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Prospects and Strategies for Accelerating Sustainable Agricultural Growth in Assam: Policy Issues and Challenges: A Review

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ABSTRACT

Sustainable agriculture is the key to keep up the level of production in the future. The state's agriculture has reached the highest production levels possible under the available technologies, it is still insufficient to feed the over increasing population. Sustainability in agricultural production and the natural resource base is under threat, as warnings have been sounded on over exploitation of land and water resources and degradation of land and environment ecology. This paper is highlighted to find out the strategies for sustainable agricultural development to fulfil the need of upcoming population. It is observed that agricultural growth in Assam is not cheering as compared to other states of the country. The study is based on secondary data collected from various issues published by Directorate of Economics and Statistics, Government of India, Agricultural Census of India and Directorate of Economics and Statistics, Government of Assam. Simple statistical tools like tabular analysis, percentages, averages and ratios were used to interpret data. There is an urgent need to diversify agriculture in Assam, emphasising integrated farm practices, implementation of sustainable practices, organic farming, green manuring, crop rotation and eco-friendly techniques *etc.* Only policy framework cannot fulfil a greater goal, but it is important to point out that reaching towards the goal of sustainable agricultural development is the responsibility of all participants in the system including farmers, labourers, policy makers, researchers, retailers and consumers.

Key words: Agricultural growth, Ecology, Policy, Sustainability.

Increasing human dominance of global ecosystem, subsequent environmental and social challenges lead towards the concept of sustainable development. Sustainable agriculture is the key to keep up the level of production in the future (Rao, 2002). Reduction in use of inorganic chemical inputs, biological pest control, use of organic manures, soil and water conservation practices, crop rotations, biological nitrogen fixation *etc.* are all relevant and important technological components of sustainable agricultural growth.

Agriculture depends on natural environment like land, air, flora, fauna, water *etc.* but destruction of natural resources and environment introduces the limiting factors for agricultural production. It is important to harvest crops without decreasing yield over time so as to feed the growing population. Therefore sustainable agricultural production is the utmost priority. The destruction of forest cover in adjoining hills of Assam resulted in silting up of water bodies and water courses. As a result, the inundation and flash flood is causing huge loss of crop production together with destruction and damage of infrastructure and human habitation. Occurrence of draught is also a regular phenomenon due to degradation of natural ecosystem and irregular breaks in rainfall. The extent of loss of crop production due to draught cannot be underestimated and leaves an impact on the economy of the farming community. On the context of the above problems this paper is highlighted to find out the strategies for sustainable agricultural development to fulfil the need of upcoming population.

Agriculture plays a vital role in the economy of Assam. It is one of the agrarian states in India with a total cultivable land of 36.94 lakh hectares. Although Assam is a monsoon based agrarian state, the gross irrigated area is 4.94 lakh hectares which accounts for 13.37 per cent of total cultivable land in 2018-19. The government of Assam assigned very high priority to agriculture which was depicted through a quantum jump in rice production to 5.14 million tonnes in 2018-19 from 3.31 million tonnes in 1993-94 (Assam Vision 2025). It depicts a clear picture of increase in rice production by around 64.4 per cent in last 25 years. High population pressure on land, besides damaging the environment has changed land use pattern from agricultural to non-agricultural use resulting in shrinkage of cultivable land. During the next 25 years, the projected population increase is about 178 lakh, which is more than half of the present population of Assam. The gradual settlement of this additional population will take away about 2 lakh hectares from the existing cultivated area for habitation in the next quarter century.

The cropping intensity of Assam is currently 148.6 per cent as against 145.7 per cent in the country and consumption

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of fertilizer (NPK) is 72.68 kg per hectare (Directorate of Economics and Statistics, Govt. of Assam, 2020). Although agriculture is mechanized in Assam, however the present agricultural system has become unsustainable and non-profitable. The state's agriculture has reached the highest production levels possible under the available technologies, it is still insufficient to feed the over increasing population. Sustainability in agricultural production and the natural resource base is under threat, as warnings have been sounded on over exploitation of land and water resources and degradation of land and environment ecology. The technology base green revolution is also not so much effective in Assam's agriculture. Over intensification of agriculture has led to water depletion, reduced soil fertility along with micro nutrient deficiency, non-judicious use of farm chemicals, problems of pesticide residue, soil erosion *etc*. leads to sustainable agricultural growth.

