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Indian Agriculture with Special Reference to Jammu and Kashmir- An Overview

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ABSTRACT: At present Indian agriculture is existing on fragmented land holdings with majority of small and marginal farmers. To cater the need of growing population without dwindling natural resources. It is utmost significant to maintain the equilibrium among production of cereals, pulses and oilseeds. To combat the declining productivity, degrading environment under climatic change earlier reports has been presented that highlights to adopt holistic approach through judicial use of resources, establishment of tool like micro-irrigation techniques, promotion of water harvesting structures resources, standardization and adoption of location specific integrated crop management modules, organic and natural farming for agricultural sustainability. However, a collective outline of agriculture practicing tools with respect to challenges faced by Jammu and Kashmir itself has been reported rarely. Thus, in lieu to the discuss and study the current challenges in the agriculture practices of Jammu and Kashmir, a descriptive review is presented to study and deliver the suggestions as remedial. Also, the current review contributes to researchers depending on the scenarios of different resource availability, the further research programmes can be generated that have an impact on farmers community. Besides planners can consider the current review towards further projections, development and decision making purposes.

Keywords: Climate change, Current agriculture, Natural farming, Neem coated urea, Rice, Wheat, Maize.

INTRODUCTION

Land use pattern. India globally leads in milk, pulses, spices as well as in livestock population whereas second in rice, wheat, cotton, sugarcane, farmed fish, sheep & goat meat, fruit, vegetables and tea. From aerial point of view, the Indian continent houses ~ 200.20 million hectare gross cropped area out of which 68.77 % is rainfed while 48.65% is available for irrigation. The average holding size of the country is 1.15 mega hectare (mha) with cropping intensity of 143.60%. However, in Jammu and Kashmir (J&K) the available gross cropped area matches to 1.08mha having cropping intensity of 152.11% with irrigated area of 28.04% having holding size 0.59 ha which includes mostly hilly terrain with forest coverage of 0.64 mha and 0.10mha of permanent pastures cover. From climate point of view, J&K experience three agricultural agroclimatic zones namely subtropical, intermediate and temperate with two major agro-ecologies of irrigated and rainfed (Padder and Mathavan 2022). Table 1 shows the details of area and productivity of major crops (Agricultural statistics at a glance 2022, 2022; Usda, 2020). Both country and state has temporal and spatial distribution of rainfall that lead to more fallow lands due to increase invariability in the precipitation and irrigation water, and low level of mechanization. Further, if these lands can be brought under cultivation it would enhance agricultural production and food security of the poor and marginal farmers (Pandey and Ranganathan 2018).

Indian food production scenario. To feed the continuously rising population of 1.38 billion, there is a pressure to grow more food, especially cereals. India with total food production of 310.7 million tons has maximum area under rice crop 43.78mha followed by wheat ~31.45mha), besides maximum productivity is observed in sugar cane crop (77893 kg/ha). From state point of view, West Bengal, Uttar Pradesh, Andhra Pradesh and Madhya Pradesh are the leading producers of rice, wheat, maize and pulses. Currently India is actively producing 25.4 million tons of pulses with productivity of 817 kg/ha. The per capita availability of pulses has reached 55.9 gram/day, against ICMR recommendation of 52 gram/day pulse requirement. like pulses the oilseeds production is also stagnant with

35.9 mt and productivity of 1236kg/ha having a huge gap between demand and supply thus have made India import reliant for oilseeds, leading to price volatility. (Anonymous, 2021). However, as indicative from Table 2, 3, 4 and 5 in J&K, the maximum area of UT is engaged for cultivating rice (280.51 thousand ha), maize (268.67 thousand ha) owing to maximum productivity ~2094 kg/ha for rice and 1872 kg/ha for maize. Whereas a meagre area is available for pulses (16.44 thousand ha) and oilseeds (49.26 thousand ha) with further resulted productivity matching to 509 and 789 kg/ha respectively. Thus, these statistics indicates a strong need to bridge the huge gap in pulses and oilseeds production through motivating farmers to shift these marginal land crops to irrigated conditions, devising stable minimum support price (MSPs) and framing policies to boost their production besides restructuring infrastructure (Choudhary, 2018). Further, to sustain long term use of natural resources, It will also be necessary to promote direct seeded rice or aerobic rice, there should be demarcation of rice and wheat crop areas and farmers should be convinced to include high values crop in their cropping system (Sunita *et al*., 2017).

