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RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES

A concept of novel technological approaches for livelihood security and poverty alleviation for poor farmers: a review

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Abstract

The main causes of stagnant agriculture include depletion and degradation of natural resources, increasing biotic and abiotic stresses, poor seed replacement rate, soil nutrients draining excessively, indiscriminate use of pesticides, changing soil microbial dynamism, lack of low input-highly profitable concept of technologies and overall lack of attempt for holistic approach to address problems. The present study discusses the novel approaches evaluated using low input-highly profitable technologies. Benefit: cost (B:C) ratio in various models of integrated farming system (IFS) ranged from 2.4-3.0 in comparison to 1.5-1.6 in traditional farming. Optimum utilization of family manpower in various IFS models was 67 to 187 man days/year during 3 years observation period. Resource generation options explored were goat, rural poultry (new technology), pig, high value vegetables (off season), cut flowers, cash crops, subsidiary units as apiculture and mushrooms. Two models of rural poultry production were developed aiming the landless and marginal farmers for resource generation and to diversify the livelihood base and self-employment. Integration of all the 3 models (third model of local chick production) enhanced production and profitability many times and B:C above 7.0. The novel low cost preventive and therapeutic formulation against mastitis and anestrous/infertility were also developed. A bio-enhancer (CSR-BIO) comprising consortium of microbes enhanced nutrient uptake and increased yield by 20-39% in sodic as well as normal soil. This created sustainable livelihood security and will also assure environmental security. Improved concept and models named as specialized IFS (SIFS) was developed with holistic approach and gave encourage results.

Keywords: Livelihood security; farmers; poverty alleviation; technologies; integrated farming system; abiotic stress; bioenhancers

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Introduction

After harvesting the boon of green revolution, the agriculture production is stagnating, not only in India, but throughout entire developing countries (Dyson, 1999; de Haen et al., 2003). Due to lower return and high risk, the investment is declining. Some of the problems causing this phenomenon are identified as: depletion and degradation of natural resources; increasing biotic and abiotic stresses; poor seed replacement rate; excessive drain of soil nutrients without replacement; damage to natural ecosystem resulting in excessive and indiscriminate use of pesticides/fungicides; changing soil microbial dynamism;

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unavailability of suitable and quality germplasm; lack of low input- highly profitable concept of technologies and overall lack of attempt for holistic approach to address the problems (Ryan and Spencer, 2001; Bouwer, 2002; Sundaram and Tendulkar, 2003; Dietz et al., 2004; Dumanski et al., 2006). The excessive drain of ground water and decreasing use of surface run off will seriously complicate the problem in future (Oweis and Hachum, 2009; Damodaran et al., 2011). The human population growth of around 2% and diversion of cultivable land for non-agricultural purposes, including urbanization, is putting vigorous pressure for increasing productivity (Reddy, 2006). The scenario is very complex and needs solutions with holistic approach.

It is necessary to remain free from stress for better livelihood. For the next generation, therefore it is possible to provide net benefits along with certain other livelihoods locally as well as globally that maintains and enhances the opportunity of sustainable livelihood (Chambers and Conway, 1992). Economists have formulated several proforma for generation of income that explains the complexities of the national economy and is nowadays used for covering a wide productive activity ranges within a community. Nowadays, several skills have been used for meeting the immediate needs. As for example, in case of food the money value can be put easily thereby making it understandable to the common mass that food can act as a source of income (Rex and Subbarao, 1993).

