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Indigenous Agricultural Knowledge: The Key Way Of Sustaining Environmental Health

Taibor Rahman Khan
Assistant Professor
Department of History
F.A. Ahmed College, Garoimari

Abstract:

Agriculture is the oldest and largest means of livelihood of mankind. It is the parent source of food supply of all living beings. The nomadic people extracted food in natural ways by fruits gathering and hunting roaming from one place to another place. Germination of thrown seeds gave the ideation of planting that conceived the knowledge of agriculture. The natural practice of agriculture continued dates long, but alarming growth of population changes the situation.

Modernization of agriculture has been the one and only way of raising agricultural productivity that has made people chemical and mechanical loving. Extensive cultivation is no longer remaining alternative means for raising agricultural production. Excessive use of chemical fertilizer and pesticides has risen the health hazard of human being. Presently, there has been wider discussion on the negative impact of such intensive way of cultivation. There has been the feeling of embracing organic cultivation among the health sensitive people. Of course, such number is meagre. In true sense, indigenous agricultural knowledge is an important national human capital to improve crop productivity and enhance sustainable agricultural development.

Fostering and documentation of indigenous agricultural knowledge can promote the wider use of organic crop production methods and sustain environmental health. Present study is an attempt of picturing the need of IAK at present situation. The study will be conducted through using both primary and secondary sources of information.

Keywords: Agriculture, food, IAK, modernization in agriculture, sustainable agriculture and environment etc.

1. Introduction:

Agriculture is the mainstay of Indian economy. More than half of the population of the country is directly or indirectly dependent on this particular sector. It is the biggest sector contributing national economy as well as absorbing employment. Burgeoning growth of population has made India the world most populus country, sheltering about 1.4 billion (projected) population at present. With the continuous increase of population, average size of operational holding has been declining at a stretch resulting farm

marginalization. Therefore, absorbing and feeding such mammoth population has been one of the biggest challenges for the agriculturee sector. Agriculture and population are two sides of the same coin that should go hand in hand solution.

Intensive cultivation is the only method for meeting such rising demand for food production. Modernization in agriculture through farm mechanization, use of chemical fertilizer, pesticides, HYV, irrigation etc. are the means of raising agricultural production and productivity. Practice of such modern means in agriculture since the introduction of **Green Revolution** period (1966) is a matter of concern in the sense of health and environmental issues on the following points;

a) Are the farmers practising agriculture scientifically?
b) Whether they are using chemical fertilizer & pesticides in accordance with their own wish or as per the advice of shopkeeper or as per the suggestion of agriculture Officer?

A long-term use of excessive chemical fertilizer, pesticides and irrigation may be harmful or deteriorating for the well-being on the following ways; *firstly*, it may deplete the soil quality which may turn the soil into barren in the long run. *Secondly*, the extraction of agro-product due to use of excessive chemical may be health hazardous. *Thirdly*, dripping too much water might push the ground water level down creating water scarcity in the long run. Therefore, use of such ttechnology in an unscientific way may deteriorate the health of environment which is unsafe to well-being harnessing threat to sustainable development.

In this regard, knowing status of **Agricultural Literacy** is very important. The term agricultural literacy is meant *'Agricultural literacy entails knowledge and understanding of agriculturally related scientific and technologically-based concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity.'* What percentage of farmers are having agricultural literacy is a matter of concern.

As per NSS Report No. 537, there were 29.45% illiterate people, while 30.5% & 13.95% people were found achieving Primary and Middle level of education. In most of the cases, farmers are found to be either illiterate or nominally literate. Therefore, possibility of practising farming in a scientific way is ambiguous. When fertilizer and pesticides are used in advice of shopkeeper, there would be possibility of it's excessive use because shopkeeper himself may be illiterate on the one hand, he may sell his product with profit motive on the other hand. At the end part of the cropping season, shopkeeper may encourage farmers to buy more chemical fertilizer and pesticides even at a lower price to empty his stock during lean season.

Therefore, knowing about agricultural literacy is very important for an agro-dependent country like India. In order to get rid of agriculture practise in such unsafe way, precaution should be taken with an immediate effect. A much social awareness among the farming communities, consumers, policy makers etc. is urgently needed. There should organize mass awareness programme among agriculturists, consumers and other related stakeholders on the proposed topic. Rederivation and application of **'Indian Knowledge System'** may be encouraged for a long-term solution of such alarming burning question. ***'Any negligence on such a serious issue may cause to bear the cost for the country'***. Therefore, an open

discussion on the proposed issue is need of hour. The policy maker should take the issue seriously and initiate systematic and schematic project.

