



An AGRI-NUTRI (A2N) SMART VILLAGE MODEL for FOOD and NUTRITIONAL SECURITY



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March 2018

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Citation:

V.Sangeetha, Premlata Singh, Satyapriya, V.Lenin, Sudipta Paul, Sukanya Barua, L.Muralikrishnan and Sitaram. 2018. An Agri-Nutri (A2N) Smart Village Model for Food and Nutrition Security. Division of Agricultural Extension, ICAR-Indian Agricultural Research Institute, New Delhi- 110 012.

Published by:

Division of Agricultural Extension, ICAR-Indian Agricultural Research Institute, New Delhi- 110 012.

Cover design:

Shivani Singh

Printed Copies: 100

Acknowledgement: Agri-Nutri (A2N) Smart Village Model model is part of ongoing institute research project titled “**Enhancing Nutritional Security and Gender Empowerment**” funded by ICAR- Indian Agricultural Research Institute, New Delhi- 110 012.

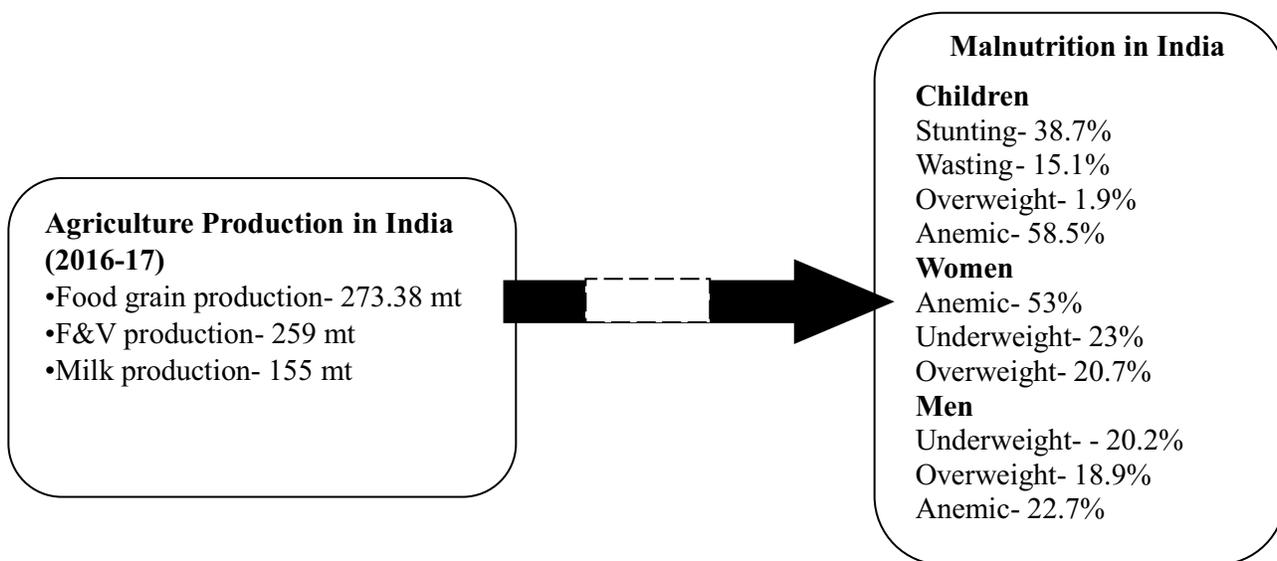
Printed at:

M. S. Printers, C-108/1 Back Side, Naraina Industrial Area, Phase-1, New Delhi-110024 Mob:
7838075335, 9990785533, 9899355565, Tel.: 011-45104606
E-mail: msprinter1991@gmail.com

“BRINGING AGRICULTURE, NUTRITION AND HEALTH TOGETHER WILL MAKE A MAJOR CONTRIBUTION TO ACHIEVING THE GOAL OF FREEDOM FROM MALNUTRITION”

-M.S.Swaminathan

In India after the independence, the immediate priority was to feed the population and it was heavily depended on imports and it was called as “ship to mouth” country. The government has taken series of policy measures to improve domestic food grain production during 1960s which was famously described “Green Revolution” in India. All the policies and programmes directed to improve the use of all agricultural inputs like introduction of high yielding varieties, quality seed, inorganic fertilizers and pesticides, land reforms or land distribution to improve the efficiency, canal development for better irrigation and T&V system for extension information all these measures has resulted in self-sufficiency in food production. It is to be noted that self-sufficiency in food production has not translated into nutritional security, indicating missing link between agriculture production and nutritional security (Figure 1). It signifies that similar to that of “Green Revolution” there is a need for “Nutrition Revolution” for achieving nutritional security.



