (powder recipes of ragi, jowar,bajra, and low-cost nutritious supplementary diets resulted in reducing the intensity of malnutrition in women and children to an extent of 70 to 80 percent over a period of time. Low-cost nutritional recipes and fruit and vegetable preservation methods have enhanced the general health status of rural communities.

A family can earn an amount of Rs. 20,000 per annum by establishing backyard nutritious kitchen garden units. So far, 150 backyard units have been established in rural and tribal areas of East and West Godavari districts through various programs like DBT funded Projects, NICRA (National Innovations for Climate Resilient Agriculture), KVKs, TSP, SCSP and APERP (Andhra Pradesh Economic Restructuring Programme).

Fruit and Vegetable Preservation: Fruit and vegetable preservation by rural women by traditional methods has been practiced from time immemorial. The fruits and vegetables fetch a high demand during the summer months and their shelf life is low due to this the market price goes low due to the high volume of production especially for tomatoes, papaya, grapes, and oranges during the season. During these seasons, the produce can be preserved for a long time through value addition which fetches a better price in the market. Hence, the preparation of juices, jams,and pickles for women groups during lean periods is introduced by improved preservative techniques. Through this activity rural women can earn Rs. 20,000 per month as an additional income.

Value Added Food Products through Solar Drying: Since ancient times, natural sunlight and heat have been utilized by Indians to preserve food products by open drying. A prolonged open drying period leads to contact

with ultraviolet light (UV) and contamination of food through insects as it is directly exposed to sunlight. This could degrade some valuable phytochemicals and vitamins *viz.*, chlorophyll, essential oil, â-carotene, and ascorbic acid in open drying. Hence a hygienic solar drying method was introduced by ICAR-CTRI with the help of Solar driers.Various food products *viz.*, mango jelly, amchur, amla candy, mixed fruit jelly, palm jelly, fruit and vegetable slices, dried grapes, herbal powders, green leaf powder, spice powders, amla nut powder, bhavana ginger, ginger candy, dry fruits can be easily made by following certain improved technologies. This technology can be made use of solar driers. This method is hygienic as the produce is kept in closed glass chambers and hence is hygienic without loss of nutrients. Solar driers cost around Rs. 50,000 to Rs.1,00,000. This can be taken up as a Homestead unit in rural areas. NEDCAP(Non-conventional Energy Development Corporation of Andhra Pradesh Limited) is popularizing this technology among rural and tribal entrepreneurs by offering financial assistance.

Soya Milk Production

Health among rural and tribal women is poor because of their irregular food habits. Diseases like anemia, vitamin deficiency, and disorders like scurvy, pellagra, and night blindness are common among women. Kwashiorkar, Marasmus, and Rickets are the prevailing disorders among the children. The soya processing unit was introduced in Ashram School hostels of Rampachodavaram mandal for supplementing protein diet among tribal school-going children in the age group of 11-15 years. The soya processing unit is a small equipment costing around Rs. 1 lakh with a production capacity of 5 liters per hour. It works with a one-fourthhp electric motor. Soaked soya bean is the raw material for milk production. The machine works with the principle of grinding and pulverizing. The tribal diets are poor in protein, calcium, iron, zinc, A and C vitamins. The introduced Soy milk (50 ml per child)/ milk products (50 gm) along with greens, millets, rajmah, and fruits in their regular diets has enriched the quality of their diets and improved the nutritional status of children to the extent of reducing malnutrition from 84% to 42% in the adopted areas. This programme was introduced in six tribal hostels of Rampachodavaram and Aggatheegala mandals of East Godavari district in collaboration with the Integrated Tribal Development Agency and other NGOs (World Vision, Laya, and Shakthi).

