



Transformation of resource-poor farmer of western Rajasthan to resource manager

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ABSTRACT

The focus of the article is to make the farmers of western Rajasthan aware about importance of integrated farming system (IFS) and its primary goal. The primary goals of IFS are (i) maximization of yield of each component (ii) rejuvenation/amelioration of system's productivity (iii) avoiding build-up of insect-pests, diseases and weed population (iv) reducing the use of chemicals. Development of sustainable livestock sector with low cost management, watershed management, use of farm ponds, bio-pesticides, bio-fertilizers, bio-gas, solar energy, compost preparation and rain water harvesting are some of the feasible options which can be incorporated in regular farming practices to improve livelihood of the farmers and make agriculture and livestock interdependent and sustainable.

Arid climate of western Rajasthan limits the option for commercialization of agriculture. The vulnerability of agriculture sector increases with changing environmental and socio-economic conditions (Singh, 2000). High temperature during most part of the season accompanied with high wind velocity and sand storms, scarce and irregular distribution of rainfall (<120 mm), high rate of evaporation, soil degradation due to wind erosion, low soil organic matter, termite infestation, rodent problem, damage to crop by birds and *nilgai* (blue bull) *etc.* make farming and livestock rearing difficult. However, indigenous breeds can survive harsh climatic conditions but crossbreds have limitations of thriving in such climate. Still agriculture along with livestock production has been back bone of Rajasthan. Farmers grow cumin, pearl millet, moth bean, guar, mustard, taramira, ber, date palm, pomegranate, isabgol, karonda *etc.* Also since a decade, Rajasthan has emerged with potent possibilities in livestock sector (animal husbandry contribution to state's GDP is around 10%) and is the second largest milk producer state in India. According to the Planning Department (2012), the challenges faced by the agriculture sector in Rajasthan are increasing gap between demand and availability of water; scanty and uncertain rainfall; deteriorating quality of land and ground water; low value agriculture; large gap between potential and realized yield of crops and high inter-year variation in productivity; low share of vegetable and fruit crops, seed spices and medicinal plants, *etc.* As uncertainty in rainfall and drought are constant companions of this region, farmers also rely mostly on livestock component for livelihood security, which automatically channelizes way for better adoption of integrated farming system

(IFS) in such conditions. Combining several production components in synergic manner decreases the risk element which integrated farming system entails. If one component fails, the other can provide critical means for survival. However above mentioned conditions limits availability of green fodder that is a major constraint in livestock rearing and milk production. The rainfall pattern varies for different regions of Rajasthan, similarly the variations in climate are not found uniform across the state and, therefore, single contingency plan for agriculture sustainability cannot be formulated for whole state and a more detailed region wise plan is the need of hour (Singh and Kumar, 2016). Western part of Rajasthan, receiving least amount of rainfall, needs special attention in terms of agriculture. To address the various agricultural problems, efficient utilization of available resources are needed through integrated approach in livestock farming and its wastes can be utilized to make agriculture sustainable. Region specific integrated farming system can be developed by incorporating the following elements under IFS.

Elements of Integrated Farming System

The following elements/ components of IFS are discussed in context of Rajasthan agriculture which can be easily adopted by farmers.

- **Watershed:** Watershed management basically implies an effective conservation of natural resources in a sustainable manner with minimum harmful impact to enhance the economic stability of livelihood. It involves management of land surface and vegetation so as to conserve the soil and water for immediate and long term



benefits to the farmers, community and society as a whole. So planning any area according to the watershed concept helps in better management of that same locality prioritizing conservation and utilization of the important natural resources; soil, vegetation and water.

- **Farm ponds:** Construction of dugout pond helps in harvesting rain water during monsoon season and utilizing it during the critical stages of crop growth and other purposes. On-farm digging of pond helps in minimizing the labor and energy needed for transportation of water. The rotational draining and cropping of pond soil also can be an effective practice to make use of, and recycle, the nutrients trapped in the bottom sediment.