Due to globalization and market oriented economies, the basic amenities are developed wherever the human population is concentrated i.e. cities, whereas rural population has poor access to these modern amenities (Holcombe, 2004). It has been well established by agriculturists that smaller land holdings are unviable preposition for agriculture (Besley and Burgess, 2000). In India, various surveys conducted observed that nearly 30% of rural population is having either nil or less than 500 sq.m cultivable land, which means landless, while nearly 40% population is having up to 1.0 ha cultivable land i.e. marginal. For these nearly 70% population, agriculture has become un-viable operation in terms of livelihood security (Warr, 2003; Dorward et al., 2004; Srivastava, 2006). Livelihood security is considered as a complex problem and includes: security of food as well as nutrition; security of education; health and economical security; as well as overall security to environment (Mahima et al., 2012a). In terms of components that are having value addition one of the most significant sub-sector globally is the livestock sector (de Waal, 1993; Galal et al., 2010). Most of the technologies being developed aims small (about 24%) and large farmers, about 6% (Foster and Rosenzweig, 2004). It is predicted that in next 20 years, about 20% population will join the landless masses, keeping in view the rate of urbanization, poor economic return, human population growth and disintegration of the families (Bansil, 1998; Tiffen, 2003). This complex scenario needs immediate policy approach as any interventions at this stage will be able to create impact only after a decade or so. Livelihood security of these vulnerable masses and continuous enhancement in productivity is of prime concern.

Poverty and livelihood security are comparative terms. Livelihood security includes food & nutritional security and must generate enough resources to meet out educational, health and economic security of the families. For sustenance of livelihood, environmental security is must (Frankenberger et al., 2000). In our baseline survey during 2009 in Barabanki and Raebareli districts of U.P. (representing the socio-economic penury of northern rural plains of India), we recorded very poor annual agricultural income amongst the farmers covering 42 villages. For landless it was Rs. 14750/- and for marginal farmers Rs. 26000/-. The average family size recorded was 7.1. In the other part of the survey when expected minimum monthly income for a reasonable and satisfactory livelihood was asked, farmers narrated as Rs. 7000-8000/- p.m. This low income and expectations are more or less similar at 2009 prices in our previous survey conducted in A & N islands also. It is not only affecting the livelihood security in the rural areas, but resulting in migration of youth force in urban areas in search of livelihood, putting pressure on amenities in the cities. If a reasonable economic security can be obtained in the rural area itself, it can serve as production hub, equal distribution of income, reduce migration of youth force, assure better education and health and will go hand in hand with development programmes of the Governments for any area.

In the present concept paper novel approaches have been evaluated using novel low input-highly profitable technologies to create a reasonable and satisfactory livelihood security and alleviate rural poverty, and based on it an approach is discussed.

Novel concepts / approachES

Integrated farming system (IFS): Conventional agriculture practices are known to cause soil and pasture degradation because of intensive tillage, particularly practised in marginal productivity regions. Therefore, technologies and management programmes enhancing productivity need to be developed and implemented. Also, efforts for preserving the limited natural resources need to be strengthened. An IFS consists of a range of resource-saving practices that aim to achieve acceptable profits and high and sustained levels of production, while lessening negative impacts of intensive farming and preserving the environment

because of environmental friendly practices (Singh et al., 2013). Among the several different alternatives of farming systems that are nature friendly, integrated systems approach along with its variations is included for the benefit of the small scale producers. A horizontal element is included in the nature of integration that includes management practices which is based on advanced knowledge. Along with it a vertical element is also included which is an end to end approach including value addition as well as marketing. This further includes economic and social dimension recognition of transfer of technology along with adoption (Galal et al., 2010; Rimal, 2013).

The traditional farming system, which is a rough variant of IFS is not profitable venture and the benefit: cost (B: C) ratio is between 1-1.7 (Rai et al., 2013a). The definition of IFS has been given by many workers. Agbonlahor et al. (2003) defined the concept as a type of mixed farming system that combines crop and livestock enterprises in a supplementary and / or complementary manner. Okigbo (1995) defines IFS as a mixed farming system that consists of at least 2 separate but logically interdependent parts of a crop and livestock enterprises. According to Radhammani et al. (2003) definition is near to its concept which narrates it as a component of farming systems which takes into account the concepts of minimizing risk, increasing production and profit. This in turn improves the utilization of organic wastes and crop residues. The concept of IFS is integration of agriculture, livestock and aquaculture farming systems, being practiced since ages. In the light of its concept we defined the IFS as integration of various farming systems viz. agriculture, horticulture, livestock, aquaculture etc. where each component is inter-dependent on each other and optimum nutrient and energy re-cycling is practiced within the system (Damodaran et al., 2011; Rai et al., 2011). The IFS provides sustainability and slightly higher profitability compared to traditional or mixed farming system (Rai et al., 2013b). We observed B: C ratio in various models ranges from 2.4-3.0. It is best suited to families with small land holdings and assures optimum utilization of family manpower in various IFS models from 67 man days to 187 man days/yr during 3 years period.