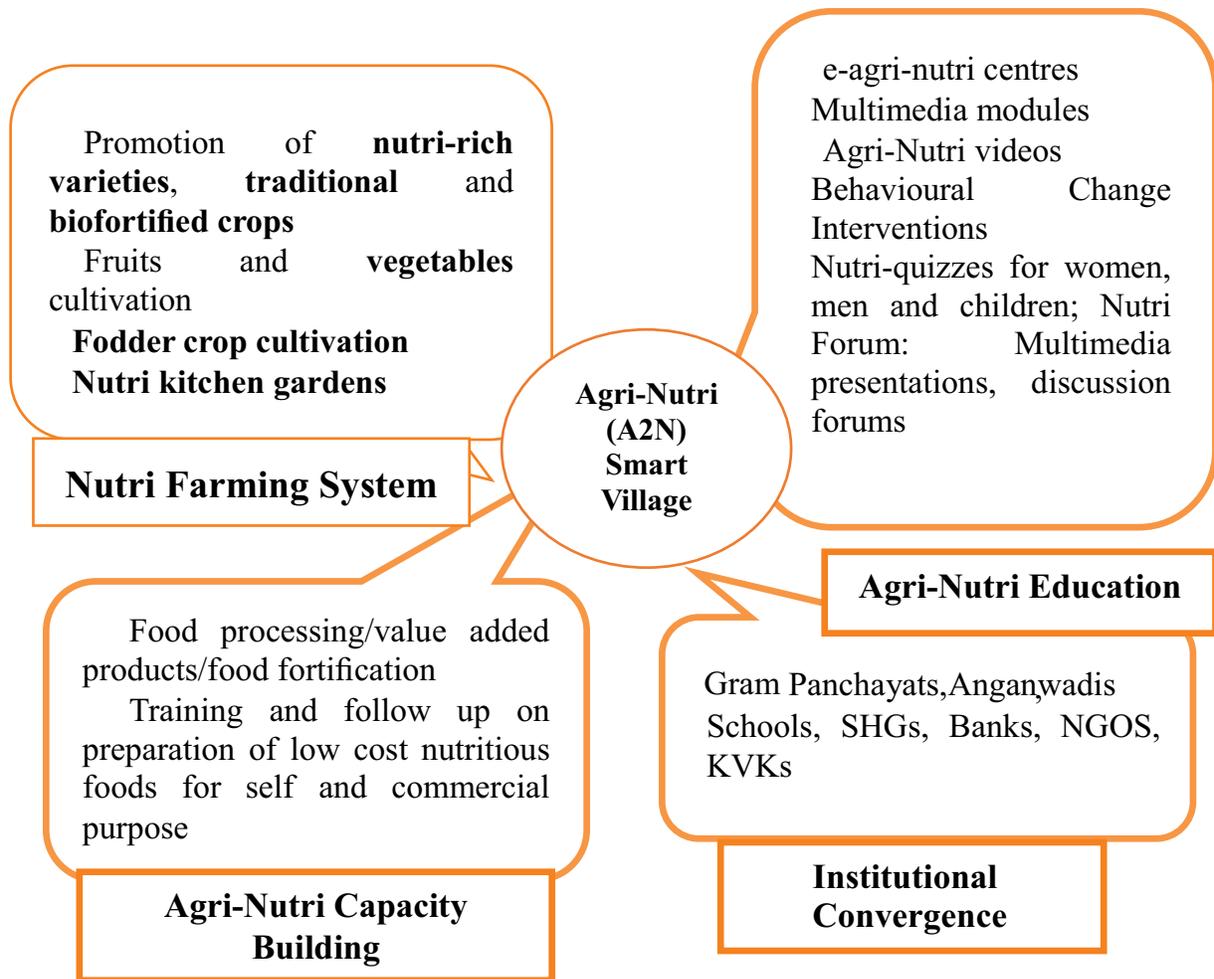
Source: NFHS -3, 2015-16

Missing link between agriculture and nutrition

This made us to think, why a country a like India which is having agriculture as the predominant occupation and surplus in food grains production, is having a significant share of malnourished people? Why there are missing links between agriculture and nutrition? Hence, in order to connect agriculture with nutrition, an Agri-Nutri (A2N) smart village model has been conceptualized.

