II

REVIEW OF LITERATURE
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Already, a good number of works on the farming systems have been done in the different parts of world as well as India and also in Assam. But it is noteworthy to be mentioned that the findings of these studies are highly location specific. Attempts have been made from time to time by different researchers to show the possibilities of increasing income and labour employment of the farm families by optimum utilization of their scarce resources. In fact, these studies were conducted in different situations using various analytical tools like Linear programming technique, Farm budgeting approach, Production function approach etc. for developing efficient farming systems. Some of the literatures available are reviewed under the following:

Desai (1961) opined on the possibilities of increasing farm family income and production in the Ahmednagar in Nasik district of Maharashtra. In his study, he found that with the existing
resource supplies and technologies, the farm income and production could be increased to a great extent.

Gulgani and Sirohi (1972) showed in a study that full benefit could be obtained by rational allocation of resources in the high yielding varieties like Maxican wheat alongwith complementary enterprises such as dairy in the union territory of Delhi. The result of the study showed that the dairy activity was remunerative and its inclusion in the production plans led to increase in the farm net returns.

Bhati and Gopalakrishnan (1978) in their studies found that in western Himalayan range, there was diversified farming system which included crop husbandry, animal husbandry, orchards and forestry.

Singh (1978) stated an optimal land used pattern in Punjab and pointed out some maladjustment in farm enterprise mix. He suggested that income of firm families could be increased by proper adjustment in the firm enterprises.
Chalkins (1981) used linear programming technique to subsistence Nepalese farm families for maximizing income for better nutritional adoption. He observed that the upland area of the crops like potato, radish, rape and mustard etc. with high nutritional value had increased when the nutritional aspect in the maximizing income had been considered in the linear programming technique.

Singh and Jain (1981), using linear programming maximization model, tried to find out the results of nine normative plans which sought to maximize net returns on each synthetic plan, simultaneously within a closed economic system. Available farm resources, particularly labour were enhanced to the projected level to examine how they were placed between different farm size categories, depending upon their marginal value productivity in each category. The normative potential was estimated with unrestricted supplies of labour at the going wage rate. The analysis showed that the existing cropping pattern needed many adjustments in order to yield high profit to farmers. There is scope for absorption of about
40 percent working capital, 40 percent labour and 91 percent more use of tractors to yield about 70 percent increase in net returns.

Bogahawatte, (1984) in his studies found that in dry zone rain fed districts of Sri Lanka, there was crop-livestock based farming system. The majority of these farms included the major and minor crop components, such as paddy, subsidiary food crops such as maize, groundnut, soyabean, pulses etc. tree crops and vegetables. The farm animals were used for production and draught power included cattle and buffalo, milch cows, poultry, goats etc. These animals produced the protein sources for the farming families (meat, egg and milk). They were fed on the by-products and crop residues from the farm and from household food refues.

Teklu (1985) reported that when farm families practiced fewer goals in less constrained resource markets, there had been a tendency to concentrate on the production of high valued crops, resulted in improving its level of income and efficiency of resource use.
Yeboah and Wright (1985) also found that farm income of Black small farmers in North Carolina could be augmented simply by switching into a more efficient allocation of their existing resources.

Doolette, (1986) of the view that the diversification is an important factor in the development of rain-fed agriculture under arid and semi-arid situations in North Africa. He also pointed out that trade-off should be required in order to get a stable, less exploitative farming system.

Killedar and Waghmare (1987) studied on optimum crop plans for three different size groups of farms for the homogeneous scarcity region of Nasik district of Maharashtra, using linear programming. It was observed that with the available resources, the suggested crop plans provided higher net returns than those under the existing crop plans. Further, with the relaxation of restriction on capital and labour, the suggested optimal plan provided higher net returns with more employment opportunities to farm labour.
Tanaka (1987) in a study concluded that upland cropping systems in Japan were changing from cereals and pulses towards feed and forage crops, fruits and vegetables. Farmers were eager to improve cultivation techniques to lengthen the effective growing seasons and converse energy use have been developed based on intercropping and mixed cropping.

Singh and Sharma (1988) in their study pointed out the possibilities of increasing farm income and employment level under different farming systems. The study indicated that optimization of resource use enhanced the potentiality of increasing the farm income by 13.54 percent over existing plan. Again the optimal plan with the mixture of livestock enterprises with the crop enterprises enhanced the farm income upto 144.27 per cent over existing plan.