Hence, application of Indian Knowledge System (IKS) in agriculture sector may be effective in this regard. IKS can be a key factor in designing sustainable agricultural systems, and can help rural populations in protecting health, environment and sustainable development. Preparing strategies for practices of organic farming, vermicomposting agriculture, use of indigenous land resource conservation and management, iindigenous water conservation etc. might have positive impact in the society.

2. Objectives:

a) To unearth various ways of Indigenous agricultural methods that can be retrieved in Indian agriculture.

b) To find out how the modern agricultural methods are havocking our own methods of agriculture.

3. Research Methodology:

Present study basically depends on both primary and secondary data. Primary data was gathered from direct personal investigation while the secondary data were collected from the various sources like books, journal, government reports and other sources. The data are analyzed and interpreted to reach the objective of the study. In the second stage, 40 per cent of the char blocks i.e., 2 char blocks each from Kamrup and Barpeta districts and 1 block from Jorhat district were selected. Goroimari and Chomoria Blocks were selected from Kamrup district, Chenga and Rupshi Blocks from Barpeta district and Majuli Block from Jorhat district. Rupshi is the only block located in *Beki* River[1]. While, rest of the selected blocks belong to the river Brahmaputra. Some blocks have a greater number of char revenue villages and some of those villages have larger number of households and vice-versa. Hence in the third stage, a sampling strategy was applied as shown in Table 1.1. The blocks having more char villages, less percentage of those villages were selected and vice-versa. The sample households were selected in the same way.

TABLE 1.1

Sampling Strategic Table

Nos. Char-chapori Villages of the Blocks	*% of Selected Villages*	*Size of Household in the Selected Villages*	*% of Selected Households*
Having < 15 Villages	25	Having < 100 HHs	20
Between 16 to 100 Villages	15	Between 101 to 300 HHs	15
> 100 Villages	5	> 300 HHs	7

[1] *Beki* River is one of the right bank tributaries of the river Brahmaputra. It is also known as Mara Manas River.

Note: HHs implies 'Households'

For the selection of sample villages, 25 per cent of the villages were selected from those blocks having less than 15 villages, 15 per cent of villages from those having 16 to 100 villages and 5 per cent from those having more than 100 villages. For the selection of sample households, 20 per cent households were selected from those villages having less than 100 households, 15 per cent households were selected from those villages having 101 to 300 households and 7 per cent households were selected from those villages having more than 300 households. The process of selection of sample blocks, sample villages and sample households are shown in Table 1.2

TABLE 1.2

Selected Districts, Sample Blocks, Sample Villages and Sample Households

Districts	*Blocks*				*Villages*			*HHs of Sample Villages*	
	Total	*Char*	*Selected (40%)*	*Selected Blocks*	*Total*	*Char*	*Selected*	*Total*	*Selected*
Kamrup	15	5	2	Goroimari	70	30	4	424	90
				Chomoria	88	11	3	683	70
Barpeta	12	5	2	Rupshi	68	18	3	805	70
				Chenga	58	29	4	610	92
Jorhat	8	2	1	Majuli	110	110	6	894	140
Total:	35	12	5		404	289	20	3416	462

There were 404 numbers of char revenue villages in the selected blocks of which 289 villages belonged to the char blocks. Total numbers of selected villages were 20 of which 4 villages each were selected from Goroimari and Chenga Blocks, 3 villages each were selected from Rupshi and Chomoria Blocks and 6 villages were selected from Majuli Block. There were 3416 households in the selected villages of which 462 households were selected as the sample households. The sample households were distributed as- 90 households from Goroimari Block, 70 households each from Chomoria as well as Rupshi Block and 140 households from Majuli Block.

4. Analysis and Interpretation:

It is needless to say that there are infinite problems arising due to the faster population growth in India. Increasing population leads to fragmentation in existing holding, increase in demand for homestead land that consequences decline in average size of operational holding that has been creating scarcity of cultivable land that further creating land as well as food scarcity. Therefore, ppeople are compel to raise their agricultural productivity compromising ideal norms of cultivation. Checking such unexpected vulnerability is the need of hour at present situation. Having a permanent solution of the nationwide problem should be the paramount attention of researchers, academicians as well as policymakers.