Palm Products: Traditionally the palm leaves are being used for making different kinds of day to day need based articles viz., hand fans, umbrellas, fruit baskets, packing materials, mats, water lifting baskets, roof material, etc., The leaf ribbons are being used as tying material for construction purposes of thatched sheds. But the income obtained through the sale of this produce is very meager and hence the improved techniques with low-cost equipment viz., leaf sizing and leaf cutting machines, mat frames designedby Palmyrah board have created new opportunities to add value to the Palmyrah products. Accordingly, need-based skill-oriented training programs were designed and implemented in rural and tribal areas to get additional income through this abundantly available agro-based product. In place of regular leaves, the tender leaves and leaf ribbons were collected and processed in a specific manner to prepare innovative decorative items like garlands, door curtains, fruit bowls, table decorative, wall decorative, dolls, palmyra stone dolls, art mats, sitting mats, folding fans, etc. by incorporating colour to the products, which in turn resulted in 20-fold increase over the existing income.

Palm Fibre Production

For centuries lakhs of rural and tribal families were dependent on palmyrah fiber extraction for their livelihood security. The fiber separation is a tedious and cumbersome process. The entire family, including children and aged people, is involved in this process. A family comprising of 4 to 5 members can produce 5 to 6 kg of fiber/day thus earning a net income of Rs. 50 per day by manual process. This involves high drudgery and low fiber productivity. In this backdrop, an efficient drudgery-reducing Low-cost portable device for palmyrah fiber separator (PFS) was introduced and invented by CTRI-KVK for extraction of fiber on a commercial basis. It was introduced in the villages of Seethappagudem, Buttaigudem, and Rachuru villages of Burley tobacco growing areas inthe tribal belt of West Godavari

as supplementary income activity during lean periods which resulted in an increase in fiber production by ten folds thus earning net income of Rs.500/ per day per head during 2015-17.

Adda leaf plate Making

The leaf plate and cup-making program was introduced in rural and tribal areas for the benefit of women groups by utilizing the available agro-based raw materials *viz.*,adda leaf, bamboo culmsheath, jack leaves, and almond leaves by utilizing the hand and pedal-operated pressing devices as homestead units with a meager investment of Rs.25000 to 30000. These products have high demand in catering services, family functions, Community programs, and temples, which facilitate the regular market feasibility for their products. This unit can also be taken up as a start-up by procuring double-dye hydraulic devices which cost around Rs90,000 with an output of 5000 paper plates/ buffet plates per day by two women as a unit. The net income per day will be around Rs. 750 per day.

Hill Brooms Making Unit

Hill Brooms (Thysanolaenalatifolia) are generally grown on the hill slopes of tribal areas of Pullangi region in East Godavari districts. The middlemen used to harvest and sell these products in the urban markets by converting them into brooms. In the East Godavari district, there are 15 + homestead units preparing these brooms and supplies all over the state. Due to a shortage of available raw materials, they procure second-graded raw materials from other regions. The longevity of the typical broom is very high (9-12 months) as these are made up of quality grass whereas the second quality

brooms will shed within 3 months. ICAR-CTRI has attempted to grow these brooms in plain areas and planted seedlings with 1x1 meter spacing in the area of one cent in backyards of farmers. About 10 kg of hill broom sticks were produced in a span of 10 months which in turn made into 20 brooms with little investment. Overall net returns per area of one cent is about Rs.1500/ month.

Coir based Products

East and West Godavari areas have a high potential for coconut cultivation. The by-products of coconut *viz.*, coir and coir pith are important resources for the implementation of income-generation programs for rural and tribal women. The coir extracted from coconut husk is abundantly available and can be converted into 2-ply yarn over motorized spinning rats and traditional rats. Similarly, doormat-making activities *viz.*, corridor mats, mesh mats, sinnet mats, and rope mats were taken up by the tobacco women group during their lean period as a homestead activity.

The coir pith which comes as a byproduct during the coir extraction process from coconut husk is converted into coir pith organic manure (C-POM) using plurotus fungus and urea. Coir yarn is having good demand for construction and agricultural purposes. C-POM also has high demand in nurseries which provides nourishment to the growing plants because of the presence of nutrients and highwater retention capacity. With the collaboration of ITC, ICAR-CTRI has introduced these activities providing livelihood with an additional income of Rs. 250 to 300 per day per head. In Jangareddygudem mandal, about 60 women were trained to prepare organic C- POM activity and earn a handful of income.