Table 1: Area, Production and Productivity of major crops.

Major Crops	India				World		
	Area (mha)	Production (mt)	Productivity (kg/ha)	Area under Irrigation (%)	Area (mha)	Production (mmt)	Productivity (mt/ha)
Food Grain Production	**-**	**310.7**	**-**	**-**		**2678.9**	
Rice	43.78	124.3	2705	60.1	161.70	498.82	461
Wheat	31.45	109.86	3421	94.2	215.58	762.37	3.54
Sorghum/Jowar	4.71	4.8	1005	10.3	39.74	57.92	1.46
Maize	9.72	31.5	2945	26.7	193.54	1120.13	5.79
Bajra/Pearl millet	7.52	10.86	1368	10.5			
Rapeseed and Mustard	6.78	10.2	1345	-	34.68	69.60	2.01
Soybean	12.09	12.6	928	-	122.96	339.97	2.76
Sunflower	0.24	0.22	891	-	26..03	54.20	2.08
Groundnut	4.89	10.2	2065	-	28.18	48.43	1.72
Total Oilseeds (9)[@]	27.04	35.9	1236	28.4	245.73	556.17	2.26
Sugarcane	4.57	405.3	77893	-			
Gram (Chickpea)	10.17	11.9	1116	-			
Arhar (Tur)	4.54	4.3	842	-			
Lentil*	1.32	-	894	-			
Total Pulses	28.34	25.4	817	19.1			
Cotton	13.37	35.2	451	-	33.88	1.30	43.97

Table 2: Area, Production and Productivity of major crops (J&K UT).

Major Crops	UT Area (000 ha)	Jammu (000 ha)	Kashmir (000 ha)	UT Production (000 q)	Jammu (000 q)	Kashmir (000 q)	UT Productivity (kg/ha)	Jammu (kg/ha)	Kashmir (kg/ha)
Rice	280.51	127.48	153.30	5874	2444	3430	2094	1597	2690
Wheat	243.93	242.65	1.27	4883	4869	14	2002	2007	1065
Maize	268.67	197.67	70.99	5414	4085	1329	2015	2067	1872
Total Pulses	16.44	11.38	5.57	101	58	43	509	771	377
Total Oilseeds	49.26	12.91	36.34	389	-	-	789	-	-
Total food grain production	976.63	648.19	328.43	16397	11579	4818	1678	1786	1466

Source: Digest of statistics 2019-20. Directorate of Economics & Statistics, Government of Jammu and Kashmir.

Table 3: Land use pattern of J&K and India.

Particular	J&K	India
Net sown area (mha)	0.71	139.42
Gross sown area (mha)	1.08	200.20
Cropping Intensity (%)	152.11	143.60
Holding Size (ha)	0.59	1.15
Irrigated area (%)	28.04	48.65
Rainfed area (%)	71.96	68.77

Source: Anonymous, 2020. Digest of statistics 2019-20. Directorate of Economics & Statistics, Government of Jammu and Kashmir.
Source: Anonymous, 2021, Ministry of agriculture and farmer welfare, Government of India 2021

Table 4: Land Resources in J&K UT and India (mha).

Particular	J&K	India
Forest area	0.64	72.02
Land put to Non-Agricultural Uses	0.21	44.82
Barren and uncultivable Land	0.29	16.99
Permanent Pastures and other Grazing Lands	0.10	10.34
Fallow Land Including Current Fallow	0.03	26.36
Net sown area	0.71	139.42

Source: Anonymous, 2020. Digest of statistics 2019-20. Directorate of Economics & Statistics, Government of Jammu and Kashmir.
Source: Anonymous, 2021, Ministry of agriculture and farmer welfare, Government of India 2021

Table 5: Ranks of Indian states in different crops.

