DOI: 10.15740/HAS/AU/14.2/195-202
Agriculture Update
Volume **14** | Issue 2 | May, 2019 | 195-202
Visit us : *www.researchjournal.co.in*
ISSN-0973-1520

A REVIEW :

Micro-transition and the agricultural systems in Kashmir Valley

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ARTICLE CHRONICLE :
Received :
14.02.2019;
Accepted :
24.05.2019

SUMMARY : The Indian economy is having a transitional behaviour. The early transition in the economy took place from feudalism. India had evinced a structural transformation in the overall setup of the economy though has evinced the state of Jammu and Kashmir. But the state has missed the intermediate stage of structural transformation *i.e.* there is no development of industrial base in the state especially in the Kashmir Valley. The share of agriculture GDP in the state has steadily declined over the last few decades with the result large section of rural workers confined to low productive work and low income.The state has witnessed a drastic sub-sectoral transition from agriculture to horticulture. The present study is a gentle attempt to study different transitions faced by the state of Jammu and Kashmir in General and Kashmir region in particular during the last two-three decades.

How to cite this article : Ganaie, Shabeer A. and Bhat, Arshad (2019). Micro-transition and the agricultural systems in Kashmir Valley. *Agric. Update,* **14**(2): 195-202; **DOI : 10.15740/HAS/AU/14.2/195-202.**

KEY WORDS :
Transformation, Output, Shift, Occupational behaviour, Agro-ecosystems

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BACKGROUND AND OBJECTIVES

Transitions are visible in different agro-ecosystems across Kashmir valley. All the aspects of the system exhibit different degree of transitions over the years. There are different factors that compel transformation in different agro-ecosystems. The differences between various wealth groups depends upon variety of socio-economic factors, which included age, educational background, family size, landholdings and number of animals. Efficiency of farming is influenced more or less by the resource availability and socio-economic overheads at the command of an individual farmer. Accordingly formulation of various developmental programmes and their implementation necessitate a critical examination of the existing resource endowments at farm level. The present section, therefore, provides an insight into the socio-economic status of the households in the study area.

Family structure of sample households in different agro-ecosystems:

An insight into the land utilization pattern is pertinent to frame developmental strategies and future policies.Land holdings are important for raising crops that enhance farm income, ensuring food security and livelihood. It may be noted that Indian agriculture is the home

of small and marginal farmers. Therefore, the future of sustainable agricultural growth and food security depends on the performance of small and marginal farmers. As per the field survey, the average family size in the study area ranges from 5.68 (Pulwama) to 7.30 (Budgam) members and male members have outnumbered their female counterparts in all the agro-ecosystems and resulted in unfavourable sex ratio. The sex ratio in new generation (upto 6 years age group) ranges from 813 to 972 implying that district Pulwama has more number of males compared to female members (Table 1). The sex ratio in favour of male members which is not desirable in view of the fact that agriculture workers are migrating to rural non-farm sector. There are many activities like seed selection, manuring and fertilization, weeding, transplanting and harvesting, animal husbandry/dairying etc. which are exclusively taken up by female members and accordingly their majority in family will be desired. The age of head of the family is an important determinant of risk bearing capacity in strategic decisions which in turn affects farm productivity. Young farmers have more risk bearing potential than that of old age farmers which encourage them to adopt technologies and practice farming on scientific lines. The figures indicated that majority of family members fall in age group of 16-50 years. This age group should be considered as target group for building capacities and importing skill development.