Agri-nutri smart village model

An Agri-Nutri smart village (A2N) model is a framework to address the problem of malnutrition by integrating agriculture and nutrition. It is a part of the ongoing research project “Enhancing Nutritional Security and Gender Empowerment” of the Division of Agricultural Extension, ICAR-Indian Agricultural Research Institute, New Delhi. The main components of this model are nutri farming system, agri-nutri education, capacity building and SHGs based nutri forums for social learning.



An agri-nutri smart village (A2N) model has been conceptualised and is being validated in project villages of Baghpat district, Uttar Pradesh and Sonipat district, Haryana, India. A2N model is a framework which includes the various agriculture interventions, awareness campaigns and capacity building programmes, field days and field demonstrations on nutri rich crops and varieties, farmers-scientists interface, exposure visits, streaming of videos on healthy practices as well as on nutri rich varieties, minimal processing techniques of pulses, fruits and vegetables *etc.* The interventions target various stakeholders such as farmers, farm women, Self Help Group members, Anganwadi workers, school children *etc.* through Behavioural Change Communication (BCC) by involving all the local institutions. As part of the BCC interventions, a number of videos related to nutrition, Scientists-Farmers' interface; Nutrition awareness

campaigns, Exposure visit of farmers and farm women to Nutri-Kitchen garden of IARI *etc.* are being shown/conducted/organized to increase the awareness level on nutrition, to consume healthy or nutritionally rich foods, to increase production and consumption diversity and for improving nutritional security through introducing Nutri Farming System.

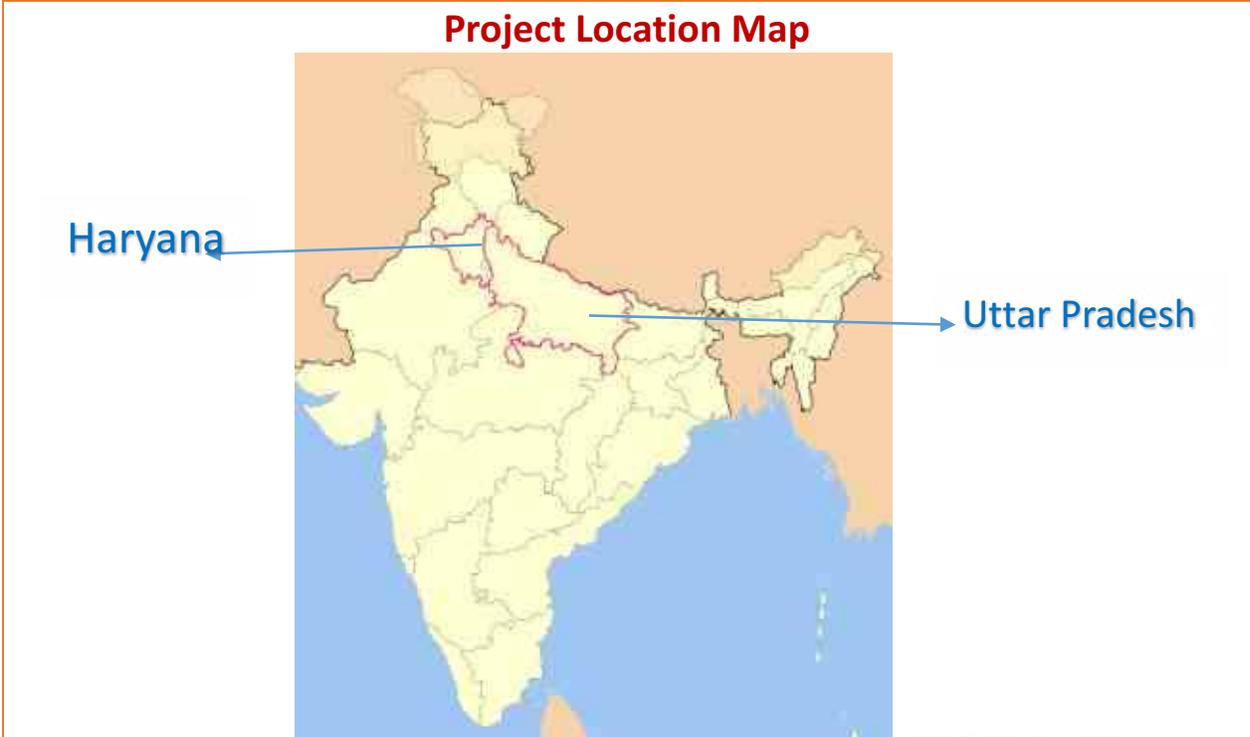
The Indian Agricultural Research Institute (IARI) has made concerted efforts to address the numerous challenges facing food and nutritional security. The Institute has been making tremendous contributions in addressing nutrition security through the development of high yielding varieties as well as products which are rich in nutrients.