Crop	Rank
Rice	West Bengal = 1st
	Uttar Pradesh = 2nd
Wheat	Uttar Pradesh = 1st
	Madhya Pradesh = 2nd
Maize	Andhra Pradesh = 1st
	Karnataka = 2nd
Sugarcane	Uttar Pradesh = 1st
	Maharashtra = 2nd
Pulses	Madhya Pradesh = 1st
	Rajasthan = 2nd

Source: (Agricultural statistics at a glance 2022, 2022)

Irrigation Scenario. In India, spatial and temporal variation of precipitation has been boundless variation from 11000 mm to 90 m. Having maximum received from Cherrapunji (>11000mm) to lowest receiver is the area of western Rajasthan (<100 mm). Nevertheless, groundwater has been the major source of irrigation due to its timely and independent access over the years. Besides, the over utilisation of groundwater has depleted the water table ~ 64% of the county (Jain *et al.,* 2019). As shown in Table 6, the J&K region, the major water for irrigation is meet through the canals (257.51 thousand ha), wells (16.42 thousand ha), tanks (10.54 thousand ha) and others (23.07 thousand ha). Canals alone account for about 84 per cent of the total area irrigated, while the remaining about 16 per cent was irrigated by wells, tanks and other sources. Switching to micro irrigation structures with suitable water harvesting techniques can mitigate the crisis of water exploitation. Efficient method, like micro irrigation, can play greater role in management of irrigation water according to demand of the field crop. Properly designed and managed drip and sprinkler irrigation system have irrigation efficiency of about 90% and 70%, respectively contrast to surface irrigation method which have just about 40%. Further, Farmers should be made aware of the various national as well as state government schemes to utilize the utmost potential of micro irrigation (Jain *et al.,* 2019).

Table 6: Sources of irrigation in India.

Particular	Canals	Tanks	Wells	Tubewells	Others	Total
India (lakh ha)	17005.7	2249.4	1149.4	29108.2	4289.2	64624.7
J&K (000' ha)	257.51	10.54	16.42	-	23.07	307.55

A lakh is a unit in the Indian numbering system equal to one hundred thousand (100,000; scientific notation: 10^5).
http://indiabudget.nic.in/es2015-16/echapvol1-04.pdf
Source: Anonymous, 2020. Digest of statistics 2019-20. Directorate of Economics & Statistics, Government of Jammu and Kashmir.
Source: Anonymous, 2021, Ministry of agriculture and farmer welfare, Government of India 2021

Fertilizer consumption scenario. As Indian agriculture is progressing, the financial constraints for small and marginal farmers are increasing proportionally. The economic fluctuations have made it hard for the marginal and small farmer segment to manage the basic farming necessities like machines and tractors maintenance or practicing of new technology for crop production. The variation in farmer's financial circle has affected its potential to maintain the fertility of its respective agriculture land through natural resources as they require significant preparation cost and time. Thus, they are left with the alternatives like use of consumable modern inputs *viz.,* agrochemicals in the form of fertilizers and pesticides to enhance their productivity. As shown in Table 7, the subsidies in this sector is further aggravating to 4.16 percent per annum that can further results to disturbing of the N:P:K ratio to 6.7:2.7:1 from ideal requirement of 4:2:1 (Sadhukhan *et al.*, 2018).

India ranks second in the world and among the SAARC countries in terms of total fertilizer consumption with average per hectare application ~ 145 kg in India with reduced NUE of 15-30%, low P use recovery of 15% the rate of consumption may enhanced to 277kg/ha (Jadhav, 2021; Shukla and Kumar Behera 2022). Table 8, outlines the leading Indian states in fertilizer

consumption are Telangana (245.3kg/ha) Haryana (224.5kg/ha) Punjab (224.5kg/ha). Whereas, Jammu and Kashmir have consumption of 61.9 kg/ha. However, the scenario of the fertilizer use in Jammu and Kashmir is increasing to the tune of 10 to 15 % every year (Muktar, 2021). This excessive use of chemical fertilizers has led to the problems of algae eutrophication in addition to environmental degradation and climate change. As a remedial to these issues, adoption of Integrated nutrient management practices, use of neem coated urea, adoption of location specific crops and genotypes can reduce the fertilizer use to the tune of 20-30 percent (Shukla *et al.,* 2022).

Table 7: ALL India Consumption of N,P_2O_5& K_2O (1950-51 to 2020-21).