In general practice under IFS no or negligible attempt is made to optimize the production and productivity and thus, the profitability is not up to optimum level. While working on the system nearly for 2 decades, we observed this bottle neck and due to this it was not fulfilling the present day requirement i.e. optimization of profitability and reasonable self employment to member(s) of the family. This has led us to the development of a specialized integrated farming system (SIFS) which created a special bond among the various farming sectors viz., agriculture and livestock along with horticulture and aquaculture. This will increase the importance of developing all such farming sectors for their strong integration and interdependence. It is practiced with optimum nutrients and energy re-cycling, one or more components can be raised to the level at which it serves as reasonable source of self-employment to the un-employed youth in the family (Rai et al., 2011; 2013b). We further elaborated the models into 4 components:

- Base crops (paddy, wheat, oilseeds, pulses, dairy and plantation etc.,) which provide the support to whole system.
- Medium duration cash crops (banana, guava, papaya, goat and pig etc.,) for bulk cash needs of the family.
- Short / super short duration cash crops (vegetables-seasonal/off season, rural poultry, cut flowers, dairy for milk and mushrooms etc.,) for continuous cash flow in the family.
- Value addition (system, produce) to enhance the profitability and includes organic production systems etc.

The comparison of various farming systems viz. traditional/mixed, IFS, mono crops and SIFS in terms of B: C ratio and sustainability clearly showed that lowest ratio was in traditional followed by mono crops, IFS and SIF. The SIFS was the only system to provide B: C ratio above 4.0 and highest B:C ratio up to 6.0 was observed by 3rd year which was mainly due to continuous decrease in input cost and increasing profitability (Rai et al., 2013b, c and d). Thus, SIFS was found to be a better option to create or attain reasonable livelihood security to small land holders compared to other farming systems. Some of the advantages of IFS are:-

- Agronomic - helps improve and conserve soil fertility.
- Economic - provides an opportunity to increase economic yield by product diversification and higher yields and quality at less cost.
- Ecological - through reduction of crop pests (less pesticide use and better soil erosion control).
- Social - through reduction of rural-urban migration and creation of new job opportunities in rural areas. Combining crop with livestock enterprises increase the labour requirement significantly and would help in generating employment opportunities.
- Profitability / Sustainability - via organic supplementation through effective utilization of byproducts of linked elements.
- Recycling - effective recycling of waste materials.
- Alleviation of fodder crisis – each and every part of land area is effectively and fruitfully utilized.
- Agro-industries - wherein one of the produce in IFS increases to commercial level there is surplus

value adoption leading to development of allied agro- and food- industries.

- Fuel and industrial wood production gets enhanced by linking agro-forestry appropriately thus helpful in reducing deforestation and preserving our natural ecosystem and resources.
- Help in identifying alternate fuel resources and reduce dependency on fossil fuel. Effective recycling technique - the organic wastes can be utilized for generating biogas.
- Helpful in adoption of new technology. Money flow round the year and economic sustainability as well as stability gives an encouragement to the small/ original farmers to go for the technology adoption and propagation of IFS practices.
- Linkage of components of different nature enables to produce various sources of nutrition.

IFS of livestock and poultry with agricultural crops: Dairy animals also provide ample farm yard manure, which may yield organic matter for improving soil fertility. On the other hand, farm byproducts are gainfully utilized for feeding the animals. Nowadays value addition of dairy products and ready to eat products/packages and high demand of milk and its milk products (flavored milk, paneer, khowa, probiotic curd, etc.) have raised interest among rural farmers and boosted dairy industry too. Similarly, goat farming along with agriculture crops is also gain popularity due to better efficiency of goats to convert crop residues into excellent quality of meat. Such an integrated farming venture is more productive and profitable. Poultry rearing has emerged as an industry having highest growth rate compared to the livestock sector because of the efficacy of poultry in converting grain into delicious meat, high reproductive rate, short generation interval and quick turnover of the input costs. IFS of poultry and agricultural crops has been found beneficial. Poultry farming help in generation of self employment, supplementary income and cheap source of protein, while its by products like manure, which is rich in plant nutrients *viz*. nitrogen, phosphorus, potassium and other minerals can be used as an effective fertilizer in sustainable agro-farming, which adds to its merit. Apart from that, pigs are excellent components of IFS models/practices and are important in the ecological context. In "pig tractor" systems, animals are confined in crop fields prior to planting and "plow" the field by digging for roots.