Nutrient rich varieties of IARI

| Crop | Varieties | Nutrient value |
|--------------|---|--|
| Wheat | Malavkirti, Pusa Mangal- rich in vitamin A, Pusa Prachi | iron, zinc, copper |
| Mustard | Pusa Mustard 29, Pusa Mustard 21, Pusa Mustard 30 | low erucic acid Zero erucic acid |
| Pearl millet | Pusa composite 443 | high Fe (60 ppm) and high Zn (50 ppm) |
| Cauliflower | Pusa Betakesari | bio-fortified beta carotene (800 – 1000 µg/100 g) rich |
| Radish | Pusa Jamuni, Pusa Gulabi | rich in anthocyanins and ascorbic acid |
| Mango | Pusa Shreshth, Pusa Pratibha, Pusa Lalima | rich in vitamin C and beta-carotene |
| Lentil | Pusa Vaibhav | rich in iron |

Project location

Project Location Map



Agri-Nutri (A2N) Smart Village Model

Nutri Farming System interventions

| | | |
|---------------|--|--|
| Kharif | Pearl millet, Moringa, Nutri kitchen garden | Nutrition Fodder- Indirect nutrition to human |
| Rabi | Wheat, Mustard, Lentil, Nutri kitchen garden Fodder crops (Berseem) | Nutrition, flavor/taste, health To increase milk production |
| Zaid | Green gram | Nutrition/Additional income |

Mustard- Mustard oil is the common cooking oil in North India. A mustard oil that is healthy and yet retains its characteristic pungency is the ideal cooking oil and which is something many consumers especially in northern India want. It cannot be denied that mustard oil has a beneficial fat composition. However, it is equally undeniable that mustard oil contains more than 40 per cent erucic acid. The health risks associated with erucic acid in mustard oil are: accumulation of triglycerides in the heart; development of fibrotic lesions of the heart; increase in risk of lung cancer etc. The high erucic acid levels in Indian mustard have led to a growing market for imported rapeseed or canola oil (*Brassica napus*), which in 2014-15 (November-October), was amounted to over 14.4 mt valued at \$10.5 billion.

Indian Council of Agricultural Research (ICAR) has given due emphasis to improve the nutritional quality traits of various crops including mustard. ICAR - Indian Agricultural Research Institute (ICAR-IARI), New Delhi has developed a low erucic acid Indian mustard variety namely Pusa Mustard-30 (PM-30) using conventional breeding method. Apart from good production potential, it is beneficial for health as it has low erucic acid and has the best combination of other desirable fatty acids. Besides, the two other two essential fatty acids viz., linoleic and linolenic acids, which are not synthesized by human body are supplemented by diet only, are also present in very balanced proportion. The quantity of such important essential fatty acids has also improved in this oil (Oleic acid 45%, linoleic acid 29%, lenolenic acid 14% and ecosenoic acid, 3%.) to make it healthier with enhanced shelf life. The new variety possesses oil content of 38% oil and composition of fatty acids is erucic acid less than 2%.