ALL India Consumption of N,P_2O_5& K_2O (1950-51 to 2020-21) (`000 tonnes)					
Year		**N**	**P_2O_5**	**K_2O**	**Total ($N+P_2O_5+K_2O$)**
1950-51		55.0	8.8	6.0	69.8
1960-61		211.7	53.1	29.0	293.8
1970-71		1,479.3	541.0	236.3	2,256.6
1980-81		3,678.1	1,213.6	623.9	5,515.6
1990-91		7,997.2	3,221.0	1,328.0	12,546.2
2000-01		10,920.2	4,214.6	1,567.5	16,702.3
2010-11		16,558.2	8,049.7	3,514.3	28,122.2
2019-20		19,101.3	7,662.0	2,607.0	29,370.4
2020-21 (P)		20,404.0	8,977.9	3,153.7	32,535.6

Inference. All India Consumption of N, P_2O_5& K_2O (1950-51 to 2020-21) (1000 tonnes)				
	N	**P**	**K**	**Total**
Pre-Green Revolution Period (1950-61)	133.35	35.35	17.5	186.2
Post- Green Revolution period (1970-91)	4384.8	2828.2	729.4	7942.4
Year 2000-2020	15533.13	6642.10	2562	24737.23

Source-Anonymous, 2020-21 The fertilizer association of India

Table 8: State-Wise (kg/ha) Consumption of Fertilizer (N+P+K).

State/Union Territory/Zone	**2018-19**
Andhra Pradesh	173.3
Telangana	245.3
Karnataka	183.2
Kerala	36.4
Tamil Nadu	186.4
Puducherry	227.9
Andaman and Nicobar Islands	16.1
Lakshadweep	-
Gujarat	135.5
Madhya Pradesh	90.3
Chhattisgarh	86.3
Maharashtra	126.0
Rajasthan	60.8
Goa	36.5
Daman & Diu	38.6
Dadra & Nagar Haveli	13.9
Haryana	224.5
Punjab	224.5
Uttar Pradesh	170.1
Uttaranchal	140.7
Himachal Pradesh	63.3
Jammu and Kashmir	61.9
Bihar	227.3
Jharkhand	59.8
Odisha	70.6
West Bengal	161.1
Assam	73.7
Tripura	0.0
Manipur	68.3
Meghalaya	0.0
Nagaland	-
Arunachal Pradesh	-
Mizoram	55.9
Sikkim	-
ALL INDIA (Average)	**133.1**
Inference of Highest fertilizer Consuming State (kg/ha)	2018-19
Telangana	245.3
Haryana	224.5
Punjab	224.5

Source: Anonymous 2020, RBI report, Agricultural Statistics At a Glance, Ministry of Agriculture and Farmers Welfare, Government of India.

Pesticide consumption scenario. Globally India captures the 12th rank and 3rd across Asia Pacific in pesticide use with highest use share of insecticides (51%)(Nayak and Solanki 2021). However, in 2020-21, India share only 1% of the global pesticide use ~ 62193 MT. The Per hectare application rate of pesticide was only 0.31 kg in 2017. Although usage is less but uncontrolled , use of sub-standard pesticide is causing high pesticide residues as well as a polluted environment (Bhat *et al.*, 2021). As indicative from Table 9. Indian states like Maharashtra (13243MT), U.P (11557 MT) and Punjab (5193 MT) are leading consumers of pesticides whereas Northeastern states are consuming least pesticides as maximum of them are converting to organic farming. Whereas, Jammu and Kashmir have utilized 2459 MT of pesticides during 2018-19. Use of bio-pesticides *viz. Trichoderma* spp., Pseudomonas, NPV, Azadirachin, Bacilus etc. have proven to be the finest alternative to chemical pesticides for promoting a sustainable method of development in the agriculture sector, besides reducing pollution. But The lower adaptability and declining interest of farmers community towards biopesticides have become a matter of concern. Besides the challenges in the form of production, manufacture and application in agroecosystems have also raised a question on their long-term sustainability (Mishra *et al.,* 2020). However, increase in education level (illiterate to primary, primary to secondary, secondary to college level and college level to university level) leads to 1.35 per cent decline in defensive expenses and 2.5 per cent more willing to buy biodegradable packaged pesticides than the earlier ones (Bhat *et al.,* 2020).

Table 9: Consumption of Chemical Pesticides (MT) in Various States/Uts.