The objective of the study was to examine agricultural sustainability in Assam regarding land utilization, water, crop production, fertilizer consumption *etc*. and the policy issues.

The study is based on secondary data collected from various issues published by Directorate of Economics and Statistics, Government of India, Agricultural Census of India and Directorate of Economics and Statistics, Government of Assam. Simple statistical tools like tabular analysis, percentages, averages and ratios were used to interpret data.

Land utilization pattern

Land use pattern provides information on various aspects of land utilization in Assam. Land in the state is mainly shared by two major components, agriculture (51.57%) and forests (23.62%), besides build up areas, hills and water bodies, wastelands *etc.* The results from the Table 1 reveals that out of the total geographical area of 7843.8 thousand hectares, the net sown area increased from 2601.9 thousand hectares in 1970-71 to 2811 thousand hectares in 2010-11 which was increased by 8.07 per cent in 40 years. It is again decreased to 2723.5 hectares in 2018-19. Accordingly the total cropped area has increased gradually from 3006.2 thousand hectares in 2070-71 to 4160 thousand in 2010-11. After that a slight decrease in total cropped area to 4004.5 hectare in 2018-19. The reason behind is that more and more area under plough. The barren and uncultivable land has shown a sudden increase by 28 per cent from 1970-71 to 1980-81. After that it is decreasing gradually till 2010-11. But it is noticed increasing in 2018-19. The area under uncultivated land excluding fallow land is shown quite fluctuating. The reason behind is that every year a massive amount of area are submerged under flood resulting in increase of uncultivated land. Since, there is a scope for increase in agricultural production through horizontal expansion.

Cropping intensity

With the gradual adoption of input intensive agriculture by the farmers, the cropping intensity increased manifold in the last four decades. Although the state farmers has faces a huge losses due to flood every year, the cropping intensity has increased from 115.5 per cent in 1970-71 to 123.7 per cent in 1980-81 and a further 147 in 2018-19. According to Ministry of Agriculture, Government of India, Punjab and Tripura has the highest cropping intensity of 190 per cent each followed by West Bengal (188 per cent) in 2015-16 while Assam's cropping intensity was 146 during that period which was far behind in comparison to above mentioned states.

Distribution of operational holding

Agricultural economy depends much on the land holding as well as land use pattern because the economic efficiency of the farming community depends much on the size of land holding. The distribution of operational holdings by size groups of Assam is shown in the Table 2, reported by Agricultural of India in different point of time. The table shows that the highest number of farmers in Assam is belong to marginal and small category. In 1970-71, the percentage of operational holdings to total number of holding was 57 per cent with an average size of holding was 0.45 hectare which was increased to 68 per cent in 2015-16 with a fall of average size of land holding to 0.42 hectare. The reason behind the fall of average size of land holding is due to two principal factors- ever increasing population of Assam causing breaking down of land parcels to distribute among heirs and government land reform measures which set the ceiling for land holding per family is 50 bigha at present *i.e.* around 6.66 hectare thereby promoting and facilitating land fragmentation. In all other farm size groups, the percentage of operational holdings to total number of holdings found to have marginal differences.

Table 1: Changes in land utilization pattern in Assam (000' in ha).

Particulars	1970-71	1980-81	1990-91	2000-01	2010-11	2018-19
Total geographical area	7843.8	7843.8	7843.8	7843.8	7843.8	7843.8
Net sown area	2601.9	2712.0	2705.7	2793.2	2811.0	2723.5
Total cropped area	3006.20	3356.0	3807.0	4091.7	4160.0	4004.5
Cropping intensity*	115.5	123.7	140.7	146.5	147.9	147.0
Barren or uncultivable land	1379	1770	1540	1452	1408	1214
Total fallow land	67.9	73.0	172.1	146.8	128	199.9
Uncultivated land excluding fallow land	60.1	115.0	534.7	444.9	1211	553.6

Source: Author's calculation from data obtained from the official website of Directorate of Economics and Statistics, Govt. of India.
*Cropping intensity is in percentage to gross cropped area by net cropped area expressed in percentage.