Under this project, demonstrations on Pusa 30 Mustard are being conducted from 2015 onwards and so far 200 acres of land has been covered for ensuring healthy consumption of mustard oil.



Mustard (PM 30) in farmer's field



Field day on Mustard (PM 30)

| Season | Total seed Quantity (in Kg.) | No. of demonstrations held | Total area covered (in acre) |
|---------------|------------------------------|----------------------------|------------------------------|
| Rabi 2015 -16 | 30 | 40 | 15 |
| Rabi 2016 -17 | 200 | 130 | 100 |

Field day on Mustard (Pusa 30)

Apart from this, field day on Pusa 30 (mustard) was organized to create awareness among farmers about its health benefits. In future, these mustard growers will be linked with companies to market their products and get an additional income.

Since, it has low erucic acid content, the toxic elements usually found in other oilseed cakes is minimal in this variety. That's why, its by products like oilcake can be used as an important livestock feed as it is highly nutritious and easy to digest and it may be used as an excellent organic manure, which can improve plant health and productivity and soil health.

Pearl Millet

Pearl millet is an important coarse grain cereal cultivated in states like Rajasthan, Uttar Pradesh and Haryana. It has rich composition of proteins and minerals and has several health benefits. It has the highest protein content for any grain. It contains several essential minerals like phosphorus, zinc, magnesium, essential vitamins and amino acids *etc.* Even though, it was part of the traditional diet pattern, but, now a days, due to changing cropping pattern and consumption pattern, such crops are disappearing from the field and diet as well (even though, pearl millets are being cultivated by the farmers but it was only for the fodder purpose).

Indian Agricultural Research Institute, as a part of the National Agricultural Research System in India, has played a pioneer role and developed iron rich pearl millet varieties. Such high iron content dual purpose pearl millet varieties (Pusa composite 443 and 701) have been demonstrated and a field day on it was organized to the farmers and farm women to create awareness about its high iron content and how important it is with respect to nutrition. As it was a dual purpose variety, the stem can be used as fodder for livestock. As the farmers were having livestock, the straw (stem) were used as cattle feed, which is again an additional nutritional benefit to human beings who consume such milk and milk products.



Field day on Pearl millet



Awareness programme on *bajra* products

Bio fortified wheat

Around 70 per cent of the Indian population consumes less than 50 per cent of the recommended dietary allowances (RDA) of micronutrients. This deficiency will severely affect the productivity of the population in future. Keeping in view the increasing graph of malnutrition, scientists from Indian Institute of Wheat and Barley Research (IWBR), Karnal have developed WB-02 variety, which has high in zinc compared to other wheat varieties. Normally, wheat contains 30-35 parts per million (PPM) of zinc, whereas this variety has 42 PPM zinc. This **WB-02** field demonstrations have been conducted in project location, as farmers will have a nutritious choice in their staple food.



Bio-fortified wheat (WB-02) on farmer's field

Apart from this, Farmers-scientists interface on the importance of bio-fortification and how it augments to the nutritional security of our country was organized for the farmers. The importance/ need for cultivating nutri-rich crops and varieties and consuming it on regular basis for the healthy function of the human body was explained and emphasized.



Farmers Scientists Interface on Bio-fortification

Durum wheat products

Awareness about various products of durum wheat (*suji*, *dalia* etc.) and its nutritive value was created among the farm women. As durum wheat is grown in central India but rich in protein compared to normal wheat grown in north India, its nutritional benefits were elaborated to farm women.



Awareness on durum wheat products

Pulses are one of the major protein supplier for poor one who cannot afford the costly protein source such as meat and also vegetarian population also mainly depends on the pulses for daily protein requirement. In India relatively the rich and vegetarian populations are more when compared to other countries which signify the importance of pulse consumption. However, it has been observed that among the nutrients only protein has registered a negative growth, but small in magnitude that is about one per cent. Pulses consumption has declined in rural areas about 6 to 5 g/day (23%) and urban areas about 8 to 6 g/day (22%) in rural areas (1993-94 to 2011-12)

Green Gram- Hence, to increase the production and availability of pulses, summer moong (varieties Pusa Vishal and SML 668) have been demonstrated in the farmers' field.



