



Impact of Diversification in Agriculture on Food and Nutrition Security

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Abstract

Intervention of various technologies to improve the food and nutritional status of the population proved the following facts: Promotion of malt based small scale food industry not only provides opportunity for rural women to develop entrepreneurship and employment, but also provides food and nutritional security through income generation. To address this several technologies were developed under NATP like value addition to fish and prawn products, artificial pearl culture, processing of salted fish, which helped the self-help group women of Andhra Pradesh, Karnataka, Kerala and Tamil Nadu to improve their economic status. Received two patents and licensed the technology which helped the women to reduce their drudgery and also preserve the fresh fish for a longer time without getting spoiled. Product development can be taken as income generating activity in the rural areas by the illiterate women. Products can be included in supplementary feeding programs in order to improve the nutritional status of the vulnerable groups of the population. The horse gram which is commonly used for cattle feed can be diversified for human consumption with less investment. Mothers as well as Anganwadi workers preferred amylase rich supplementary foods which reduced Grade 111 and grade 1V malnutrition in Pre-school children significantly. The studies revealed that spawn multiplication can be done by women as a co-operative venture and mushroom cultivation can be undertaken at household level as an income-generating activity. Introducing red palm oil is beneficial to overcome vitamin A deficiency. Formers are encouraged to grow back yard nutrition garden. Impact of women's supplementary income on family's nutritional status showed that the supplementary income of women has a positive impact on the socioeconomic status of the family. This impact is particularly felt on the food and nutrient intake of the family contributing towards food and Nutrition security.

Keywords: Product Development; Technology Intervention; Nutrition Security; Health Security and Economic Empowerment

Introduction

India has the second largest population after China. Agriculture occupies nearly 45% of the total geographical area and is the primary occupation of 64% of the total population. The Green Revolution in the 1960s has made India a food surplus country. National Nutrition Policy (1993), National Nutrition Plan of Action (1995) and National Nutrition Mission (2001) have not achieved nutrition goals. The reason is nutrition is a poor cousin even in health and agriculture planning and execution. Nutrition improvement is not a stated goal with measurable parameters in National Food Security Mission, National Horticulture Mission and National Rural Health Mission. This paper deals with the diversification of Agriculture, intervention of Horticulture, Dairy, Fisheries, Mushroom, Value addition, Women empowerment and Nutrition education for food and nutrition security.

Experimental methodology used to start from Surveys, Chemical analysis, Biochemical estimations, bio-availability studies on rats as well as human subjects; clinical observations and histological studies were used as per the study design. Product development, value addition, Technology transfer, Entrepreneur skills development, income generation activities and creating awareness through Nutrition Education were also used.

Results and Discussion

Research carried out on impact of agriculture diversification on nutrition security is discussed under Diversification of Agriculture Horticulture; Mushrooms; Dairy; Fisheries; Value addition; Nutrition Education; Welfare Programs; Economic Empowerment of Women and unexploited biodiversity.

Agricultural diversification

Integrated Crop Management (ICM) Modified form of System of Rice Intensification (SRI) designed and promoted by the Food and Agricultural Organization is an effective strategy to realize the maximum of the potential yield of a crop variety. According to the World Health Organization, an estimated 334 million children in developing countries are malnourished. In 2020, one out of every four children in these countries will still be malnourished. It is recognized that modern agriculture must diversify production and achieve sustainable higher output to supplement food security.

Crop diversification/cropping systems

- Intercropping of ragi and redgram in 8:2 ratio is found to give additional income of Rs. 5,500/- ha compared to sole crop of ragi.
- Ground nut intercropped with either red gram (4151 kg/ha) or castor (4238 kg/ha) in 7:1 ration recorded maximum
- Redgram based cropping systems, redgram+ clusterbean (3263 kg/ha) in 1:7 ration gave highest redgram
- Among different alternate crops tried to groundnut during late rabi, blackgram recorded maximum net returns (Rs. 26801 /ha) and followed by sesasum (Rs. 20697 /ha)
- Cluster bean and field bean are excellent alternative crops for rain fed groundnut in bad years.

Home-based low-cost energy protein rich preparations using Horse gram for vulnerable groups [1].

The horse gram which is commonly used for cattle feed can be diversified for human consumption with less investment. Processed horse gram flour was prepared using Puffing and Roasting, Processed Soya bean flour was prepared by Dehulling and Roasting. The low-cost energy protein rich products namely RAGINA and EPRF were prepared using the simple home scale processing methods like germination, roasting and puffing, to improve the nutritional status. Horse gram has been identified as potential food resource for the tropics and also occupies an important place among pulses because of its ability to resist severe drought conditions. Soya bean (*Glycine max*) is one of the best vegetable proteins and has tremendous potential to meet the protein deficiency in the cereal based Indian Diets at a low cost. Product development can be taken as income generating activity in the rural areas by the illiterate women. Products can be included in supplementary feeding programs in order to improve the nutritional status of the vulnerable groups of the population.