Agriculture is the oldest and largest means of livelihood of mankind. It is the parent source of food supply of all living beings. The nomadic people extracted food in natural ways by fruits gathering and hunting roaming from one place to another place. During that period, there was no difference in livelihood pattern human being and animals. People didn't have permanent settlement who used to stay on top of trees, inside of caves or in any other secure place to get rid of attack of

wild animals. When people stayed in a particular place for few days, germination of thrown seeds gave the ideation of planting that conceived the knowledge of agriculture. Since then, idea of permanent settlement as well as human civilization was started. People had the natural way of life. Nature was the main factor to look after them in case of health and other issues. The natural practice of agriculture continued dates long, but alarming growth of population changes the situation. There was enough scope of raising total production through bringing more area under cultivation. The food production they extracted were fresh and free of chemicals.

Fostering and documentation of indigenous agricultural knowledge can promote the wider use of organic crop production methods and sustain environmental health. Present study is an attempt of picturing the need of IAK at present situation. The study will be conducted through using both primary and secondary sources of information.

- **Ploughing Process:** Ploughing using bullock/cows is one of the most important means of cultivation in Indian agriculture system. Wooden plough are/were used in ploughing soil that has a natural benefit of keeping a balanced biodiversity. Firstly, the wooden plough digs up to a certain level that doesn't harm general soil quality on the one hand and also it doesn't kill earthworms which is regarded as the friend of agriculture. But mechanization of agriculture has caused it damaged the advantage for the cultivators.
- **Rotation of Crop:** Rotation of crop and leaving land fallow improves soil nutrition quality. When a plot of land is used for a long period of time for agricultural purposes, it declines its natural nutrition level. If it is kept fallows and let grazing, it replenishes its fertility level. On the contrary, rotation of crop is very essential for replenishing its lost nutrition quality. Rotation of crop helps in restoring lost nutrients of the soil as first the crop plants use up all the nitrogen in the soil. To restore the nitrogen the farmers, plant a leguminous plant which contains bacteria which changes the atmospheric nitrogen in usable nitrogen compounds than being used up by the crop plants. Farm animals graze on the fallow land, adding organic matter to the soil.
- **Cow Urine:** Use of pesticides has been the common way of controlling pests and all. One of the traditional ways of controlling such pests is splashing cow urine to control fungi.
- **Manuring:** Using cow dung is the most convenient way of raising fertility quality of soil which was the one and only way for the cultivators. This is known as organic farming. Farmers prepared humus[2] for using in agriculture was found to be practiced by most of the farmers. Farmers use dried cow dung mixed with ashes to manure transplanted rice. They also burn cow dung cakes in nursery plots before tilling.
- **Raised bed Planting:** Farmers use raised beds for vegetables to reduce the wetted area compared to flat beds. It helps the plant to grow easily raising productivity. Some crops like potato, arum etc. are convenient to practice in such method.
- **Smoking:** Farmers smoke meat, fish, and vegetables to preserve them and add flavour.

[2] the organic component of soil, formed by the decomposition of dung, leaves and other plant material by soil microorganisms.

- **Traditional oil Extraction:** Farmers use bullocks to power wooden or stone oil presses to extract oil from oilseeds. This method is known as "Ghani" or "Ghani pressing". Especially horses are used to produce mustard oil in manual. These ways are going to be outdated day by day due to introduction of machinery.
- **Stone grinders:** Farmers use stone grinders to process grains, spices, and condiments.
- **Other indigenous agricultural practices**: Besides above-mentioned methods, some more indigenous agricultural practices include intercropping or multiple cropping, Terracing, Mixed cropping with legumes, and Agroforestry etc.

5. Modernization in Agriculture and Its Impacts:

When an agro-economy is flourished with the contribution of natural sciences like physics, engineering, chemistry and biology then it is supposed to advance in the field of agricultural technology. Agricultural technology replaces traditional means of cultivation with modern inputs. Agricultural economy may technologically advance in two different ways[3] viz,

(1) Bio-chemical Technology (BT) and

(2) Mechanical Technology (MT)

Bio-chemical technology provides the contribution of chemistry and biology that enriches agriculture in supplying the inputs like High Yielding Verities (HYV), chemical fertiliser, pesticides, weedicides, herbicides etc. Use of chemical inputs in replenishing the lost fertility of the soil and protects plants from disease and pest. However, an agro-economy is supposed to be advanced in mechanical technology when it enriches the agriculture sector in terms of modern equipment like tractor, power tiller, harvester, thresher etc. due to the contribution of physics and engineering.[4] Modernisation in agriculture is the outcome of hand-to-hand development of bio-chemical and mechanical technology that promises for a positive change of agriculture sector.