Farm women with summer moong seeds

As this summer moong can fit in the paddy-wheat, wheat-sugarcane cropping system as sole and inter crop (as the intercrop, it does not require much inputs), it was an additional benefit for farmers..



Summer moong (Pusa Vishal) introduced in farmers' field

Lentil – It is one of the commonly consumed pulses in many parts of the country. IARI has developed iron rich lentil (Pusa Vaibhav). It was also demonstrated in the farmers' field to reap the benefits of it.

Vegetables- To ensure the year round supply and consumption of seasonal nutritious vegetables (summer and winter vegetables), farm trainings on nutri-kitchen garden are given to farmers from project villages. The vegetables included Spinach, Amaranthus, Brinjal, Sem, Tomato, Carrot, Raddish, Cauliflower, Vegetable Mustard, Pea, Bean *etc.*



Farm women with IARI Nutri kitchen garden kit

Details of Nutri Kitchen garden

| Nutri kitchen garden (Rabi) | Vegetables (Varieties) | Nutrition information |
|-------------------------------|-------------------------------|---------------------------------------|
| | Palak (All green) | Iron |
| | Mustard sag (Pusa Sag-1) | Iron & Anthocyanin |
| | Carrot (Pusa Rudhira) | Vitamin A & Anthocyanin |
| | Carrot (Pusa Vasudha) | Vitamin A & Anthocyanin |
| | Methi (Pusa kasuri) | Protein, Minerals & Fibre |
| | Methi (Pusa Early Bunching) | Protein, Minerals & Fibre |
| | Peas (Pusa Shree) | Calcium, Minerals & Protein |
| | Radish (Pusa Mridhula) | Vitamin A & B Complex and Minerals |
| | Broad bean (Pusa Sunith) | Minerals |
| | Turnip (Pusa Swethi) | Minerals |
| | Coridander (Pusa Selection) | Minerals |
| | | Iron |
| Nutri kitchen garden (Kharif) | Vegetables (Varieties) | Nutrition information |
| | Methi (PEB) | Protein, Minerals & Fibre |
| | Methi (Pusa Kasuri) | Protein, Minerals & Fibre |
| | Bottle Gourd (Pusa Naveen) | Minerals & Fibre |
| | Palak (AG) | Iron |
| | Amaranthus (Pusa Lal chaulai) | Iron, Minerals & Calcium |
| | Brinjal (Pusa Shyamala) | Minerals & Anti carcinogenic elements |
| | Tomato (Sadabahar) | Lycopene & Vitamin A |
| | Sem (Pusa Sem 3) | Minerals & Fibre |
| | Peas (Pusa Pragati) | Minerals & Fibre |
| | Chillies | Calcium, Minerals & Protein |
| | Carrot (Pusa Gulfi) | Iron & Calcium |
| | | Vitamin A & Anthocyanin |



Farmers-Scientist interface on Nutri kitchen garden



Nutri kitchen garden in farmer's place

Demonstration on IARI technologies/others in context of nutritional security

Fodder crops are also introduced in the project villages to ensure the nutritional security of the targeted group through livestock fodder. Berseem seed varieties (BB-1, BB-2 and BB-3) were demonstrated in farmers' field.

| Year 2015-16 | No. of beneficiaries | Total acres covered |
|--------------|----------------------|---------------------|
| Vegetables | 208 | 14 |
| Mustard | 40 | 20 |
| Summer Moong | 92 | 37.5 |
| Total | 352 | 71.5 |

| Year 2016-17 | Name of the crop | No. of demonstrations |
|----------------|------------------|-----------------------|
| Baghpat | Vegetables | 619 |
| | Mustard | 180 |
| | Summer Moong | 214 |
| | Bajra | 368 |
| | Lentil | 8 |
| Sonipat | Vegetables | 222 |
| | Mustard | 23 |
| | Summer Moong | 37 |

Fodder crop

Fodder crops are also introduced in the project villages to ensure the nutritional security of the targeted group through livestock fodder. Berseem seed varieties (**BB-1**, **BB-2** and **BB-3**) were demonstrated in farmer's field.