Seashell Processing: Sea shells are collected from the seashore at the Chollangi area of Kakinada port, where the fisher women collect this produce and supply it to the handicrafts unit of the Tamil Nadu area and get additional income. ICAR-CTRI introduced this program of seashell processing and decorative making under the NICRA Project of ICAR in the year 2015 in Rangampeta mandal. A total of 100 families were selected and imparted need-based training programs in the processing of the seashells with bleaching powder and HCL acid. The processed sea shells *viz.*, button shells, bi-valve shells, and Burma shells are being used in mankind of half-door curtains, full-door curtains, wall decorative, pot hangers table decorative, plait buckles, garlands, dolls, etc., Through this activity the women were able to get an additional income of Rs. 200-300 per day per head. By establishing linkages with the Lepakshi Handicrafts emporium and other lady fancy shops, a marketing facility for their produce was created.

Rural Bakery

Rural Bakery is an enterprise suggested for farm women of tobacco crops. Farm women were relatively free from their farm work as the grading operations were complete by the month of January for early planting crops.The women are relatively free from their farm work except for household operations and start preparing traditional recipes on the festive occasion of Makara Sankranti. During this time, the bakery can be taken up as a homestead occupation by utilizing the available locally available millets *viz.*, pearl millet (bajra), foxtail millet, finger millet (ragi) along with a small amount of refined wheat flour, butter, sugar, and milk. This portable simple stainless-steel device is designed by ICAR-CTRI for making different bakery products viz., biscuits, cakes, curry puffs, bread, rusks, etc., A woman can make 1000-1200 biscuits per day and earn a monthly income of Rs. 15,000 to 20,000 by selling these products. Ragi biscuits, Jowar and Korra cake, and bajra bread, are the popular millet products that have a high demand. The women are selling these products at local school points and local provision shops.

Tailoring and Garment Making: In rural areas, farm women in a few cases work for long hours in their farms to attend to all cultural operations but social customs are prevalent that they should not attend the work on other farms. Tailoring is a skill-based activity suitable for this small and marginal category of farm women. Tailoring programs were designed based on their interest and skills. In addition to this, based on the skills they acquire, they make travel bags, school bags, lunch carriers, file folders, with the help of jute cloth, quilt, and rexin material. They earn Rs. 15000 to 20000. Self-help groups are formed where the group members stitch together school uniforms and necessary tie-ups are made with local schools. Further, linkages were made with local vendors on a piece-rate basis for making the finished products in the case of semi-skilled persons. More than 100 units were established in rural villages of East and West Godavari Districts. Thus the training and capacity building activities are being implemented for improving the livelihood security options in tobacco and non-tobacco villages for women empowerment for making them as partners in the national mainstream.

Impact Analysis of Empowerment Programmes on Farm Women in Tobacco Cultivation

Impact of Tobacco Research and Adoption

The Institute has been making impressive strides since its inception in the evolution and contribution to the scientific development of the tobacco sector by way of developing varieties with desirable traits and a host of agro-technologies and technology dissemination activities for improving the productivity and quality of tobacco in the country. The extensive adoption and deployment of institute technologies, varieties and services have created a huge economic impact on tobacco farmers and farm women. Sustained research and developmental efforts have resulted in evolving appropriate agro-technologies, which have made a significant impact on family income, quality of life, and living standards and paved the way for women empowerment and finally yielded in the socioeconomic development of farming communities in tobacco growing regions of the country.