Educational status of sample households in different agro-ecosystems:

Literacy level plays a catalytic role in the scientific management of farming and more so in case of new technology adoption. Education plays a vital role in the

Table 1: Family structure of sample households in different agro-ecosystems

District		FLCES	FRCES	LSEC	CCES
Age group	Gender				
0-6	Male	0.46	0.16	0.12	0.36
	Female	0.38	0.13	0.10	0.35
	Sex ratio	826	813	833	972
7-15	Male	0.30	0.60	0.38	0.22
	Female	0.29	0.46	0.30	0.21
	Sex ratio	967	767	789	955
16-50	Male	2.28	2.08	1.82	2.36
	Female	1.88	1.66	1.62	2.30
	Sex ratio	825	798	890	975
>50	Male	0.84	0.56	0.68	0.78
	Female	0.83	0.48	0.66	0.72
	Sex ratio	988	857	971	923
Average	Male	3.88	3.40	3.00	3.72
	Female	3.38	2.70	2.68	3.58
	Sex ratio	871	850	893	962
Average family size		7.26	6.10	5.68	7.30

Source: Field survey (2012-2014)

Table 2: Educational status of sample households in different agro-ecosystems

Education status	FLCES	FRCES	LSEC	CCES
Illiterate	3.14 (43.25)	2.56 (41.96)	2.16 (38.02)	3.26 (44.65)
Literate	4.12 (56.74)	3.54 (58.03)	3.52 (61.97)	4.04 (55.34)
Primary	1.46 (20.11)	1.18 (19.34)	0.90 (15.84)	0.66 (9.04)
Secondary	1.44 (19.83)	1.54 (25.24)	1.64 (28.87)	1.96 (26.84)
Graduate and above	1.22 (16.80)	0.82 (13.44)	0.98 (17.25)	1.42 (19.45)

Source: Field survey (2012-2014) Figures in parentheses indicate percentage

betterment of socio-economic conditions and provides healthy as well as clear environment for a good standard of living through a developmental change in social and cultural life of the people, living both in plains and hilly regions. It was observed that incidence of illiteracy was more in Budgam (44.65%) and relatively less in Anantnag (43.25%) (Table 2). Pulwama has maximum proportion of literate members of which a good proportion were found to attain secondary education which gives an idea that literates might have shifted out of agriculture in search of government or formal jobs.

Occupational pattern of sample households in different agro-ecosystems:

Income of a household determines financial resources at the hand of farmers which not only gives idea about his well-being, but also provides us an impression that farmers with better resources can invest more on adoption of technologies. It was observed that district Anantnag has higher percentage of employs (11.01) and businessman (5.50) than other districts and relatively lower percentage of labour (4.95) and dependents (66.11) due to which lower percentage are engaged farming (12.39) (Table 3).

Land holding and utilization pattern:

Agriculture, by and large, is a land-based avocation and as such, land resource is the most critical and constraining resource in farming, especially in developing countries like India, which has abundant supply of labours. The average size of holding determines the well-being and capacity to produce food for consumption as well as farm earning. The farmers in the study area have an average holding of land ranging from 10.79 kanals in Anantnag to 12.92 in Budgam (Table 4). It was observed that district Anantnag had 11.77 per cent of land holding under residential purpose which is maximum followed by Shopian 11.45 per cent. The district Shopian has 12.74 per cent of land under pastures followed by Anantnag 12.23 per cent.

Cropping intensity is the number of times a crop is planted per year in a given agricultural area. It is the ratio of effective crop area harvested to the physical area. It is the ratio of gross cropped area to net area sown multiplied by 100. The areas with irrigated area have more cropping intensity.

Cropping pattern of sample households in different agro-ecosystems:

The cropping pattern shows the spatial distribution of different crops with respect to area at a particular point of time and thus, indicates the relative importance of each crop in the total cropped area. Allocation of area under crops depends mainly on physical and environmental factors like the type of soil, climate, etc. It is also governed by the economic factors such as prices of the outputs, income, cost of inputs, farm size, availability of inputs, marketing outlet, etc. The spatial allocation of

Table 3: Occupational pattern of sample households in different agro-ecosystems

Occupational behaviour	FLCES	FRCES	LSEC	CCES
Farmer	0.90 (12.39)	0.92 (15.08)	0.94 (16.54)	1 (13.69)
Employ	0.80 (11.01)	0.48 (7.86)	0.56 (9.85)	0.70 (9.58)
Business	0.40 (5.50)	0.26 (4.26)	0.20 (3.52)	0.16 (2.19)
Labour	0.36 (4.95)	0.30 (4.97)	0.46 (8.09)	0.48 (6.57)
Dependent	4.80 (66.11)	4.14 (67.86)	3.52 (61.97)	4.96 (67.94)