5.1 Practice of HYV

Introduction of HYV gives a new way to accelerate the growth of agriculture sector of the world. HYV programmes have brought a revolution in the field of agriculture with the introduction of improved and guaranteed quality of seed whose yield is substantially higher than the normal seeds. The HYV possesses certain distinctive attributes like[5] *firstly*, it is capable of turning large quantity of soil nutrient into crops rather than leaf growth, secondly, its maturing period is much shorter than the normal seed and finally, their maturation is independent of the length of exposure to daylight. Due to faster growth of population in the country, the demand for food production has increased at a greater extent and consequence to it, necessity for HYV has also increased manifold.

[3] Shigemochi, H. (1978): *The structure of disparity in Developing Agriculture*, The Institute of Developing Economics, Tokyo, p. 5.

[4] Venkateswara, A. (1998): *Developing Agricultural Technology*, Rawat Publications, New Delhi, pp. 13-14.

[5] *ibid.*, p. 16.

5.2 Consumption of Fertilizers

When a piece of land is used for crop production over a long period of time, it may loss its stock nutrients. Decay of nutrients in soil outcomes low agricultural productivity that impedes in the development of agriculture sector. Application of fertilizers may be a compensatory measure for reviving the lost nutrient required in growing plants. Fertiliser has been the key input in recent technological advancement in the field of agriculture that enables to usher in a revolutionary augment in the level of agricultural productivity. [6] [7] It produces the secondary nutrients like sulphates, nitrates, calcium and phosphates for the plants as these compounds are not abundant naturally in the soil. Besides, success of HYV largely depends on the way of consumption of fertilizer.[8] Fertilizer empowers soil to reinforce in augmenting agricultural production with higher yield rate. The maximum additional yield on account of consumption of fertilizers has been estimated to be 25 per cent to 35 per cent even more in case of irrigated crops.[9]

In India, the average consumption of fertilizer in 2023-24 was 139.8 kilograms per hectare. In terms of fertilizer consumption, India occupies 2nd position in the world and 1st position in SAARC countries.

Fertilizers are basically of two types viz, organic fertilizers and inorganic fertilizers. On the one hand, application of chemical fertilizers may be more effective for the cultivators because of its available supply in the market and on the other hand, it can yield higher amount of production and productivity with some certainty. Use of organic fertilizer among the cultivator has become less popular because of gradual farm mechanization. Majority of cultivators have become reluctant to use animals in their tillage of cultivable land that make crisis of raw materials for preparing organic manures. People at present have become dearer to the consumption of chemical fertilizer that helps the state to be self-reliant in food supply.

5.2.1 Mode of Chemical Fertilizers & Pesticides Used

Reduction of depletion of soil nutrient and maintenance of soil health has become the major challenge in the state of Assam.[10] This can be done by minimizing the use of external inputs and by regenerating internal resources more effectively or by combinations of both. The use of external inputs may be less harmful only if it is rationally used. Scientific use of chemical fertilizer as well as pesticides is very difficult because majority of the farmers in char areas are illiterate. If anybody is using less fertilizer, it is due to the shortage of fund but not thinking about its harmful effect. The misuse and overuse of pesticides and the hazards they pose to human health and ecological balance have been a matter of increased public

[6] FAI (1974): *A Study on Fertiliser Demand and Marketing (Fertiliser distribution and marketing facilities)*, vol. 1, State Report, Part X- West-Bengal, The Fertiliser Association of India, New Delhi, p. 9.

[7] Shivay, P. S. (2013): "Efficient Use of Fertilisers can increase Agricultural Production", *Kurukshetra*, A Journal on Rural Development, vol. 61, no. 8, Increasing Agricultural Productivity, June, New Delhi, pp. 9-16.

[8] Khan, Shafique (1989): *Agricultural Modernisation in India*, Anmol Publications, New Delhi, p. 34.

[9] Government of India (1967): *Handbook of Indian Agriculture*, Indian Council of Agricultural Research, New Delhi, p. 82.