Changes in cropping pattern

Cropping pattern refers to the proportionate area under different crops during a year. In Assam crops are grown mainly in *Kharif* (July to October) and *Rabi* (October to March) seasons (Singh, 2021). The area under various crops as a percentage share to the state's total cropped area is shown in Table 3. In Assam cereal crops dominate the entire cropping pattern (Moromi Gogoi, 2011). Rice is the major crop grown in Assam which occupies around 65.67 per cent of total cropped area in 1970-71 which was increased to 66.42 per cent in 1980-81. After that it is observed that although the gross cropped area has increased from 3006 million hectare in 1970-71 to 4004.4 million hectare in 2018-19 by around 33 per cent, the percentage share of rice area to total cropped area has decreased to 60.56 per cent in 2018-19 with a decreasing rate of around 5 per cent. In Assam winter rice is mainly grown with the onset of monsoon. Flood is also a major natural calamity during that period which causes reduction in percentage share of area under rice to the total cropped area although the gross cropped area has increased. Among seven principal crops grown in Assam, rape and mustard occupies second position next to rice with an area share of 4.57 per cent in 1970-71 and it is increased up to7.14 per cent in 2018-19. The percentage share of area under rape and mustard was highest during 1990-91 with a notable amount of 7.75 per cent.

Assam also has a potentially productive belt of jute covering a sizable part of its cultivated area as depicted in the Table 4. The percentage share of jute area was 4.26 per cent in 1970-71. But it is observed declining to 1.64 per cent in recent years, which is not a good sign. The jute belt suffered a decline in productivity due to pest attack and flood. The lack of knowledge on scientific cultivation and government's main emphasis towards growing food grain crops, led to compulsion of areas for commercial crops. The other crops grown are wheat, maize, sugarcane, pulses, potato and other oilseeds. Potato is the major vegetable crops grown extensively in Assam, has shown a noticeable increase in area from 0.81 per cent in 1970-71 to 2.58 per cent in 2018-19. There is a scope to increase production by pulling more and more area under potato cultivation with improved techniques to grow potatoes commercially.

During 90's, the sugar mills in Assam were stopped working as a result the area under sugarcane cultivation had decreased from 1.43 per cent in 1980-81 to 0.78 per cent to 2018-19 .

The biggest achievement of the green revolution era was the attainment of self-sufficiency in food grains. The green revolution also had an impact on the agricultural input industry, resulting in a rapid growth in the fertilizer, seed and farm machinery industries (Arora, 2013). However the green revolution was not so much effective in Assam; the state farmers followed their traditional cropping practices and the technological knowledge was lagging far behind. This resulted in low productivity of crops in Assam. However it is observed from the Table 4 that the yield of rice has

Table 2: Distribution of average size of operational holdings and percentage to total number of holding in Assam by different size groups (area in ha).

Categery of holding	1970-71		1980-81		1990-91		2000-01		2010-11		2015-16	
	Avg. size of holding (ha)	P.C. to total no. of holding	Avg. size of holding (ha)	P.C.to total no. of holding	Avg. size of holding (ha)	P.C. to total no. of holding	Avg. size of holding (ha)	P.C. to total no. of holding	Avg. size of holding (ha)	P.C. to total no. of holding	Avg. size of holding (ha)	P.C. to total no. of holding
Marginal (0-1)	0.45	57.03	0.42	59.3	0.39	60.28	0.39	62.65	0.40	67.7	0.42	68
Small (1-2)	1.41	23.76	1.43	22.7	1.40	22.19	1.30	20.69	1.46	17.78	1.40	18
Semi-medium (2-4)	2.74	14.03	2.73	13.66	2.67	13.58	2.73	12.96	2.83	11.22	2.73	10.71
Medium (4-10)	5.54	4.78	5.29	4.00	5.17	3.75	5.22	3.52	6.54	3.13	5.17	2.89
Large (above 10)	57.31	0.38	73.66	0.26	80.8	0.20	53.02	0.18	51.37	0.15	72.7	0.13

Source: Author's calculation from data obtained from the official website of agricultural census of India.

Table 3: Area under principal crops as percentage share to the total cropped area of Assam.