Source: Field survey (2012-2014) Figures in parentheses indicate percentage

Table 4: Land use pattern of sample households in different agro-ecosystems

Land possession (kanals)		FLCES	FRCES	LSEC	CCES
Residential/Wasteland		1.27 (11.77)	1.42 (11.45)	1.38 (10.98)	1.36 (10.52)
Pasture (Gasscharrie)		1.32 (12.23)	1.58 (12.74)	0.38 (3.02)	1.04 (8.04)
Operational area	Irrigated	7.72 (71.54)	1.34 (10.80)	10.14 (80.73)	9.32 (72.13)
	Unirrigated	0.48 (4.44)	8.06 (65.00)	0.66 (5.25)	1.20 (9.28)
Total		8.20 (75.99)	9.40 (75.80)	10.80 (85.98)	10.52 (81.42)
Average holding size		10.79 (100)	12.4 (100)	12.56 (100)	12.92(100)

Source: Field survey (2012-2014) Figures in parentheses indicate percentage

area under different crops grown in the study area has been given in Table 5. The data reveal that, the total area sown is more in Budgam (17.82) indicating its higher cropping intensity while district Shopian lower cropping intensity. The lower cropping intensity in Shopian was mainly due to cultivation of perennials crop like apple and walnut and because of harsh climatic conditions, experienced during winters in the study area. Though Kashmir division of J&K state falls under temperate zone as such the state has by and large a mono-cropping system. However, since all the respondents cultivate vegetables both in the *Kharif* and *Rabi* seasons as such the cropping intensity was more in the vegetable growing areas.

All the aspects of the system exhibit different degree of transitions over the years. The average family size in the study area decreases gradually from 10.05 to 6.59 during last 25 years as depicted in Table 6 which could be because of increase in educational setup, better health and hygiene and better living standard and quality of life. On the other hand, another good picture appears across different agro-ecosystems, was literacy rate that has increased from 45.06 to 57.95 per cent since 1990. The progress could be due to the fact that government has provided education facilities to the people at local level that plays a catalytic role to reduce the dropout rate. Parents also show positive role in education for the betterment of socio-economic conditions of their children as well as clear environment for a good standard of living through a positive change in educational standards.

It was observed that the employment and entrepreneurial activities increased over the years but at the same time labour force and people engaged in farming sector decreased due to less incentive and low income, non-availability of cash/credit and less/fragmented land holdings. This factor in turn resulted in low production and productivity of farm which compelled them to out migration from agriculture in search of non-farm jobs.

The area under residential, fruits and vegetables increased during last 25 years while as the area under field crops, permanent pastures, fallow land and cultivable wasteland have a decline during 1980 to 2015. The decline in these land-use classes is inconsonance with the increase in the area under horticulture crops, roads and buildings.

Figures documented in Table 6 reveal that fertilizer consumption in J&K has gradually increased and 99 per cent of households use chemical fertilizers at present. Further, the absolute numbers and density of tractors/ power tillers were increasing at an alarming rate. Innovations in the form of region-specific machines could perform better under the hilly terrains of the state and irrigation capacities in the state also need to be augmented. The micro studies have revealed poor percolation of package of scientific practices of various crops in different agro-climatic regimes in the state. Generally, more seeds are used in principal crops and there is less application of FYM and fertilizers when compared with scientific recommendations leads to lower crop productivity. On the other hand, pesticides are applied on apple significantly above the prescribed level. 99 per cent of farmers were found applying pesticides in apple while as only 3 per cent apply in paddy.