Besides these, vermi-composting technology is also effective to recycle farm residues into rich manure. Earthworms constitute more than 80% of soil invertebrate biomass and helpful in disposal of nontoxic solid and liquid organic wastes. The NPK (Nitrogen, Phosphorous and Potash) content of vermicompost is higher than the farmyard wastes (FYW) and it also contain abundant sources of vitamins, antibiotics and enzymes such as proteases, amylases, lipases, cellulases and chitinases. This technique provides self-employment opportunities for the weaker section.

Resource generation: This is the most important aspect of livelihood security. The landless and marginal farmers are resource poor farmers and by themselves cannot take up any activities which can enhance their economic status within reasonably short period (Farouque and Takeya, 2008). They are unable to absorb the risk associated with any venture. Often it leads to debt to an entrepreneurship when funds or loans are made available. The earning, even if the failure is not there, is first utilized for the family needs and then payment of loans (Mishra, 2008). It has been indicated that determination of the access to opportunities related to economy is done by human capital (in terms of education as well as skills and knowledge; health). Human capital therefore individually has been seen for a long period of time as a key determinant of probability of migration. Better advantageous are those having better education as well as skills. This is more profitable in destination markets of labour. Attainments of education are however of restricted significance in decisions related to migration but other assets remain significant (Lucas, 1997; Knox et al., 1998; De Haan, 2000).

For sustenance, risks over a period must be neutralized which is not possible. The suicides and sailing of family land by farmers due to crop failures and debt traps is a well known phenomenon (Meeta and Rajivlochan, 2006; Nagraj, 2008). To overcome these problems we experimented and validated a novel approach where these resource poor farmers themselves generate the resources and create assets. Thus, there is no risk of failure. Since the farmers are generating resources which are gradual, it is utilized for family needs and up-scaling and diversifying the livelihood base. In the process permanent/semi-permanent assets and infra-structure is also created.

In this concept we evaluated various options viz. goat, rural poultry (new technology), pig, high value vegetables (off season), cut flowers, cash crops, subsidiary units as apiculture and mushrooms etc. The 4 years study has clearly established new rural poultry production technology (Model-1 & 2) as the best tool for resource generation, self employment and overall poverty alleviation addressing both landless as well as marginal farmers (Rai et al., 2013c). The off season vegetables and cut flowers were the second options for marginal farmers in short duration. To support the diversification, low investment cash crops such as banana, goat, pig, papaya in medium duration provided enough resources for diversified livelihood base. The concept of opening dairies at negligible cost, a high

capital intensive venture, was successfully implemented by the farmers.

Novel technological developments and interventions: Technologies play crucial role in enhancing production and productivity and are basically reflection of advancement in research (Wark et al., 2007; Krehbiel, 2013; Mahima et al., 2012b). The main focus of technological development is on increasing production and the natural target is farmers with reasonable land holdings i.e. small and large farmers. Use of biotechnology in nutrition such as protected amino acids, fats and other nutrients; genetic manipulation of rumen microbes; use of enzymes, probiotics, prebiotics etc help in improving the health condition of animals and ultimately increase the production (Mahima et al., 2012b). These technologies are in high input-higher production mode and depend mainly on entrepreneurs for their dissemination (Gershon and Umali, 1993; Sean and David, 2001). They require infra-structure development for production, quality control and marketing. The best example is seeds and their multiplication technologies. The real benefit of these modern technologies are not fully harvested by resource poor landless and marginal farmers, though majority of population is in these categories and a major challenge exists to provide sustainable and reasonable livelihood security to them.

