The Journal of Rural and Agricultural Research Vol. 17 No. 1, 94-96 (2017)
Received February 2017; Acceptance May 2017

Importance of Crop Diversification For Sustainable Production

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Abstract

Indian agriculture has gone through a sea change past 50 years as knowledge progressed, new technologies developed and the rate of growth in agriculture increased, the cropping system research also went through various stage of evaluation during which its scope expended and its focus sharpened in accordance with newly acquired scientific knowledge. However, somehow multiple cropping become synonymous with cropping system in our country. In effect, designing of efficient cropping system for different agro- ecological situation and farm resources base through diversification, become the major plank of cropping system research. Hence agronomists have been striving for designing cropping system that give higher yields, more net return, higher resource use efficiencies and remain sustainable over a longer period with regard to these parameters.

Key words: crop diversification, cropping system, monocropping sustainable

Introduction

In practice, the farmer's decisions with respect to choice of adoption of crops and cropping system in influenced by several forces related to infrastructure (household and custom hired storage facilities, transport facilities , post harvest handling and processing etc.) , socio-economic factors (farmer's resources base, land ownership, size and type of land holding , dietary habits and household need of food, fodder, fuel, fibre, finance; labour requirement and availability etc.). Technical developments (level of mechanization, irrigation facilities, improved varieties, plant protection need etc.) soil & climate, trade and marketing, all operating interactively at micro-level. *Devkant et al. (2013)* have tried to enlist the major cropping systems of primary, secondary and tertiary importance, in terms of their spread in each district of the country. They identified 250 double cropping systems being followed throughout country. But it is estimate that only 30 major cropping systems are prevalent in the country, barring they are under mono cropping due to moisture or thermal limitation. These 30 systems are: Rice-Wheat, pealmillet-gram, Pearlmillet-Mustard, Pearlmillet-Sorghum, Pearlmillet-Wheat, Cotton-Wheat, Cotton-Gram, Cotton-Sorghum, Cotton-Safflower, Cotton-Groundnut, Maize-Wheat, Maize-Gram Sugarcane-Wheat, Soybean-Wheat, Soybean-Gram, Sorghum-Sorghum, Sorghum-Groundnut, Sorghum-Wheat, Sorghum-gram, Sorghum-Rice, Groundnut-Wheat, Groundnut-Gram, Groundnut-Groundnut, Groundnut-Sorghum, Groundnut- Rice, Pegionpea-Sorghum, Pegionpea-Wheat, Rice-Wheat, Rice-Rice and Rice-Groundnut.

Crop Diversification:

Crop diversification in several area may prove to be of paramount importance in several fanning situation in mitigating the problems of soil health, weed infestation e.g. diversifying Rice-Wheat system with crop such as Sugarcane, Berseem, Mustard etc. has been found to effectively minimise the problem of *Phalaris minor* infestation while inclusion of legumes either for grain, fodder or green manure improves the soil fertility and soil physical characteristics.

Millets, pulses and oilseeds continue to be the important components of the farming system in dry land agriculture. However, to provide greater stability to production and income there is a need to diversify the cropping systems into alternative land use such as agri-horticulture, agri-silviculture and silvipasture.

These system can be adopted based on the land capability with an overall aim of achieving higher system productivity than of individual components. Rainfed areas also excellent niches for cultivation of a number

of medicinal aromatic and dye yielding plants.

The global demand for such plant material is expected to rise substantially in the coming years which can be met from rainfed areas. Therefore, appropriate agrotechniques for these crops/ species need to be developed and standardised by on farm testing.

Why Need of Diversification

A farmer wants higher biological productivity and economic return with lesser risk for say more stability over a period of time under fluctuating environmental situations, saving of inputs and minimum degradation of soil resources with infrastructural support in terms of input supply and marketing . As a result the new multiple systems developed through research, rarely found favour with the farmers, unless duly supported by input supply and infrastructure. But wherever a prevalent cropping system becomes unsustainable, due to any reason, it is replaced by new emerging system. Many a time introduction of a new crops or development of new crop varieties through technological innovations triggers the diversify and paves the way for new cropping systems which are relatively more productive/ profitable than the existing ones. These diversifications are necessitated by several reasons, such as:

1. Incidence of certain disease(s), insect pest(s) in epidemic form in component crop.
2. Change in labour availability pattern due to some social /economic variations
3. Changes in pricing structure of inputs/ products.
4. Weed infestation
5. Creation of demand for certain commercial crops on account of socio-economic or political decisions which favour development of processing industry or international trade for some crops.
6. Technical breakthroughs, such as development of new genotypes in preferential crops, making their cultivation feasible in non-traditional areas.