In nut shell all the aspects of the system exhibit different degree of transitions over the years. The average family size in the study area decreased gradually from 10.05 to 6.59 during last 25 years which could be because of increase in educational setup, better health

Table 5: Cropping pattern of sample households in different agro-ecosystems (kanals)

Crop	FLCES	FRCES	LSEC	CCES
Rice	4.48	0.28	4.31	4.23
Fruits	3.24	9.00	5.12	3.33
Maize	2.18	0.76	1.55	2.24
Pulses	0.21	0.10	0.09	0.43
Vegetables	1.60	1	2.10	7.50
Others	4.49	0.28	4.31	4.24
Total area sown	16.20	11.42	16.78	17.82
Operational area	8.20	9.40	10.80	10.52
Cropping intensity (%)	198	121	155	210

Source: Field survey (2012-2014)

and hygiene and better living standard and quality of life. On the other hand, another good picture appears across different agro-ecosystems, was literacy rate that has increased from 45.06 to 57.95 per cent since 1990. The progress could be due to the fact that government has provided education facilities to the peoples at local level that plays a catalytic role to reduce the dropout rate. Parents also show positive role in education for the betterment of socio-economic conditions of their children as well as clear environment for a good standard of living through a positive change in educational standards, the employment and entrepreneurial activities increased over the years but at the same time labour force and people engaged in farming sector decreases due to less incentive and low income, non-availability of cash/credit, and less/ fragmented land holdings. This factor in turn resulted in low production and productivity of farm which compiled them to out migration from agriculture in search of non-farm jobs. The area under residential, fruits and vegetables increases while as the area under field crops, permanent pastures, fallow land and cultivable wasteland have a decline. The decline in these land-use classes is inconsonance with the increase in the area under horticulture crops, roads and buildings, that fertilizer consumption in J&K has gradually increased and 99 per cent of households use chemical fertilizers at present. Further, the absolute numbers and density of tractors/ power tillers were increasing at an alarming rate. Innovations in the form of region-specific machines could perform better under the hilly terrains of the state. On the other hand, pesticides are applied on apple significantly above the prescribed level. 99 per cent of farmers were found applying pesticides in apple while as only 3 per cent apply in paddy.

Sustainability:

The study provide an overview of major factors affecting agricultural sustainability in the Kashmir valley

Table 6: Micro level transitions in agro-sectors

Year		1990s	2015	Per cent change
Average family size (No.)		10.05	6.59	-34.4279
Education	Literate (%)	45.06	57.95	28.6063
Occupation (%)	Farming	16.4	14.42	-12.0732
	Labour	7.04	6.12	-13.0682
	Business	3.02	3.87	28.1457
	Govt. services	7.31	9.58	31.05335
Land possession (%)	Residential	6.7	11.04	64.77612
	Pastures	15.4	9.01	-41.4935
	Cereals	29.03	27.7	-4.58147
	Fruits	39.24	42.28	7.747197
	Vegetables	7.06	8.05	14.02266
Livestock population (No./HH)	Cattle	4.05	2.18	-46.1728
	Sheep	1.65	1.22	-26.0606
	Goat	0.16	0.12	-25
	Horse	0.05	0.03	-40
	Poultry	7.24	3.04	-58.011
Implements (No./HH)	Ploughs	0.1	0.08	-20
	Tractors	0.01	0.02	100
	IP sets	0.02	0.03	50
	Power sprayer	0.03	0.05	66.66667
Inputs	FYM	90	70.33	-21.8556
(% of HH)	chemical fertilizers	50.31	99	96.77996
Plant protection	field crops	2	3.54	77
(% of HH)	fruit crops	76.24	99	29.8531