[10] Government of Assam (2009): *Economic Survey Assam*, Directorate of Economics and Statistics Assam, Guwahati, p. 31.

concern at the present-day situation.[11] Table 6.5 shows the number of cultivators using chemical fertilizer as well as pesticides among the sample households.

Percentage of cultivators using chemical fertilizer as well as pesticides were 62.60 & 56.23 in the sample blocks. Chomoria was the leading block where 97.96 per cent and 85.71 per cent of the sample cultivators used chemical fertilizers and pesticides. Corresponding figures in Goroimari Block were 96.97 per cent and 84.85 per cent respectively. Least number of cultivators (5.83 per cent) in Majuli Block is found to go for the consumption of fertilizers as well as pesticides in their farming. The cultivators of Majuli Block were found reluctant to use chemical fertilizer in the cultivation of those crops which are produced for the purpose of domestic consumption. Some of them used chemical fertilizer in commercial crops only.

TABLE 5.1

Number of Cultivators using Chemical Fertilizers and Pesticides in the Sample Blocks

Name of Blocks	*Number of Cultivators Use*		*Total Cultivators*
	Chemical Fertilizer	*Pesticides*	
Goroimari	64 (96.97)	56 (84.85)	66 (100)
Chomoria	48 (97.96)	42 (85.71)	49 (100)
Chenga	66 (84.61)	59 (75.64)	78 (100)
Rupshi	41 (85.42)	39 (81.25)	48 (100)
Majuli	7 (5.83)	7 (5.83)	120 (100)
All Blocks:	226 (62.60)	203 (56.23)	361 (100)

Source: Compiled from Field Survey, 2011.

Note: Figures within parenthesis is the percentage of the total cultivators of respective blocks.

Table 5.2 shows the mode of using chemical fertilizer among the sample cultivators. The data was collected to find out the way of using chemical fertilizer by the char cultivators. Did they use it in accordance with their own wish, in the advice of shopkeeper or in the advice of agriculture officer? The reason behind such enquiry is to check how scientifically the char cultivators perform their agriculture

TABLE 5.2

Mode of use of Chemical Fertilizer in the Sample Blocks

Name of Blocks	*Mode of use of Chemical Fertilisers*			
	Own wish	*Advice of Shopkeeper*	*Advice of agri. Officer*	*Total*
Goroimari	47 (73.44)	17 (26.56)	-	64 (100)
Chomoria	32 (66.66)	11 (22.92)	5 (10.42)	48 (100)
Chenga	53 (80.30)	6 (9.09)	7 (10.61)	66 (100)
Rupshi	31 (75.61)	7 (17.07)	3 (7.32)	41 (100)
Majuli	4 (57.14)	2 (28.57)	1 (14.28)	7 (100)
All Blocks:	167 (73.89)	44 (19.47)	15 (6.64)	226 (100)

Source: Compiled from Field Survey, 2011.

The survey results imply that 73.89 per cent of the sample cultivators were found using chemical fertilizer in accordance with their own wishes. Percentages of cultivator using chemical fertilizer in the advice of shopkeeper and agriculture officer were 19.47 and 6.64 respectively. Highest percentage (80.30

[11] Maroodi, M. A. (2004): "Pesticides and Environment- A Perspective", M. A. Khan & M. Y. Zargar (eds.): *Agriculture and Environment,* APH Publishing Corporation, New Delhi, p. 125.

per cent) of cultivators in Chenga Block was found use chemical fertilizers according to their own wishes. Percentages of cultivator using chemical fertilizer according to the advice of shopkeeper and agriculture officer were 9.09 and 10.61 respectively. However, lowest percentage (57.14) of cultivators in Majuli Block is found using chemical fertilizer in accordance with their own wishes. The percentages of cultivator using chemical fertilizer in the advice of shopkeeper and agriculture officer were 28.57 and 14.28 respectively. The pattern of use of chemical fertilizers in Goroimari, Chomoria and Chenga Blocks are almost similar.