Crop	1970-71	1980-81	1990-91	2000-01	2010-11	2018-19
Rice	65.67	66.42	66.37	64.67	61.79	60.56
Wheat	0.67	2.73	2.21	1.69	1.08	0.42
Jute	4.26	3.14	2.51	1.70	1.50	1.64
Sugarcane	1.07	1.43	0.94	0.65	0.71	0.78
Rape and mustard	4.57	5.57	7.75	6.71	5.86	7.14
Arhar	0.14	0.19	0.19	0.18	0.17	0.14
Potato	0.81	1.11	1.55	1.97	2.04	2.58
Gross cropped area ('000 ha)	3006.2	3356.0	3807.0	4091.6	4160.0	4004.4

Source: Author's calculation from data obtained from the report published by Directorate of Economics and Statistics, Govt. of Assam.

increased from 1022 kg per hectare in 1970-71 to 2240 kg per hectare in 2018-19, but it is still very low in comparison to other rice growing states and national average. From the Table 4 it is found that all other crops shown an increasing trend in case of yield except maize, jute and sugarcane.

Expansion of area under high yielding varieties (HYV's)

In Assam, the high yielding varieties are mostly grown for rice crop. The total area under HYV of autumn rice, summer rice and winter rice is estimated at about 18.63 lakh hectares during 2016-17. From Table 5 it is evident that the area coverage under HYV rice during 2001-02 was 14.29 lakh hectares. However the area under autumn rice has decreased from 2.50 lakh hectares to 1.07 hectares in 2016-17, but the area under winter rice had increased from 9.2 lakh hectare to 14.09 hectare from 2001-02 to 2016-17 led to overall increase in the area under HYV rice of Assam. In Assam winter rice is the main rice crop, therefore the emphasis is given to increase the area under winter rice. Although the increasing area under summer rice from 2.59 lakh hectare in 2001-02 to 3.47 lakh hectare in 2016-17 has led to increase HYV rice area in Assam.

Issues and challenges for sustainable agricultural growth in Assam

One of the most pressing problems has been the sustainability of the pattern of agricultural development adopted in Assam and the country as a whole. The poor performance of agricultural sector not only has repercussions for food security but also has adverse socio economic effects on agriculture dependent people of Assam. The key challenges for sustainable agricultural growth are:

Productivity growth lags behind other states in the country

Agricultural production growth in Assam has been lagging far behind that of other states such as Punjab, Haryana, Andhra Pradesh, West Bengal *etc*. While crop productivity has increased over decades, it is still far behind other states. Average yields of most key crops in Assam are still low compared to major producers and gap remains stagnant.

Fragmented land use patterns persist

What marks Assam out from other major crop producing states in the country at a similar level of development is the continuing fragmentation of operational holdings, whose average size is around 1.7 hectare and still falling due to over increasing population. The sector is dominated by a large number of marginal and small farmers; around 86 per cent of operational holdings in Assam are of less than 2 hectares at present. In turn only 3 per cent of farmers operate on holdings larger 4 hectares (Department of Agriculture, Cooperation and Farmers Welfare, 2015-16).

Frequent flood during main crop season

Floods and dry spells are the principal natural disasters faced by farmers in Assam every year. The main sources of flood are the river Brahmaputra and its tributaries. The rapid occurrence of flood increases salutation of the soil through water logging which is a responsible factor for soil degradation and is a threat to sustainable agriculture.

Rapid increase in population growth and food and nutrition insecurity

with the rapid increase of population and to meet the growing demand for food, more and more fertilizers and pesticides are applied in agricultural fields. This is a threat to sustainable agriculture.

Pressure on natural resources risk reducing long-term production growth

land degradation is increasingly prevalent throughout the country as well as in Assam. Across many regions, inappropriate application of fertilizers- in terms of timing, quantity and place, the balance of N, P, K use does not reflect actual soil and crop nutrient needs. Chemical fertilizers contribute to greenhouse gas emissions as well as to water pollution and soil contamination when used properly.

Strategies and policy issues

Increasing agricultural productivity maintaining agricultural sustainability is a great challenge not only for Assam, but also for the country as a whole. It is necessary that Assam records its rightful potential position in agriculture sector in any interstate comparison. If serious efforts are made to

Table 4: The yield of principal crops in Assam (kg/ha).