Nutrient intake, morbidity and nutritional status of pre-school children are influenced by agricultural and dietary diversity in western Kenya [2].

A cross sectional survey was set up to assess the influence of agrobiodiversity and dietary diversity on morbidity, nutrient intake and the nutritional status of preschool children in Western Kenya. About 34.8% preschool children were severely stunted, 21.5% severely underweight and 8.3% were severely wasted. There was a positive and strong relationship between agricultural biodiversity, dietary diversity and caregivers' level of education. Morbidity level and dietary diversity had significant influence on underweight levels and stunting. Consideration of agro biodiversity in terms of dietary diversity can improve the nutrition and health status of a preschool child.

Horticulture intervention

This will focus on increasing the supply nutrient-rich crops, in part through the promotion of home gardening. Horticulture intervention will involve the Ministry of Agriculture for the supply of seeds, extension, and storage support. Vitamin A and Iron Nutritional status of nutritionally vulnerable segments of population subsisting on Horticulture crops and dairy farming in East Godavari district of A.P. (Aruna 1997, Phd. Thesis) showed very significant improvement in their nutritional status. Significant impact of Nutrition Garden/Home garden reflected on Iron and Vitamin status of the families under study.

Transfer of home level preservative techniques of selective fruits and vegetables to rural women in Guntur district [3]:

There was a significant, negative correlation between age of the respondents and gain in knowledge. There was a significant positive correlation of socio economic variables such as educational status, family income, and land holding on gain in knowledge.

Operational feasibility of RPO supplementation to pre-school children in Anganwadi centers of ICDs Project [4]:

Vitamin A deficiency causes many health problems especially among children. A study was undertaken to screen the effect of supplementation of Red Palm Oil (RPO) obtained from the fruits of tree *Leis guineensis* Jac. The oil is rich in B-carotene, a precursor of Vitamin A. Supplementation of crude RPO to Anganwadi Children increased the attendance of children, increase in heights and weights of children. Decrease in Grade 11 and Grade 111 malnutrition was observed in respect of sex.

Gymnema Sylvestre leaf powder [5]:

Effects of dried *Gymnema Sylvestre* leaf powder showed a significant reduction on blood glucose, lipid profile and blood pressure in newly diagnosed type 11 diabetic subjects- a pilot study.

Mushrooms**Rural women as entrepreneurs in mushroom cultivation [6]:**

Every woman is an entrepreneur as she manages, organizes and assures responsibility for running her house. It has been increasingly realized that women possess entrepreneurial talent which can be harnessed to create employment opportunities. In the rural areas a woman can easily manage 4 - 10 beds depending on the space available, helping them to earn Rs. 180 to Rs. 450 per month. The results of the studies revealed that spawn multiplication can be done by women as a co-operative venture and mushroom cultivation can be undertaken at household level as an income-generating activity.

Intervention of dairy**Impact of dairy programme on the nutritional status of women and preschool children in Vihiga District, Kenya Africa [7]:**

The dairy programme in Kenya has a significant impact on the overall improvement of the family in specific to improving production, consumption and marketed surplus of milk. Food and nutrient intake and nutritional status of women and preschool children from participant households improved. The prevalence of under nutrition in preschool children in participant households was lower (1.7%) than that of children in non-participant households (2.9%). Stunting was 8.7% and 21.4% in preschool children from participant and non-participant households respectively. Less percent (6.7%) of women in participant households had body mass index less than 18.5, whereas 7.3% of women from non-participant households fell below this cut-off point.

Fishery intervention**Role of women in fisheries in coastal eco-system of Andhra Pradesh, Karnataka, Kerala and Tamil Nadu [8]:**

Fish eaters in the study area comprise 47 per cent of the total population ranging from 237 per cent in Tamil Nadu to 85 per cent in Kerala. Though the position of Tamil Nadu in terms of number of coastal districts and possession of coast line including the number of landing centers is envious, the number of fish eaters in the state is minimal. Andhra Pradesh employs 32 per cent of its fisherwomen in fish curing/drying/net making and 27 per cent in processing plant works.