To cope up with the scenario workers world over advocates low input technologies. Though increase in production and profitability of 10-20% over the traditional system are obtained problem arises with such concept. The problem is that generally low inputs technologies are unable to achieve production level equal or near to modern technologies. Therefore, we advocated a concept of low input-highly profitable technologies which are able to provide production level nearer to modern high cost technologies but the input cost is negligible. These results in very high profit margin and resource poor farmers can adopt it easily. The only problem we witnessed is less attraction from market forces. Due to lower cost of technologies the margin is lesser and thus less lucrative from business angle. In contrast farmers group, social workers, voluntary organizations etc. are more attracted due to negligible investment in production inputs. Some of the technologies developed, validated and popularized are discussed as below.

New rural poultry production technology: For self-employment a better option is production of poultry (one among the fastest growing sectors). It is a sector which is organized well in terms of production of chicks as well as their supply; equipments; feed as well as marketing. Such facts are the matter of concerns mostly in rural areas for the farmers who are resource poor (Bartussek, 1999; Soqunle et al., 2012). Since ages the open range system is practiced and is found perfect for subsidiary income but cannot act as livelihood security source. Cost of commercial feed (balanced) which is ever growing further affects the deep litter system profitability (Miao et al., 2005; Singh et al., 2013). Two models under rural poultry production technology, based on semi-range system and integrated with azolla *in situ* production and feeding were developed (Rai et al., 2012, 2013a) aiming the landless and marginal farmers for resource generation to diversify the livelihood base and self-employment. It was integrated with SIFS as well as other farming systems. In the Model-1, target was continuous bulk cash flow initially at 3-4 months and later at bi-monthly intervals. Suitable backyard chicks targeting body weight in the batches of 250-300 at 2 month intervals were introduced and disposed off gradually when they crossed the body weight of 1.5 kg. Thus, each chick fetched net profit of around Rs. 120-150/- in about 4 months. The second one (Model-2) was developed for continuous daily income using egg production. With a size of 500 layers in the model daily income of over Rs 1000/- is assured by the model. While the Model-1 requires total investment around Rs. 10000/-, the Model-2 needs around Rs. 25000-30000/- (recoverable in 2.5-3.0 months). A separate low cost feeding practice (based on azolla and local resources) was developed and integrated. To sustain the system, under model-3, chick production locally using either brooding hens or modular hatcheries was introduced. Integration of all 3 models enhanced the production, productivity and profitability many times and benefit: cost ratio (B: C) above 7.0 (Rai et al., 2012, 2013 c and d). Such novel technological approach suiting the socio-economic penury of the area is much better compared to high input-high production concept in terms of adoptability and profitability.

Dairy development at negligible initial capital cost: Dairy enterprise, whether small or medium sized, is considered as a sustainable source of income, encompassing the entire ethnic group (Karmakar and Banerjee, 2006). However, the major challenge to resource poor farmers is huge capital cost to purchase the animals and start the dairy unit. To overcome the scenario, approach needs to be developed to avoid this initial cost. We already developed an approach to establish dairies with negligible initial cost (Gebre Wold et al., 2000; Rai et al., 2013e) and it is very suitable to landless and small land holders.

There may be significant contribution to alleviation of poverty as well as nutrition in the nation because of the potential for smallholder income as well as generation of employment considerably from dairy products of high value (Staal, 1995). The malnutrition

level is comparatively high in several countries (Gebre Wold et al., 2000**).** Development in the dairy sector helps to improve the status of nutrition in children by improving the availability of milk for consuming besides providing opportunities for income (Redda, 2001). For sustainable option of livelihood security reasonably in rural areas small dairies are better options (Staal et al., 1997). The major challenge however is to create livelihood security to marginal as well as landless farmers reasonably (Satterthwaite et al., 2010).