Singh and Sharma (1988) observed that the small farmers followed diversified farming systems in Mid-West region of Uttar Pradesh. The small farmers would like to combine livestock enterprises with crop enterprises. The study further stated that the
optimal plan with both crop and dairy enterprises increased the farm income over existing plan.

Bhogal et al., (1989) conducted a study in Meerut of Uttar Pradesh to examine the potentiality to raise the income and employment of small and marginal farmers through optimum integration of crop and milk production activities. They used profit maximizing linear programming model and found that there was possibility of reallocation of resources among various milk production and crop activities on small and marginal farms in the study area. Considerable potential for increasing the family income and employment of farmers through optimization was also established. They also found that the milk production was relatively more important for marginal farmers from the point of view of its existing and potential contribution to the family income than that for small farmers.

Juo (1989) studied three models of farming system in the wetter tropics as the irrigated rice multi-story homestead garden complex in Asia, the tree and cash crop plantations of Latin America
and mixed root crop brush fallow systems of Africa. He concluded that there was a great potential for the improvement and adoption of multi-storied homestead gardens and mix systems which included trees, annual and perennial crops.

Gogoi (1989) studied on the resource allocation in farms in flood affected situation in Sibsagar district of Assam, by using Linear programming technique and found out that area under HYV paddy increased whereas local paddy area decreased. The farms' net return in case of small farm increased substantially. This was possible because of maximum area allotment to the relatively more remunerative crops like vegetables in the optimal plan. Dairy cow and poultry were found to be remunerative among live stock activities.

Thanh (1990) conducted a case study on management practice of animal integration on selected rice-based farming systems in the Mekong delta of Vietnam where farmers had been raising fish, pigs, chicken, ducks, cattle, buffalo and goat besides rice and cash crops. He observed that integration of rice with other crops and animal
husbandry raised the farm income. Fodder and green manure trees could be grown in order to develop a complete sustainable agricultural system.

Dutta (1992) evaluated the economic efficiency in cropping pattern across different size groups of farms in Titabor developmental block in Jorhat district of Assam. He developed 24 optimal plans in this area. He observed that mixed farming was prevalent in the study area and paddy was the major crop dominating the crop pattern. Further, he found that net return realized from homestead farming was highest in small farm families.

In another study, 21 type of farming systems were identified on the basis of crop and livestock enterprises in Sonitpur district of Assam. The resource utilization pattern and return among the different farming systems adopted by the farmers of various size groups of farms were not identical. The study also found that there is a scope for making better use of the existing resource and increase in net return of the farms through reorganization of the farm business. The study further revealed that as a result of resource
optimization, the area under major crop paddy showed a decrease while relatively remunerative crops like vegetable crops covered more area in the optimal plan (Bhowmick et al., 1992).

Ngambeki et al., (1992) demonstrated the profitability of the systems in northern Cameroon by integrating livestock into a crop based farming through increased financial benefits and a better use of intermediate farm resources such as manure, draft power and crop residues.

Phukan (1993) conducted a study on the agroforestry farming system in Jorhat district of Assam and concluded that mixed type homestead agroforestry was common to all farm families irrespective of their farm sizes. The study brought out that about 54.65 per cent of total fuel requirement was met from the fuel wood alone. The average per capita per day fuel consumption was worked out to be 0.0215 qt in the study area. It was observed that per family fuel consumption increased with the increase in family size.

A study on identification of specific enterprise based farming system in vogue in Jorhat district of Assam taken up by Das (1996)
revealed that in total 27 farming systems were in practice across different size of farmers in the area. Out of these 27 systems, 7 were rice based, 5 vegetables based, 3 dairy based, 5 pig based, 4 poultry based and 3 fish based farming systems.

It is observed that low soil productivity and poor rainfall condition during rainy (kharif) season makes it very difficult to produce enough food by the farmers in arid areas. Therefore, to ensure a regular income and sufficient food for their families and decent living standards of the farmers, it is necessary to opt for some other alternate land use-based farming system or subsidiary enterprises which would provide more income and employment to the farmers. Such enterprises include livestock rearing, fodder production and growing of trees etc. or a judicious combination of these that would bring better utilization of available resources. The study further suggests that besides farming, advance technologies should be undertaken for providing suitable income to the farmers and to make the farming a viable enterprise (Singh et al., 1999).
Jayanti et al., (2000) based on the experience from Tamil Nadu, India described these systems as a mixed animal crop system where animal component was often raised on agricultural waste products while the animal was used to cultivate the soil and provide manure to be used as fertilizer and fuel.