Studies on Fisher Women in the Coastal Eco System of Andhra Pradesh, Karnataka, Kerala and Tamil Nadu [9]:

Two Equipments I) Low Cost Ice Cream Freezer, II) Fresh Fish Vending and Display Table have been fabricated and received Patents and the technology was licensed to Smt. G. Varalakshmi, W/o. Sri G. Satya Kiran, M/s. Yogi Industries, and Secunderabad for manufacturing this two equipment's for a period of two years. She is the sole authority to manufacture in the country. After expiry of two years the technology on low cost ice cream freezer was licensed second time to another women entrepreneur namely Mrs. Lakshmi Bhuvanewari W/o Devi Hariprasad, D.No.23/321, Bachupeta, Hindu College Road, Machilipatnam - 527 001 on 16th September 2006 for a period of 6 years. These equipment's were fabricated mainly to improve the Health and Nutrition Security.

Health and Nutritional status of preschool children in coastal fishing villages of South India Andhra Pradesh, Karnataka, Kerala and Tamil Nadu [10]:

The consumption of vegetables, fruits was found to be low, milk consumption was fairly low among the preschool children and fish consumption was found to be 34 gm/CU. The intake of nutrients in case of preschool children was found to be less than the RDA. It was observed that macro nutrient intake was fairly better when compared to the micro nutrient intake. 31% of preschool children were anemic. The other clinical symptoms like angular stomatitis, chelosis and dryness of skin were 35% on an average. The reason for high anemic might be due to low consumption of iron rich foods, poor health, hygiene and sanitation and also might be due to lack of nutritional awareness.

Value addition**To study the effect of feeding malted food on the nutritional status of vulnerable groups [11]:**

Amylase Rich Malted Mixes (ARMM) two types were formulated using Ragi/Wheat and suitable products namely *Laddu*, *Roti*, *Kheer*, and *Porridge* were prepared using formulated malted mix. The ARMM's found to be nutritional dense. For the supplementation of malted mixes 8 villages of Lepakshi Mandal, Ananthapur District was selected. Preschool children (400), pregnant women (100) and Lactating women (100) were selected and fed with two types of malted mixes (Ragi/Wheat) for a period of 3 months. Anthropometric data, Food intake showed a significant increase in the preschoolers, pregnant women and Lactating mothers. Clinical as-

assessment showed considerable reduction i.e. (50%) in nutritional deficiency symptoms and morbidity rate of all the subjects. Training programmes were conducted to 40 members by lecture and method demonstrations using developed education material such as Posters, Flip book, Manual and CD-Rom. After the training 60-70% improvement was observed in Knowledge, Attitude and Practices scores of the trainees, project profile for bulk production was also developed. Supplementation of ARMM's helped to improve the nutritional status of the vulnerable groups of population in rural areas especially with regard to *protein, energy, iron, and calcium* and *B-complex vitamins*. Promotion of malt based small scale food industry not only provides opportunity for rural women to develop entrepreneurship and employment but also provided Food and Nutritional Security through income generation.

Therapeutic food supplementation in ICDS projects of Andhra Pradesh [12]:

Total 2267 children of age range of 1-3 years were selected (892 children from rural ICDS project, Saravakota; 507 children from new ICDS project, Kottam; and 778 children from tribal ICDS project, Seethapeta) for a period of 1 year. The three types of supplements were prepared and distributed by A.P. Foods, Hyderabad. The supplements were distributed either in the form of Laddu or as in the form of powder. Nutritive value of 100g of supplements provides 400 to 480 Kcal 12.5 to 13.8 g proteins.

It was very encouraging to note that 92% of grade III children showed improvement in their weight and height; 80% of moderately malnourished; 42% of mildly malnourished and 44% with normal grade showed improvement. It was also observed that there was positive correlation between the calorie and protein intake and also improvement in weight and height. All 100% of mothers as well as Anganwadi workers preferred these supplementary foods better as compared to earlier supplied food i.e. ready to eat food.

Nutrition Education

Tribal mother's attitude towards lactation performance [13]:

Tribal women are mostly involved in food preparation (25%) where as men are involved in occupational activities. Majority (85%) of tribal women do not think lactation as a necessity to take special care about either food because they were lactating. Majority of mothers (66%) were aware of the reason for decrease in lactation performance. Only a small number of mothers (5%) knew that sickness and insufficient food (2%) played a role in decreasing the

lactation performance. As nursing mothers, they do not receive any special attention from the family members regarding the additional intake of food. A positive change was observed in lactating mothers through Nutrition Education as a tool.