In dairy enterprise extensive work has been done to control the diseases and effective vaccines are available and in use. However, production related diseases/ conditions severely affect the profitability. Two important conditions are mastitis and anestrous (infertility) which has no satisfactory remedial measures and threaten the profitability of the venture (Yusuf et al., 2010; Deb et al., 2013a). We developed novel low cost preventive and therapeutic formulation against mastitis (Rai et al., 2013f) and anestrous/infertility (Rai et al., 2013g). Such economical and effective approaches will enhance the profitability of the venture beyond 250%. The perennial grasses as CO-4 (yield around 350t/ha) will assure year round green grass availability as well as lesser land requirement. Thus, practically in one hectare land 40-50 animals can be reared. Reduction in inter-calving period (around 15 months) will significantly enhance the profitability (Rai et al., 2013h). Higher biomass yielder azolla (*A. microphylla*) cultivation in village ponds will further reduce the input cost.

Organic production system: There is an ever growing debate regarding ethical aspects of production as well as trade in recent time due to concerns regarding trade to be fair; safe conditions of working (for producers as well as employees); and management of natural resource (both sustainable as well as safe environmentally). Organic farming involves holistic and ecologically balanced approach to farming, which promotes and enhances viability of agro-ecosystem, biodiversity, biological cycles and biological activity of the soil (Singh et al., 2013). The high input-intensive conventional agricultural production systems seem to be becoming unsustainable in the present scenario. Therefore, every effort is being made to identify and adopt feasible, profitable and eco-friendly farm diversification strategies. In this context, the importance of organic farming practices is gaining popularity and can be a major option that can help prevent accumulation of chemical residues in soil, water and plants and consequently in the food-chain and end users/consumers. There is wide range of organic agriculture principles including concerns for production of food safely; for the environment and animal welfare; as well as for issues concerning justice in the society (Browne et al., 2000). Over exploitation of soil nutrients without replacement is making the soil sick (Lal, 2000). The extensive and indiscriminate use of potent systemic pesticides is resulting in lower soil microbes (Palis, 1998). The resultant impact is decreasing soil fertility. Use of NPK is providing only these 3 major elements and not addressing the resulting widespread deficiency (or lower levels) of Zn, Mg, Cu, Fe, Mn, Boron etc. though scientists advise for their use which is seldom followed in systematic way (Smith et al., 1997). One of the approach, we followed, is enhancing biomass (organic carbon) in the soil through dhaincha/ sunhemp, improved bio-composting etc. and increasing the nutrient uptake through soil microbial dynamism. This approach is equally effective for degraded (acidic, sodic, saline) soils also. We developed a bio-enhancer (CSR-BIO) comprising consortium of microbes which is enhancing nutrient uptake and increased yield by 20-39% in sodic as well as normal soil (Damodaran et al., 2013a&b). Often livestock are included in organic production system for using nitrogen suppliers like leguminous forages to the crops (grains) in the rotational policy. In relation to the farms (with 'set-aside') an alternative approach is managing green manure crops (leguminous) in the field directly by repeated cutting as well as mulching. Comparison of the dry matter and accumulation of nitrogen for legumes (that has been grown for a period between 6 months – 2 years) has been done for comparing with rye grass (non-legume). Subsequently measurement of the performance of wheat has also been done. Cutting of red and white clover along with trefoil and green manures along with rye grass is done for maintaining a height of 30-40 cm or less. It has been concluded that if the cultivation is delayed till the spring arrives there is subsequent reduction in leaching due to soil that remains uncultivated over winter. The environmental risks in association with systems of farming rely on nitrogen fixation (which is natural) and evaluation of the activity of soil microbes must be done fully (Stopes et al., 1996; Liebig and Doran, 1999; Theobald, 2002).

On the basis of comparison between experimental farms environmental impact of organic vs conventional production of milk is done potentially. Life cycle assessment (LCA) is required to be performed at large quantity for showing differences in impact of environment potentially among several systems of production. On practical farms however the LCA and its application requires research in-depth for understanding processes that are underlying and for predicting or measuring emission variations that are in practice realized (Cederberg and Mattsson, 2000; de Boer, 2003).

There is comparatively lower availability of compost and production level can be maintained nearer

or above to inorganic farming systems. But mass multiplication and use of VAM in sodic or degraded soil with such consortium of microbes will improve the soil fertility within one year. For mass multiplication of these microbes very cheap source of media needs to be developed so that soil fertility improvement cost is significantly reduced as we developed one such media (Rai, 2012) and commercialized it. Such approaches will be sustainable and will assure environmental security.