Source: Field survey (2012-2014)

and associated challenges that must be overcome to achieve long-term sustainability. In Kashmir Valley, the depth of poverty and hunger is already great and environmental degradation is further reducing the productive resource capacity. Thus, measures to be taken in the future for gains in food security requires clear, effective and synergetic strategies for sustainable agriculture and environmental conservation. The data reveal that the area under rice in the state has steadily decreased. Such a decline was due to diversification towards horticultural crops and shifting of agricultural land to non-agricultural purposes. Weinberger and Thomas (2007) have highlighted the growing importance and demand of horticultural crops due to increasing income levels, changing life styles, urbanization and contribution of horticulture crops in reducing poverty and increasing economic development via employment generation and income augmentation. Bazaz and Haq-Imtiyaz-ul-Haq (2013), stated that due to the stagnant growth in agriculture sector and low commercial value of staple crops farmers have made their intensions clear about the shifting of the agriculture sector to horticulture production. Diversification towards horticulture has become a viable option to stabilize growth and increase farm income and enhance agriculture growth. The diversification towards horticulture for improving sustainability, profitability and productivity will help not only in improving farm income but will generate gainful employment. It is believed that horticulture sector can be promoted as a means of agro-diversification for second green revolution in India. Under conventional agriculture, humans have simplified the structure of the environment over vast areas, replacing natural diversity with a small number of cultivated plants and domesticated animals (Buck *et al.*, 2004). This artificial ecosystem needs constant human intervention in planting site preparation, planting, and use of agro-chemicals to control weed and different pests and manipulation of crop genetics (Altieri, 1995).

Increases in agricultural productivity have come in part, at the expense of deterioration of the natural resources base on which farming systems depend. Deforestation, loss of the germ plasmas of traditional crops and extinction of plant and animal species has threatened the production of quality and quantity of food and raw materials for the subsistence farmers.

Conversion of natural ecosystems to agricultural production accelerates soil erosion, acidification, primarily as a consequence of base depletion from crop removal, increased organic matter decomposition, and the application of ammonium-based nitrogen fertilizers (McCool *et al.*, 2001). Sustainable production of crops, livestock and wood products depend on systems of land use that maintain soil fertility and reduce erosion and other kinds of degradation. Efforts to improve soil fertility include livestock production, efficient use of crop residue and manure and introduction of herbaceous, tree forage legumes that can fix atmospheric nitrogen. Long-term sustainable development of agriculture ranges from the maintenance of a supportive biophysical resource base, the economic viability of production and the continuation of a sufficient supply of agricultural products, to the social vitality of agriculture-based rural communities (Xu and Mage, 2001).

Combining trees with agricultural crops or livestock will achieve the objectives of sustainability, increased production and benefits to the rural poor. Trees and shrubs are the very important components of the farming systems, which provide the local communities with wood products for domestic use and income generation, environmental protection, land productivity improvement, shelter and shade.

Rangaswamy *et al.* (1992) in a study to evolve economically viable and sustainable farming system for small and marginal farmers in rice based wetlands of Coimbatore opined that the net profit worked out under integrated farming system was 100 per cent higher than the conventional cropping systems followed in these wetlands. The additional employment generated through integrated farming system over conventional cropping system was 48 per cent higher. They finally concluded that farming system, comprising crops, poultry, fisheries and mushroom production enhanced the net income of the low land rice farmers.

McCool *et al.* (2001) points out that conversion of natural ecosystems to agricultural production often accelerates soil erosion, acidification, primarily as a consequence of base depletion from crop removal, increased organic matter decomposition and the application of ammonium-based nitrogen fertilizers. Tillage-based farming systems also exploit organic matter and quickly exhaust biologically oxidizable forms. Soil biology is vital to the functioning of soil and thus, can influence the sustainability of an agro-ecosystem.

Xu and Mage (2001) state that agro-ecosystems provide clean water, regulate carbon, nutrient cycling or

soil maintenance and are equally important to sustaining agricultural ecosystems. Long-term sustainable development of agriculture ranges from the maintenance of a supportive biophysical resource base, the economic viability of production, and the continuation of a sufficient supply of agricultural products, to the social vitality of agriculture-based rural communities. The health of an agricultural ecosystem depends on the way the land is used, the quality of the soil and the input and output of the nutrients (WBCD, 2008).