Berseem in farmer's field

Moringa

Moringa/Drumstick tree is called as **multivitamin** tree as it is said to provide 7 times more vitamin C than oranges, 10 times more vitamin A than carrots, 17 times more calcium than milk, 9 times more protein than yoghurt, 15 times more potassium than bananas and 25 times more iron than spinach. Although it is easily cultivable and an easy remedy for malnutrition, there is lack of awareness among the rural farmers. Hence, it is being promoted in the project location.



Moringa tree introduced on field boundaries in farmer's field

Capacity building interventions

Soybean is an important source of complete protein in the vegetarian diet, readily providing the body with all eight essential amino acids, fiber, vitamins and minerals. It provide energy and keep the body functioning at its optimum level. Soy milk, which is made from soaking, grinding and boiling soy beans with water, is a very nutritious drink. In every aspect, it is healthy, nutritious and good for health and also easy to make. Even though, soybean is not cultivated in the project locations, an awareness regarding different uses of soymilk, its importance, nutritive value, and its health benefits was created and rural women were trained to prepare soymilk.



Soymilk training to farm women

Farm women were trained to prepare mixed vegetable pickle, ginger-lemon squash and amla candy technically and were explained about its importance and nutritive value



F&V Processing training to farm women

Hence, fruits and vegetables have abundant important nutrients, it is very essential to consume them. Equally, important is processing of fruits and vegetables to produce direct products of consumption. Different uses of fruits and vegetables and its health benefits were explained to the farm women.

Because, it can help in reducing wastage. Awareness regarding how fruits and vegetables effectively can be processed for the household food security was created among the farm women.

Awareness regarding storing fruits and vegetables with minimal infrastructure and how the wastage can be minimized or avoided was created



Awareness on Low cost Storage structure

Agri nutrition through video extension

Nutrition education can be very effective with innovative instructional tools like video. Educating people with video has been proved very effective as it involves the senses of both seeing and hearing. Hence, in order to utilize Information and Communication Technology (ICT) tools like video and women's leisure time effectively, videos on nutrition like Anaemia-Blood and Iron deficiency, Nutrition tips for improving health, Nutritional Management of Eyes, Vitamin A Benefits, Hand Washing, General Immunization, Polio Immunization, ORS Benefits *etc.* in local language, are regularly being shown to the villagers through Computers (e-agri nutri centre), Laptops and Pico projectors. In addition to this, to focus on agri-nutrition, multimedia modules on low erucic acid Pusa Mustard 30, iron rich pearl millet and its benefits, Processing Machineries for Bajra Puff and Soy Nuts preparation, Corn cultivation, Good Nutritional habits and Curry leaves & Moringa benefits have been prepared in local language (hindi) and shown to the farmers to convince them about the nutritional benefits of the IARI varieties and to increase their awareness level on their importance in nutrition as well as health perspective.



Farm women watching videos on nutrition



Farmers watching video on low erucic acid Mustard (PM 30)

Exposure visits

Exposure visit of farmers and farm women from project villages of Baghpat and Sonapat districts to Pusa *Krishi Mela*, held in ICAR-IARI, New Delhi



Farm women in Pusa *Krishi Vigyan Mela*

Exposure visit of farmers and farm women from project villages of Baghpat and Sonapat districts to nutri kitchen garden demonstration field in ICAR-IARI.



Farm women in IARI Nutri Kitchen garden demo field

Inter-institutional collaborations

Awareness campaign

The various technology and stakeholder platforms of research institutes, government departments and local NGOs and farmer groups in the area have been formed to leverage the power of knowledge and intervention partnerships.

Institutional collaboration with scientist and students from Department of Food and Nutrition, Lady Irwin College, Delhi University, New Delhi has been established. The nutrition awareness programme regarding the benefits of balanced diet and protein rich food was organized with the involvement of students and scientist from this college. By using various communication aids, importance of balanced diet, vitamin A rich vegetables and fruits; pulses; milk and milk products; diet diversity and its importance; vitamin A rich vegetables and fruits; pulses; milk and milk products; iron deficiency and anemia; importance of breastfeeding; foods to be consumed during pregnancy *etc.* high awareness among the rural population were created.