Health status of tribal's of chinthapalli block [14]:

Health problems of the tribal's are related to number of factors which include illiteracy, ignorance of the disease and its prevention, poverty, poor nutritional status Poor environmental sanitation and poor personal hygiene, non-availability of safe drinking water, which make people more vulnerable to infections. Superstitions and beliefs add to the health problems and complicate the situation. Malnutrition leading to tuberculosis and goitre are major disease in tribal. Vomiting; diarrhoea and consequent dehydration are causes for death among infants and children. Skin diseases especially scabies and heat boils are common.

Welfare programs

Effect of Jawahar Rojgar Yojana Programme during lean season on the Nutritional Status of Women in Landless Labour Families of Drought prone areas [15]:

The study was conducted in eight villages of four interior Mandals having low rainfall (500-750mm) in Ananthapur a drought prone district of Andhra Pradesh. A household survey was conducted to screen the families having at least one women of child bearing age from the eight selected villages of the four Mandals. A total of 120 families were selected for the study of which 60 families were JRY beneficiary families' where at least one member of the family was being employed under JRY scheme and 60 families were non-JRY beneficiary families. The study showed that the additional income gained by the landless labourer families during the lean season from Jawahar Rojgar Yojana (JRY) programme had beneficial effect on the nutritional status as assessed by the anthropometric measurements as well as clinical observations. The results indicated the past malnutrition status of the population in Ananthapur district because of the repeated and prolonged droughts.

Effect of Jawahar Rojgar Yojana scheme during lean season on the Expenditure [16]:

A significant positive trend towards improvement in the *quality of food* taken by the landless labour families with the additional income generated through welfare programme i.e., Jawahar Rojgar

Yojana in lean season as evinced by *better* food and non-food expenditure pattern of the JRY beneficiary families over the counterpart non JRY families in dryland and drought prone areas of Ananthapur district, Andhra Pradesh.

Coping mechanisms adapted for food security at household level in drought prone areas of Ananthapur, Andhra Pradesh [17]:

A study was carried out in eight villages of four interior Mandals having low rainfall (500 - 750 mm), in Ananthapur a drought prone district of Andhra Pradesh. Families having at least one women of child-bearing age were enumerated. Two rounds of survey were conducted to understand the difference in coping mechanisms operating between peak and lean seasons. The study centered around the empirical examination of eight major groups of coping mechanisms comprising of land, livestock, economic, food procurement and production, food consumption and distribution, food storage, social and health based mechanisms adapted by the families. The various economic activities under taken by the women in the study area included Agriculture, Agriculture labour, basket making, Beedee making, brick making, broom making, cattle rearing, firewood collection, flour mill, fodder collection, forest produce collection, goat/sheep rearing, laundering, mat weaving, non-agricultural labour, petty trade, pottery, poultry rearing, ring making, sericulture, tailoring, tamarind peeling, vegetable vending and weaving clothes etc. Most often children especially girls were involved in home based trades like groundnut shelling, beedi making, tamarind peeling etc. A few of the mechanisms were found to be beneficial and can be encouraged.

Economic empowerment of women

Family income and nutritional status of pre-scholars' in rural areas of Tenali division [18]:

The increase in the annual per capita income of the family increased slightly the nutritional status of pre-scholars. The results also reveal that no significant difference was observed between the body weight of children and income of the parents in all the age group. In spite of having high purchasing power, lower educational status of the mothers and also low nutritional awareness, majority of the children are in Grade 1 degree malnutrition.

Impact of women's supplementary income on families' nutritional status [19]:

The study was carried in 4 villages of Rajendarnagar Mandal and Ranga Reddy District on vegetable vendera, Shop Keepers,

Washers, Fruit venders, Tea and Snack Venders. The results reveal that the supplementary income of women has a positive impact on food and nutrient intake of the family.

Un exploited biodiversity

2,50,000-3,00,000 species of plants exist, 10,000-50,000 are edible 150-200 are used as animal food. Three species – rice, maize and wheat –supply almost 60% of the calories and protein humans derive from plants.

Conclusion

Strategies for food and dietary diversification: Promotion of mixed cropping and integrated farming systems; Introduction of new crops (such as soybean); Promotion of underexploited traditional foods and home gardens; Small livestock raising; Promotion of fishery and forestry products for household consumption; Promotion of improved preservation and storage of fruits and vegetables to reduce waste, post-harvest losses and effects of seasonality; Strengthening of small-scale agro-processing and food industries; Income generation; Nutrition education to encourage the consumption of a healthy and nutritious diet year round.

Strategies to address micronutrient malnutrition: Three of the main strategies for addressing micronutrient malnutrition are dietary diversification, fortification (including bio fortification) and supplementation.

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