Howarth and Farber (2002) reported that valuation is useful in settings where institutional arrangements are not functioning well to reflect the social cost of environmental degradation. The recognition of the market failings and their impacts on poverty has placed sustainable development at the forefront of the global agenda through the 1992 Earth Summit and the subsequent 2002 World Summit on Sustainable Development (WSSD). The outcome of the WSSD was a 'commitment' by the international community to a plan of implementation regarding sustainable development. Fundamental to this commitment are three main challenges: the eradication of poverty, changing patterns of consumption and production, and protection and management of the natural resource base for economic and social development (United Nations, 2002).

Hamilton *et al*. (2003) points out sustainable agriculture is based on recognizing and building on locally-available resources and natural processes, including encouraging nutrient recycling and biodiversity conservation and limiting the use of external inputs of agrochemicals and non-renewable energy. A basic principle is full participation of farmers and rural people in all processes of problem analysis and technology development, adoptions and extension. These include the interaction between crop plants and insects, soil micro-organisms, weeds and many other elements of the local environment.

Wadear (2003) conducted study in three dry zones of northern Karnataka with an overall objective of identifying and analyzing the optimality and sustainability of different animal based farming systems. It was noted that sustainability value index was highest in all the categories of farm in all the zones of farming system-I (greengram, *Jowar*, tur, blackgram, paddy, sunfower and groundnut in *Kharif*, bengalgram and *Jowar* in *Rabi* and sugarcane and dairy animals) compared to farming system-II (greengram, tur, sunflower, chilli and groundnut in *Kharif*, bengalgram and *Jowar* in *Rabi* and dairy animals). Further, the author estimated the optimum plans by reallocating the existing resources and by relaxing the labour and capital constraints to obtain optimum plan-I and optimum plan-II, respectively. In Zone-I, there was marginal decline in the net returns from farming in optimum plan-II, compared to existing plan (Rs. 66,121.00). However, there was slight increase in net income in optimum plan-I (Rs. 96,321.00). As a result, per cent change in net returns over existing plan was marginal in optimum plan-I (44.93%) and optimum plan-II (42.34%).

Kiresur *et al*. (2004) study the optimum plans for sustainable farming systems in northern eastern dry zone in Karnataka. In farming system II the area under sunflower during *Kharif* was increased by 77.27 per cent in model-I and 89.78 per cent in model-II. In *Rabi* season area under bengal gram increased from 0.1 ha to 0.96 ha (model-II) while area under sorghum declined by 87.65 per cent. The cropping intensity was increased from 159.12 per cent in existing plan to 189.78 per cent in optimum plan. In large farms the area of *Kharif* sunflower was increased by 56.51 per cent. It was concluded that FS-I was found to be more sustainable than FS-II.

Ramrao *et al*. (2005) carried out investigations in Durg district of Chattisgarh to find out a sustainable mixed farming model which was economically viable integrating the different components like crops, livestock, poultry and ducks on a 3.5 acre land holding. A model having 2 bullocks + 1 cow + 2 buffaloes + 15 goats + 20 poultry + 20 ducks along with crop cultivation was the best with a net income of Rs. 58456 per year against arable farming (crop farming) alone (18300 per year) with a cost benefit ratio of 1: 2.25 and employment generation of 571 days. Tesfaye (2005) says that loss of soil fertility due to high rate of soil erosion, leaching of nutrients, removal of crop residues and cow-dung and low inherent soil fertility has threatened wide areas of Sub-Saharan African countries of which Ethiopia is a part. This has exacerbated the depletion of nutrients, which have limiting effect on plant growth and crop production. Sustainable production of crops, livestock and wood products depend on systems of land use that maintain soil fertility and reduce erosion and other kinds of degradation. Natural resources are depleted in the production process, reducing the

production potential of the agro-ecosystems unless sufficient amounts of productivity raising investments are carried out. In Sub-Saharan Africa, the depth of poverty and hunger is already great and environmental degradation is further reducing the productive resource capacity. Thus, measures to be taken in the future for gains in food security requires clear, effective and synergetic strategies for sustainable agriculture and environmental conservation.

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