Crop	1970-71	1980-81	1990-91	2000-01	2010-11	2018-19
Rice	1022	1120	1313	1568	1982	2240
Wheat	583	1158	1248	1219	1256	1400
Maize	7110	7150	6860	7070	7140	3250
Jute (bales/ha)	1305	1455	1632	1730	1808	1158
Sugarcane	37217	35800	42510	36898	36196	35060
Rape and mustard	410	485	535	515	585	640
Arhar	711	715	686	707	714	830
Potato	4524	5888	7240	8254	7735	7490

Source: Author's calculation from data obtained from the report published by Directorate of Economics and Statistics, Govt. of Assam.

Table 5: Area under HYVs of rice in Assam (in lakh hect.).

Year	Autumn rice	Winter rice	Summer rice	Total HYV rice area
2001-02	2.50	9.20	2.59	14.29
2005-06	2.35	9.05	2.66	14.11
2010-11	2.13	11.34	3.54	17.01
2016-17	1.07	14.09	3.47	18.63

Source: Statistical Handbook of Assam 2017-18, Directorate of Economics and Statistics, Govt. of Assam.

adopt effective and adequate strategies some remunerative alternatives, the goal can be achieved to a large extent. Above all, it is the earnest desire of the farmers of the state that they require policy changes which was framed in the year 2010 (Draft Policy of Agriculture, 2010). In India, states have constitutional responsibility for many aspects of agriculture, but the central government plays an important role by developing national approaches to policy and providing the necessary funds for implementation at the state level (Sharma, 2015). Here are some policy issues that government and agricultural department need to give priority.

Resolving land issues to support productivity growth

Bringing more and more cultivable waste land under cultivation and thereby increasing the crop area. Encouraging the farmers to follow the best suitable multiple cropping pattern, to increase the productivity. Fallow lands are needed to be brought under cultivation in its best possible way. The transaction of farm lands is to be made more transparent for protecting interest of farmers.

Soil management strategy

Giving more emphasis on organic farming and reduction in use of chemical inputs to improve soil fertility. Encouraging farmers to rotate crop with green manuring crop, use of compost, IPM and IFM practices, use of slow release fertilizers like neem coated urea to attain fertilizer use efficiency *etc.*

Water management strategy

The focus should be given on growing crops under irrigated condition using ground water and strengthening the irrigation to utilise river water to grow crops.

Encouraging efficient and sustainable use of variable inputs such as fertilizers

Government intervene by providing subsidies to lower input prices in agriculture, across a broad range of inputs from fertilizers, water, seed and credits. In some points it is observed that they are not very effective in raising farmer's income due to leakages and can contribute to environmental damage. Subsidies may leads to excessive use of inputs and thereby causing environmental degradation.

Agriculture enabling environment

Increasing agricultural productivity and scaling up to the participation of farmers in value chains requires good governance through laws and regulations that are conducive to private sector economic activity, while addressing market failures, strong and effective institutions through which policies can be operationalized, as well as an adequate provision of public goods across all economic sectors (Nadkarni, 1993). Technological options promoting conservation and efficient use of natural resources and institutional reforms to improve incentives for adoption of environment friendly farm practices can contribute to sustainable production systems.

CONCLUSION

It is quite obvious from the above observations that agricultural growth in Assam is not cheering as compared to other states of the country. Though green revolution has created the agricultural growth at higher level but it created inequality across various geographical regions and across different size of land holdings and social groups (Bedamatta, 2010). The agricultural sector is exposed to existing stresses such as the widening gap between water supply and demand, land degradation *etc.* Climate change makes the system more vulnerable because large share of agriculture land is under rain fed condition, which depends fully on monsoon pattern and small and marginal farmers have a lower capacity to cope with climate change, which impacts on agricultural productivity. There is an urgent need to diversify agriculture in Assam, emphasising integrated farm practices, implementation of sustainable practices, organic farming, green manuring, crop rotation and eco-friendly techniques *etc.* there must be a changes in cropping pattern to include fruits, vegetables, oilseeds and also some commercial crops such as cotton, jute and Mesta, animal husbandry, fishery *etc.* Besides these there has to be adequate harvesting, post harvesting handling, processing, quality control, storage and assured marketing facility. Only policy framework cannot fulfil a greater goal, but it is important to point out that reaching towards the goal of sustainable agricultural development is the responsibility of all participants in the system including farmers, labourers, policy makers, researchers, retailers and consumers.

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