Specialized integrated farming system (SIFS): It is a well established fact that traditional farming is not a profitable option for livelihood security. Mono-cropping is profitable but not sustainable due to higher input cost and risk of failure (Hanson et al., 2008). Just integration of several components in order to reduce the cost of input gives rise to integrated farming system (IFS) but by that way optimum production cannot be ensured. The concept of improved IFS has thus been conceptualized in this context that targets low input; production as well as productivity at optimum level; and highest profitability (Noble, 2009; Damodaran et al., 2011; Rai et al., 2013a). Therefore, models like SIFS, suiting to the socio-economic penury of the area, needs to be developed taking holistic approach. Such systems should have higher profitability, lower and decreasing input cost and easier to adopt (Rai et al., 2013b; Rai et al., 2013c). SIFS is "practice of integrated farming system in which, each component is interdependent but perform to its optimum level and one or more components can be raised to the level where it serves the level of self employment venture" (Singh et al., 2013). To overcome the bottleneck of various IFS models, improvement in components, concepts and practices have been attempted. Four different components have been included in SIFS viz., base and medium duration crops; crops of super short or short duration along with value addition. Just like IFS the basal crop provides with system support and may include cereals and pulses; plantation crops (oilseeds); dairy wastes like dung and urine. Area specific modifications can be done. The system must assure continuous cash flow to meet out daily needs of the family, bulk cash flow at intervals to diversify the livelihood base and taking up bulk cash needs of the family. It must further assure a background support component as plantations, crops, dairy etc. to cushion the risk and reducing the input cost. Thus, the profitability growth is assured beyond the limit of IFS. Each farming system incorporates the modern scientific/technological development continuously and optimizes the production and profitability. The success should be measured if the input cost is below 20% that of I year within 3-4 years period (Praphan, 2001; Verma, 2007).

Support services/extension: For sustenance of any approach, support services are must. Technological awareness, inputs, master trainers not only provide the technological know-how but also assures sustenance of the activities like artificial insemination, assisting in births, treatment of fracture, chick production/supply, generalized ethno-veterinary knowledge used to treat and prevent animal diseases, and range management strategies to minimize threats from their local environment etc and earn their livelihood through it (Gabalebatse et al., 2013). The ready availability of inputs assures quality and sustenance. The farmers groups explore the proper market and quality. This avoids middleman and full benefit goes to the producers.

Conclusion and future perspectives

In developing nations the simple fundamental approaches of the Government policy makers is creating sustainable livelihood to the mass living in rural condition. Nowadays, poultry farming has been combined with plantation as well as vegetation (an integrated farming approach) that ultimately increases the economic return of rural livelihood. In addition, this approach also reduces the cost of biomass; increases productivity and also reduces pests/ insects as poultry fed on the pests that effect the vegetation. Further investigations are required in this context to undertake exploratory studies. Technological approaches that are having low input cost along with further implementation of systematic implementation scheme (SIS) when initiated for generation of resource help in establishing small dairies in rural areas. Thus production of milk becomes easier without incurring any losses via extra expenditure. The rural youths' earning status automatically improves by this. The efforts undertaken during integrated farming system approach for improving efficiency of reproduction in large ruminants along with upgradation of the status of nutrition and reduced new animal purchase cost prove to be beneficial. Over exploitation of soil nutrients without replacement deteriorates the soil. Along with this there is reduction in fertility of soil due to potential application of pesticides that reduce the soil microbiota. In this regard organic production system is quiet beneficial both for livestock as well as the product like milk out of livestock sector. The shortage of cultivable lands that help to gain more economic return worsen the condition in case of landless and marginal farmers. For the marginal farmers in the current scenario of decreasing landholding specialized integrated farming system (SIFS) is found to be profitable. In the forthcoming years input cost thus will get reduced compared to initial investment by implementing SIFS model. Awareness programmes related to technological

interventions and master trainers provided with technological know-how also help in assuring sustenance of artificial insemination, chick production/ supply etc. This increases milk as well as poultry meat production. Such support services therefore help farmers to earn their livelihood. All these concepts of novel technological approaches thereby help in socio-economic upliftment of landless as well as marginal farmers.

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