State/UT	2016-17	2017-18	2018-19	2019-20	2020-21
Andhra Pradesh	2015	1738	1689	1559	1559
Bihar	790	840	850	850	995
Chhattisgarh	1660	1685	1770	1672	1639
Goa*	22	24	25	30	30
Gujarat	1713	1692	1608	1784	1573
Haryana*	4050	4025	4015	4200	4050
Himachal Pradesh	341	467	322	881	56
Jharkhand	541	619	646	681	1161
Karnataka	1288	1502	1524	1568	1930
Kerala	895	1067	995	656	585
Madhya Pradesh	694	502	540	540	691
Maharashtra	13496	15568	11746	12783	13243
Orissa	1050	1633	1609	1115	1158
Punjab	5843	5835	5543	4995	5193
Rajasthan	2269	2307	2290	2088	2330
Tamil Nadu	2092	1929	1901	2225	1834
Telangana	3436	4866	4894	4915	4986
Uttar Pradesh	10614	10824	11049	12217	11557
Uttarakhand	198	210	195	224	135
West Bengal	2624	2982	3190	3630	3630
Arunachal Pradesh	18	NR	5	5	2
Assam	306	241	256	410	420
Manipur	33	27	NR	25	46
Meghalaya	**Organic State**	**Organic State**	**Organic State**	**Organic State**	**Organic State**
Mizoram	9	NR	26	27	NR
Nagaland*	20	20	21	19	36
Sikkim	**Organic State**	**Organic State**	**Organic State**	**Organic State**	**Organic State**
Tripura*	298	330	349	364	NR
Andaman & Nicobar	NR	NR	NR	NR	1
Chandigarh	NR	NR	NR	NR	NR
Dadra & Nagar Haveli	NR	NR	NR	NR	NR
Daman & Diu	NR	NR	NR	NR	NR
Delhi	88	NR	110		
Jammu & Kashmir*	2188	2430	2459	NR	NR
Ladakh	NR	NR	NR	2198	3352
Lakshadweep	NR	NR	NR	NR	NR
Pondicherry*	43	43	42	NR	NR
Grand Total	**58634**	**63406**	**59670**	**61702**	**62193**

Inference of Highest pesticide consuming state					
State	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**
Maharashtra	13496	15568	11746	12783	13243
Uttar Pradesh	10614	10824	11049	12217	11557
Punjab	5843	5835	5543	4995	5193
Inference of lowest pesticide consuming state					
Sikkim	**Organic State**	**Organic State**	**Organic State**	**Organic State**	**Organic State**
Meghalaya	**Organic State**	**Organic State**	**Organic State**	**Organic State**	**Organic State**
Mizoram	9	NR	26	27	NR
Nagaland*	20	20	21	19	36

*Figures of 2019-20 for this State have been taken from inputs provided by the States/UTs during Zonal Conference (PP) for Rabi, 2020-21 Season.

Source : Anonymous, 2020-21 States/UTs Zonal Conferences on Inputs (Plant Protection) for Rabi & Kharif Seasons.

Herbicide consumption Scenario. The use of herbicide under Indian scenario is ~ 16%, with average annual herbicide use of 40 g/ha due to the lack of technical know-how and less purchasing power of farmer (Choudhury *et al*., 2016). Also, high dose herbicides like butachlor in rice and isoproturon in wheat are replaced by low dose herbicides of pyrazosulfuron in rice, and sulfosulfuron or mesosulfuron + iodosulfuron in wheat crop due to resistance of isoproturon to *Phalaris minor* (Shekhawat *et al.*, 2022). As outlined in Table 10, India is consuming 101 thousand metric tons of herbicides as compared to 3.5 million Metric tons usage globally with 3352 metric tons of consumption in Jammu and Kashmir. The real issues of Indian weed management are small holdings, constraints of labor and mechanical tools; inadequate information of weed biology and shifting weed flora; herbicide resistant weeds; less known impact of climate change. Further there is need role to play in the development, popularization of IWM and adoption of location specific effective, economical and eco-friendly weed management technologies for different ecosystems of India (Rao *et al.,* 2020).

Table 10: Herbicides Consumption Statistics- world, India, and J&K.

Particulars	World	India	Jammu &Kashmir
Herbicide Consumption (2020-21)	3.5 million Metric tonnes	101 thousand metric tons	3352 Metric tones

Source: Anonymous 2022, https://www.statista.com/statistics/reportcontent/statistic/1263069

CONCLUSION AND FUTURE SCOPE

Looking at the present context of agriculture with has been out leading with marginal farmers working on fragmented land holdings unable to satisfied the huge gap between deficit and requirement. To sustain continuous growth and interest of farmers in agricultural profession there is a need to create a general awareness and capacity building in farmers by switching to sustainable and remunerative practices *viz*., INM, Micro –irrigation, IPM, Promoting organic and natural farming besides devising stable MSPs and framing policies to boost their production and restructuring infrastructure.

Conflict of Interest. None.

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