- **Bio-pesticides:** Biopesticides are pest management agents based on living micro-organisms or natural products (Chandler *et al.*, 2011). For example, canola oil and baking soda have pesticidal applications and are considered biopesticides. Different classes of biopesticides include: biochemical pesticides (plant extracts, sex pheromones), microbial pesticides (bacterium, fungus, virus or protozoan) and Plant-Incorporated-Protectants (pesticidal substances that plants produce from genetic material that has been added to the plant). Biopesticides are comparatively less toxic than the conventional pesticides and act on the target pests, get decomposed easily and largely limits the environmental pollution caused because of the poisonous pesticides.

- **Bio-fertilizers:** Bio-fertilizers are those substances that contain living microorganisms and they colonize the rhizosphere of the plant and increase the supply or availability of plant nutrients and/or provides growth stimulus to the plants. Biofertilizer has been identified as an alternative to chemical fertilizer to increase soil fertility and crop production in sustainable farming (Wu *et al.*, 2015). Microorganisms present in biofertilizer mobilize plant nutrients from unusable to usable form through biological process. There are several types of biofertilizers such as: nitrogen fixers, phosphate solubilizers, phosphate mobilizers and plant growth promoting biofertilizers. Though biofertilizers also come with certain limitations, but their role in nutrient acquisition has made them popular over period of time, by lowering the input cost involved in chemical

fertilizers and these also serve as excellent source of nutrient mobilization in organic farming.

- **Bio-gas:** Cattle dung obtained can be used for bio-gas preparation in scientific method. The government is also providing subsidy for installation of bio-gas plant. This can be helpful in partially solving the energy crisis and the left over cow dung slurry from biogas plants can also be used as manure in the crop field.

- **Solar energy:** Rajasthan is lucky in receiving good intensity of solar radiation and having maximum cloud free days for harnessing solar energy. Solar dryer, solar heater, solar cooker, solar thermal desalination device, animal feed solar cooker etc. are some of the technologies using non-conventional source of energy which can reduce the burden on conventional energy source and also decrease the load on fuel wood thereby protecting environmental safety.

- **Compost preparation:** Utilizing crop residue, vegetable and fruit residues for composting can be a useful tool for nutrient recycling. The available nutrient up on proper decomposition can be used as compost to meet the nutritional requirement of crops. By making compost in the farm, one can get rid of the huge mass of regular residue and animal excreta generated and instead can get valuable compost for farm use. As organic matter contains all the essential nutrients unlike synthetic fertilizers, it will improve soil health besides fulfilling the nutritional requirement of crops. Just systematic dumping of waste along with periodic watering and aeration will make the compost ready within a period of 4-6 months.

- **Rain water harvesting:** The residents of Rajasthan know the importance of rain. Little amount of available rain during monsoon season needs to be stored for utilization during the period of need. Already construction of *tanka* for rain water harvesting has been well adapted. But the scientific construction of *tanka* as suggested by the scientists of might help in increasing the storage capacity.

There are various other components of IFS such as apiculture, sericulture, duckery, goat farming, piggery, fishery, mushroom cultivation, dairy sector, poultry etc. which can be incorporated in region specific IFS model depending upon resource availability and local preference.



Conclusion

Shifting farming to IFS will ensure agricultural sustainability and profitability. Besides most of the farm input is self-sustained through recycling of available resources thereby cutting the production cost fairly. But in some cases IFS models have shown that with increase in the number of enterprises, the profit margin increases but the increase is coupled with increase in cost of production and employment generation, making rise in profit marginal. Further, it is evident that profit margin varied with the ecosystem (rainfed/ irrigated), management skill, and socio-economic conditions. As in western Rajasthan, the farming system will get changed from subsistence to integrated farming system approach that to mostly in rainfed condition, the input use will be automatically lowered and the extra cost incurring in input can easily be cut down and for obvious reason. Therefore, the profit margin will be higher in such regions enabling higher income generation as compared to the existing system of farming. As a whole the economic return of the farmers can be increased in IFS as the B:C ratio is increasing compared to non-IFS (NIFS) and this can be potential approach in increasing farmers' income.

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