Impact of the Empowerment Programs on the Awareness of Farm Women in Tobacco Production Systems

Awareness was created in the adoption of simple and viable agricultural technologies *viz.*, green manuring with sunhemp, tray seedling technology, soil test-based fertilizer application, acquaintance with yielding high-yielding varieties, use of bio fertilizers (*Trichoderma virdi*), Bordeaux preparation, topping and de-suckering, *Orobanche* management, potash application as a top dressing, crop rotation practice, plant position grading, etc.The farm women were well acquainted with the latest technologies. Therefore,the incidence of pests and diseases was minimized in tobacco. Thus, a set of agricultural technologies with focused objectives created qualitative and quantitative changes in the socio-economic status of the farmers. The knowledge and skills of the farm women were improved significantly to an extent of 82% in the adopted villages.

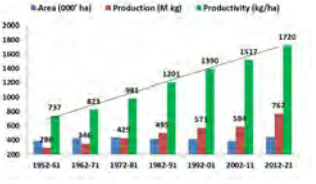
Impact of Empowerment Programs on the Adoption of Recommended Technologies by Farm Women

The technological intervention over a period of time has produced the intended benefits and the overall impact on women farmers and farming communities is quite significant. The interventions *viz.*, micro sprinklers, poly nursery tray seedling technology, water pond management, etc., in nursery management; introduction of dryland spiked weeders, drip irrigation technology, topping tools, and recommended fertilizer application aspects in field management, leaf stitching machines, bale pressing machines, NTRM baskets, etc were better designed to achieve the intended outcomes.

The target groups of women have some of the constraints like lack of technical know-how, credit information, lack of complementary inputs, lack

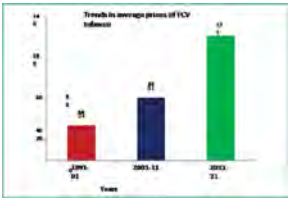
of infrastructural investments and marketing avenues, etc., To increase the adoption rate among the farm women, some of the technological constraints and barriers to adoption among them were removed by imparting knowledge and training in tobacco farming. Efforts were made to remove all these barriers, by providing information (brochures, leaflets), necessary inputs (improved seed, fertilizers, pesticides, technology, and scientific advice), and credit facilities (loan facilities). Farm women have learned to manage critical inputs, resources, and technologies, effectively and efficiently by acquiring independent facilities. Thus, by removing these barriers, the adoption rate of recommended technologies has improved and reached an extent of 92%, a highly significant adoption level.

The Impact of the Women Empowerment Programs on the Production, Productivity and Profitability of Tobacco



The introduction of high-yielding varieties and a package of practices has improved the productivity level of tobacco crops significantly. Creating awareness among farm women on appropriate production technologies, new interventions,and crop diversification has helped in achieving better yields and net returns.

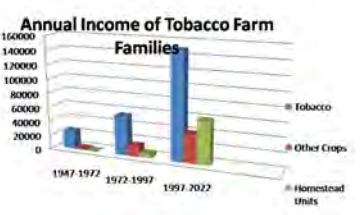
The sustainability of tobacco technologies depends on the practical experience, risk-taking behaviour, and adoption level of the farm women. Further, conducting On-Farm Trials (OFT) and Front-Line Demonstrations (FLD) of new varieties and innovative technologies involving and empowering women farmers has resulted in the adoption of improved technologies and thereby increased productivity and profitability. The net returns and productivity of tobacco crop was improved significantly. The maximum percent increase in net returns after adoption of technologies over a period of time has resulted to an extent of 48.10 %. The average prices of tobacco have also risen to an extent of R. 121/kg which can be attributed to the increased socio-economic status of women farmers.



Impact of the Farm Women Empowerment in Tobacco Production System on Family Income

Intercrops and alternative crops were introduced to the tobacco system and adoption enhanced the productivity of the unit area due to awareness created about the benefits. There was an enhancement of family income from Rs. 2000 (1947) to Rs. 40,000 (2022) per annum over 75 years through the adoption and up-scaling. Further, the introduction of the components *viz.*,

backyard poultry, livestock, horticulture, kitchen gardening, dairy units, and homestead activities have intensified the living standards and the socio-economic status of the farm women in the tobacco production system. With the introduction of these homestead units, there was a significant improvement in the income from Rs 2000 (1947) to Rs 60,000 (2022) per annum over a period of 75 years.