Since majority of (80.69 per cent) [12] of the cultivators in the char area are illiterate, uses of chemical fertilizers in accordance with their own wishes and according to the advice of shopkeeper is sure to be hazardous. Hazardous use of chemical fertilizer as well as pesticides is unscientific. It bears fear of soil depletion to harm in sustaining agriculture in the long run. On the other hand, when cultivators go for the use of chemical fertiliser and pesticides according to the advice of shopkeepers, there remains feasibility of excess use of it because a businessman generally aims at sales maximisation. During the end of agricultural season, shopkeeper plans to sell out his entire stocks and may mislead the cultivators for the

5.3 Organic Manures:

Traditional farming is the original type of agriculture which is being practiced since past. Organic fertilizers are natural types of fertilizer composed of organic matters like leaves, cow dung and parts of plants, sea weed, compost, peat moss and guano etc. and most commonly used manure in Indian agriculture.[13] It is the natural process of farming in which maximum reliance is given on self-regulating agro-ecosystem, locally or farm-derived renewable resources and the management of ecological and biological process and thus frees from any kind of side effect.[14] Organic farming is regarded as the best form of sustainable agriculture that preserves the environment and soil fertility without disturbing the rules of nature.[15] The main component of organic fertilizer is cow dung that can easily be prepared by farmers without incurring any additional cost and thus preferable for the cultivators. Application of OM homoeopathically works that avoids all types of side effect that may occur due to the consumption of agricultural commodities. Table 6.7 shows the number of cultivators use OM in agriculture in the sample blocks.

TABLE 5.3

Number of Cultivators using Organic Manures (OM) in the Sample Blocks

Name of Blocks	*Number of Cultivators*	
	Using OM	*Total*
Goroimari	2 (3.03)	66 (100)
Chomoria	3 (6.12)	49 (100)
Chenga	4 (5.13)	78 (100)
Rupshi	2 (4.17)	48 (100)
Majuli	22 (18.33)	120 (100)
All Blocks:	33 (9.14)	361 (100)

Source: Compiled from Field Survey, 2011.

[12] Government of Assam (2003): *op. cit.*, pp. 2-3.

[13] FAO (1975): *The Use of organic fertilizers in India by Ministry of Agriculture*, New Delhi; FAO Soils Bulletin, organic materials and fertilizers, Food and Agricultural Organisation of the United Nations, Rome, pp. 277-78.

[14] Pretty, J. (1998): *op. cit..*, p. 16.

[15] Government of Assam (2012): *Economic Survey Assam*, Directorate of Economics and Statistics, Planning and Development Department, Guwahati, p. 60.

About 33 out of 361 cultivators (9.14 per cent) in the sample blocks are found using organic manures in crop production. Numbers of cultivators using OM in Majuli Block were 22 out of 120 are about 18.33 per cent, which is higher than any other blocks. About 6.12 per cent of the sample cultivators in Chomoria Block are found using OM. Percentage of OM users in Goroimari Block was the lowest (3.03 per cent). Percentages of OM users in Chenga and Rupshi Blocks were 5.13 and 4.17 respectively.

Percentage of cultivators using OM is lower compared to chemical fertilizer in the sample blocks. The cultivators of Majuli Block are found conscious about the consumption of chemical fertilizers. Considerable number of cultivators in the corresponding block was reluctant to go for the use of chemical fertilizer in crop production. The cultivators among the fertilizer users are found preferred OM to chemical fertilizer. In the rest of the sample blocks, average consumption of chemical fertilizer is comparatively high and thus it is an important constraint for sustainable agriculture.

IMAGE 5.1

Cultivator applying Organic Manure in Majuli Block

IMAGE 5.2

Cultivator preparing Organic Manure in Majuli Block

5.4 Mechanization of Agriculture

Mechanization of agriculture is the appliance of machines and technology in the agriculture sector that substantially increases production and productivity per factor.[16] It means use of machines for the tillage of soil, harvesting and threshing of the farm produce, power lift for irrigation, truck for haulage of farm produce, processing machines, rice hauling etc.[17] Mechanisation of agriculture displaces traditionally used agricultural means and equipment which is labour saving, capital intensive and land augmenting. Broadly speaking, mechanisation of agriculture has two forms[18] viz,

i) Mobile Mechanisation (MM) and

ii) Statutory Mechanisation (SM*)

Mobile mechanisation (MM) is the attempt of replacing the animal power on which agriculture of the world has been basically depending.[19] Contrary to it, statutory mechanisation (SM) aims at reducing the drudgery of certain operations which have to perform either by human labour or by combined effort of human being and animals.[20]