Awareness campaign on importance of nutrition

Smart Village Development Centre

Institutional collaboration was established with Connecting Dreams Foundation, a Non-government organisation (NGO) working in the project area. They work for the empowerment of youth and women in rural India through connectivity and entrepreneurship. The collaboration helped in establishment of Smart Village Development centre where computer was installed and videos related to nutrition were uploaded for enhancing the awareness and desirable positive attitude towards nutrition. This centre aims to achieve sustainable development through electronic and knowledge Connectivity in villages leading to economic connectivity over a sustained period of time. Videos linking agriculture and nutrition (designed and validated), will be uploaded here.



Smart Village Development Centre in Lachoda, Baghpat



Stakeholders' workshop on Smart Village Development Centre

Collaboration with local institutions

Gram Panchayats

As Gram panchayats are the strong grass root level institution, a strong linkage has been developed with them to undertake all the project interventions. Local institution is taken into confidence for building rapport with villagers.

Self Help Groups

Self Help Groups are the organized platforms for rural women. In general, women are the major decision makers in preparation of food; and they are the one who prepare food for their household members. Many studies have proved that the success of any country largely depends on the condition and improvement in life of its women, because, it has positive influence on the progress of entire population. In our project location, number of SHGs are existing. Collaboration with such local institutions provided more access to the rural women. This local institution is being used to create awareness and conduct capacity building programmes for rural women, to achieve the desired results efficiently.



Meeting with SHG members

Anganwadis

Collaboration with Anganwadi workers was also established. The Anganwadi workers are the government gross root nutri-meal workers; they not only provide nutri-foods to pregnant women and children, they also deliver the messages to rural women about healthy foods to be taken during pregnancy, about calcium and iron tablets, vaccination *etc.* Hence, National Nutrition Week was celebrated with the involvement of anganwadi workers. The close link they have with rural women is being utilized properly to increase the nutrition awareness among the rural masses.



Nutrition awareness week celebration in Anganwadi

Local School

Collaboration with local school helped in assessing the school children knowledge level on nutrition, conduction of nutri-awareness programme and nutri quiz programme to school children. Apart from the fact that children are the vulnerable group and majorly affected by malnutrition, they are the messengers to their parents. With the hope that they convey the messages to their parents and other family members, they are also included in the target group.



Nutri Quiz organized at school



School children from Project location

Krishi Vigyan Kendra (Farm science centre)

In each district, one KVK is there to deliver the modern technologies and new agricultural information to the farmers. Collaboration with KVK scientists was established in selection of villages, and in identifying local contact farmers. In addition, KVKs help is being sought in organising meetings, training programmes and front line demonstrations at the famers' field *etc.* Even, field demonstations like Nutri Kitchen garden, iron rich Pusa pearl millet and Pusa Mustard 30 are being conducted in KVK fields too, hoping that farmers visiting KVK will come to know about the nutri rich crops. Hence, their collaboration is very much helpful for the successful implementation of the project.



Project location farmers at KVK, Sonipat

Mera Gaon Mera Gaurav (My Village, My Pride)

It is a flagship programme of Indian Council of Agricultural Research (ICAR). It consists of multidisciplinary team of scientists visiting the allotted villages every month. This platform is also been effectively utilised to implement the project activities.



Sweet potato seedlings are being examined by IARI scientist

Highlights/Evidence

- Introduced nutri rich varieties in existing cropping pattern of the farmers (summer moong was not part of their cropping pattern earlier, now it is finding place in their field; by introducing dual purpose pearl millet variety, they started consuming pearl millet based food products)
- Enriched awareness about the balanced diet and good nutrition practices resulted into variety of foods in the diet of the households of the project villages.
- Consumption of local traditional food snacks which is fading in the present food culture, were also finding in their food basket, because of continuous interventions.
- Women from self-help group, trained by us are motivated now to take up preparation of processed foods as an enterprise; however it needs some more time and linkages to pick up and establish.
- Videos on local language, in particular, helped in better understanding of the content.
- Besides, an overall environment was created to think, discuss and act for nutrition security in the villages. In the coming years, better results in terms of nutrition security can be expected.

“NUTRITION IS FOR ALL OF US AND REQUIRES ALL OF US TO DO OUR PART, TOGETHER, SO WE REACH THE COMMON GOAL OF OPTIMAL NUTRITION FOR ALL”

-Stacia Nordin



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