The farm women actively participated and adopted kitchen gardening and poultry to enhance the farming system. Due to improved poultry and buffalo breeds, the productivity levels were improved significantly. The fodder blocks and health camps have improved the milk yields of cattle. With the introduction of bio-gas units in the villages and creating awareness among the farm women, the family expenditure on fuel consumption, pollution, and other associated health problems were minimized.

Impact of the Empowerment Programs on the Psycho-social Attributes (knowledge, skills and abilities) of the Farm Women

Skill training and skill up-gradation programs in tobacco production systems *viz.*, nursery bed preparation, mulching, Bordeaux mixture preparation, sprinkler irrigation, drip irrigation, method of fertigation, demonstration of dry land weeders, topping tools, leaf stitching, and stringing, bale pressing machinery, etc., has improved the knowledge level and skills of farm women which resulted in reduced dependency on the opposite gender in technology use. Time-to-time demonstrations, field visits, exposure visits, field days, group discussions, interaction meetings, kisan melas, and exhibitions were arranged by ICAR-CTRI in collaboration with the Tobacco Board and trade and industry to increase the knowledge and skills of the farm women. Changes in competence, problem-solving ability, better participation, and increased motivation were observed due to increased institutional and social support.

Impact of the Empowerment Programmes on Nutritional Status and Awareness of the Farm Women in Tobacco Production Systems

The backyard kitchen gardening component that was supplemented by the rural and tribal farming system has enhanced the nutritive values of the family diets. High-yielding varieties of vegetable seed from ICAR-IIHR, Bangalore which were introduced in the backyards of farm women have enriched the family income and enhanced the regular diet of vulnerable groups. As the normal diets of rural and tribal families were low in protein, calcium, iron, zinc, and A and C vitamins, their family diets were enriched with green leafy vegetables, groundnuts, millets, soya protein, and locally available fruits.

The supplementary diets and weaning foods viz., soya products, cereal + pulse + oil seed powders, millets (ragi, bajra, and jowar) powder recipes, and low-cost nutritious supplementary diets that were introduced have reduced the malnutrition of mothers and children from 75 to 21% in NLS (Northern Light Soils) 35% in SLS (Southern Light Soils) and 32% in SBS (Southern Black Soils) regions. Skill-based training programs in preparation of cost low-cost nutritive recipes and preservative methods in fruits and vegetables have enriched the general health status of the farming community in all the regions.

Impact of the empowerment activities on the allied activities of the farm women in tobacco production systems

The subsidiary occupations such as tailoring, garment making, fruit and vegetable preservation methods, adda leaf stitching, rural bakery, soya milk production, solar preservation, hill broom making, sea shell decorative, palm decorative, door mat making, etc were introduced as homestead units during the lean period of tobacco crop as an income generation activity for the self-help women groups, which in turn resulted in increasing the family income significantly over a period of time.

Up-scaling of technologies due to Women Empowerment

The adoption level of the technologies was found to be about 75% among farm women groups. The women from Self Help Groups have established homestead units after providing training and capacity-building programs. Due to a number of training programs, demonstrations, exposure visits, field days, FLDs, OFTs, Kisan mela, etc., the diffusion of technologies was faster among the women groups with an increased adoption rate. This has motivated the other farm women from neighbouring clusters. The institute has played a proactive and pivotal role in the dissemination of need-based technologies.

Conclusion

Women in rural India are important for the progress of the rural economy. They play multiple roles as farmers, wage earners, and entrepreneurs. Farm women in tobacco are also engaged in allied fields including livestock rearing, horticulture, post-harvesting operations, agro-forestry and social forestry, etc. The Institute has realized the importance of farm women and their role as change agents and the institute has played a proactive role in utilizing the farm women as change agents in increasing the technology transfer and technology dissemination and adoption. Thus, it is envisaged that the challenge of exploring alternative livelihood security options under the new mandate of commercial crops with its gender-sensitized approach will result in new interventions and better research achievements.

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