Basavaraja, (2000) in his study in northern dry zone of Karnataka attempted to analyze the constraints to identify the factors causing the yield gap and to quantify the magnitude of their influence on the yield. These factors were grouped into main categories into two main categories (i) technological or biological constraints such as seed variety, soil problems, moisture problems, incidence of pests and diseases and non-application of recommended doses of plant nutrients and other inputs and (ii) the socio-economic or behavioural constraints including availability of funds and inputs, size of land holding, age and education levels of the farmers and proximity to the source of technical know-how. The environment factors like amount of rainfall and its distribution, humidity,
temperature etc. were also conceived to be the constraints in explaining the farm potential in various crops.

Randhawa et al., (2001) in their study in the hilly and sub-mountain regions of North India found that about 30 per cent of the total area under wheat was rainfed and largely confined to the northern hill zone, north-western plain zone and north-eastern plain zone. Poor moisture availability, inadequate and imbalanced use of fertilizers, lack of awareness of improved varieties and inadequate plan protection and weed control measures were some of the bottlenecks in improving productivity of rainfed wheat.

Hazarika et al., (2002) pointed out the prospect of increasing farm income and employment through diversification in Pakhimori development block of Nagaon district, and reported that in comparison to existing plan, the optimum plan showed increase in cropping intensity, net return and employment substantially in all the farmer categories. Further it was observed that vegetables, potato and oilseed were the most remunerative crop activity in the optimum plan.
Agbonlabor *et al.*, (2003) in their studies undertaken in Nigeria defined the concept as a type of mixed farming system that combined crop and livestock enterprises in a supplementary and/or complementary manner.

A rigorous study of the nature of changes in cropping pattern in terms of acreage allocation among the crops in West Bengal had been attempted by De (2003), where he found that diversification had taken place largely in favour of boro rice, potato and oilseeds as a whole. The diversification had also taken place largely in favour of high value crops or towards the crops with relatively higher remuneration than the other grown in their respective seasons.

Kumar *et al.*, (2004) expressed the view that sustainable farming systems or system approach could enhance the income and employment as compared to single enterprise. The level of employment of farm family is mainly determined by the size of farm business, intensity of cropping and combination of different types of enterprises adopted at different size groups of farms.
Behera et al., (2006) undertook a study in farmer’s field (0.4 ha) at Bashathi village of Coastal Orissa during 2003-05 to generate adequate income and employment opportunities round-the-year involving enterprises like field and horticulture crops, fishery, dairy and agro forestry. Net returns of Rs.47,825 were obtained with an investment Rs.18,515 and employment opportunity of 248 mandays was also generated.

Sharma and Chauhan (2008) revealed that the small and marginal holdings account for 85 per cent of total holdings in Himachal Pradesh. Agricultural diversification with off-season vegetables has made a prospective impact on the quality of life of rural population. The study shows that switching over to the cultivation of vegetable crops has made a perceptible impact on income, employment, poverty and many other aspects of life including female empowerment.

Rai and Tiwari (2011) evaluated the economics of different farming system in context of income and employment. Vegetable farming is most remunerative venture followed by crop husbandry
and system-wise analysis revealed that crops +dairy +vegetables farming system fetched highest return and maximum employment.

Phukan (2012) highlighted that there were ample scopes for diversification in the existing farming systems of flood free and flood affected villages of Jorhat and Nagaon districts. The integration of goat, pigs, and poultry with rice and vegetables could lead to enhance of adaptive capacity of the economically weaker rural farmers. But for this the farmers would have to rear improved varieties of goats, pigs and poultry and manage them scientifically. Further the study revealed that the most common feature of the farming systems which were found to be economically viable and profitable was inclusion of dairy enterprise with crop enterprise.

It is observed that diversification of agriculture is attracting increased attention to create new employment avenues and for mitigating the problem of under-employment and seasonal employment. Besides direct and tangible benefits, diversification has important intangible and ecological benefits. Though it is difficult to find any research gap on this subject particularly in the findings
already done by various researchers, no in-depth study has been carried out on this subject in the Central Brahmaputra Valley Zone till now. Hence, it was decided to carry out research work in this valley to find out scopes for further diversification to increase income and employment opportunities in the area.

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