As a consequence of any one or more than one of above actions, farmer's decisions swing in favour of better alternative crops, and new systems emerge at macro-level. Crop diversification is effected through substitution of one or more than components of the existing cropping system, which may be necessitated due to creeping in some of threats to sustainability of the present cropping system and possible opportunities for their remedy through diversification crops / cropping system.

CROP DIVERSIFICATION

1. Crop diversification for economical gain:

The economic return or monetary gain per unit area and time is one of the major consideration for diversification of a certain crop at farm as well as regional level. Farmers are more interested to produce those crop which gave more profit with minimum cost of cultivation. In Haryana, farmers are divert to growing gram crop instead of most popular existing wheat crop because farmers have gain more economic return with growing gram crop which has low cost of production than wheat and getting high price per unit economical produce. Similarly in Chhattisgarh, where Paddy crop is predominantly grown but due to low productivity and high cost of cultivation, this crop is not a profitable crop to farmers so farmers have diverted to other more profitable crop like Sugarcane, Arhar/Tur, Sunflower, Niger and rabi pulse. (*Singh Ram 2006, Singh, A. 2011 and Singh et al, 2012*).

2. Crop diversification enhanced nutrient use Efficiency

Crop grown in one or the other sequence and nutrient management strategies adopted in one crop often influence the fertilizer needs of the following crop(s) due to carry over effect of nutrients and incorporation of crop residues. Inclusion of legumes in cropping systems for green manuring, fodder or grain purposes proved an assured agro-techniques to improve nutrient use efficiency, especially that of N (*Joshi et. al., 2004, Joshi et al. 2006 and Gill, M.S. and Sharma, G.C. 2005*).

3. Crop diversification for disease/pest management:

We can minimise the use of insecticide / fungicide for controlling the insect/pest to a considerable extent through diversification approach. Reheya (1973) reported that sorghum ear head fly damage is extremely rare where red gram is planted in alternate rows. In other study he observed that incidence of root rot of cotton caused by Rhizofonia solani fungus is appreciably reduced by intercropping of dew gram (Phaseolus aconitifolius). *Gangwar et al. (2011*) observed that coriander, inter cropped with sugarcane prevented top borer attack in sugarcane. Garlic and Fennel intercropping was also found to reduce incidence of top borer in sugarcane.

4. Crop diversification for weed management:

Crop diversification in sequential cropping systems has been found to reduce some abnoxious weeds to a considerable extent, thereby reducing herbicidal application need to a great extent in are

where such weeds have assumed alarming proportions due to continuous adoption of a certain cropping system. Johnson grass (*Sorghum halepense*) becomes predominantly weed in continuous maize cultivation but can be controlled by rotating with cotton (Hosmani and Maiti, 1993). Similarly, a change from rice-wheat and rice-potato system to any other system, not involving rice in rainy season, tends to reduce population of *Phalaris minor* in wheat considerably (Bhan,1987). Adoption of sugarcane-wheat system in place of rice-wheat bring down *Phalaris minor* infestation to almost negligible level, which is otherwise not achieved even through herbicides (Bhan, 1987, Prasad et. al. 1997).

5. Crop diversification for nitrate pollution management of ground water :

Pollution of ground water owing to leaching of nitrates is a relatively new concern in India. At such low rates of N-fertiliser use prevent in the country, nitrate leaching in not likely to pose serious problems in most of farming situation. However, increase in NO_3-N content of well water has been registered in the areas, where heavily fertilised and irrigated cropping systems predominate. Selection of appropriate crop in cropping systems and management practices minimise nitrate leaching besides improving N-use efficiency. Leyeme intercropping in cereals grown with wider row reduces nitrate leaching (*Gangwar, B. and Ram Baldev 2005, Thakur et. al. 2009*).

6. Crop diversification for increasing the water use efficiency:

Irrigation water is a costly and scarce resource and its availability is expected to further go down due to increased demand for domestic and industrial uses. Though water use efficiency can be increased by replace the more water requirement crops by less water requirement crops which incorporated in prevailing cropping system (*Sharma et. al. 2014, Singh, K. and Bohra, J.S. 2009*).

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