In a mechanized agriculture, the use of machinery is greater as compared to the labour. Traditional agriculture is much dependent on the human physical labour as well as animal power. Wooden plough, spade, sickle, ladder etc. are the most convenient equipment used in such type of agriculture. Gone are the days when farmers meant a poor man labouring hard to meet his needs. Ladder now a days are not used to plain ploughed land, rather it is used to climb up to the world of technology. With the increasing influence of science and technology in agriculture, it has reduced physical labouring of people that has made possible to raise agricultural productivity per labour manifold. The use of modern tractor, for example, can plough in an hour is more than a labour can't do same job in 10 hours using a pair of bullock and wooden plough.[21] Agricultural productivity of a labour substantially depends on what type of implements he uses in his work among other consideration.[22] In fact, mechanisation of agriculture is regarded as the *sine-qua-non* to reduce the human drudgery and enhances agricultural productivity.[23] During the post-green revolution period, the impact of the farm mechanisation on agriculture sector has been well recognised where its production and productivity has increased in a considerable way.[24] Tractor

[16] Pampolone, S. (2011): "Farm Mechanization- a better solution for increasing Productivity", *Agriculture Today*, vol. XIV, no. 8, The National Agriculture Magazine, Farm Mechanization Indispensable Need of the hour, New Delhi, p. 21.

[17] Agarwal, G. D. (1948): "Economics of Mechanisation of Agriculture in India", *Indian Journal of Agricultural Economics*, vol. IV, no. 1, p. 91.

[18] Mamoria, C. B. (1953): *Agricultural Problems of India*, Kitab Mahal, Allahabad, p. 320.

[19] *ibid*., p. 320.

[20] *ibid*., p. 320.

[21] *ibid.*, p. 101.

[22] Choudhury, Rabindra Kr. (2000): *op. cit*., p. 101.

[23] Singha, Komol, S. Jaman and A. Chavali (2012): "Tractorisation and Agricultural Development in India", *Journal of Global Economy*, vol. 8, no. 4, October-December, p. 285.

[24] Verma, S. R. (2005): "Impact of Agricultural Mechanisation on Production, Productivity, Cropping Intensity, Income generation and Employment of Labour", Tyagi, K. H. Bhatia & S. Sharma (eds.): *Status of Farm Mechanisation in India*, Indian Agricultural Statistics Research Institute, New Delhi, pp. 133-153.

probably is the most crucial contributing component in raising agricultural production and productivity in the process of agricultural development in the country.

Mechanisation of agriculture in Assam is very poor. In the rural areas of Assam, power used in agriculture is yet derived from bullock cart and human labour. The farmers use primitive and simple agricultural implements like wooden plough and steel hoes in there cultivation.[25] During 2010-11, the availability of farm power per hectare in the state was only 0.90 HP as compared to 1.40 HP per hectare at national level.[26]

But in the rain-fed agriculture of Assam, a breakthrough cannot be achieved unless suitable machineries for a quick seed-bed preparation, watering, crop protection, and soil conservation is introduced.[27] The low availability of farm power per hectare of land has become one of the constraints to double or multiple cropping in the state. So mechanisation of agriculture has an overwhelming importance in bringing positive change in an agricultural economy.

6. Findings:

From the discussion, the following findings have been summed up

- Area under HYV practice in India shows an increasing trend due to rising demand of food production.
- In India, the average consumption of fertilizer in 2023-24 was 139.8 kilograms per hectare. In terms of fertilizer consumption, India occupies 2nd position in the world and 1st position in SAARC countries.
- About 60 per cent of the cultivators were found using chemical fertilizers and pesticides.
- About 74 per cent of the farmers were found to use the fertilizer in accordance with their own wish, about 20 per cent in accordance with the advice of shopkeeper and about 9 per cent were found to use fertilizer according to the advice of agriculture Officer.
- About 9 per cent of the farmers were found to go for the use of Organic Manure.
- Mechanisation of Agriculture is very backward in Assam. Majority of the farmers in the state operate their cultivation in an un-mechanised way. The availability of farm power per hectare in the state is quite lower than the national level.

6. Suggestion:

- We should encourage the indigenous methods in agriculture that will safe environment.
- Use of animals in agriculture will encourage Organic agriculture
- There should be wider progation of harm of excessive use of chemical fertilizer.
- Mass awareness among farmers is very important.
- The Department of Agriculture should take initiatives in optimum consumption of

[25] Goswami, P. C. (1994): *The Economic Development of Assam*, Kalyani Publishers, Ludhiana, p. 64.

[26] Government of Assam (2011): *op. cit.*, p. 63.

[27] Borbora, Saundarjya (1989): "Input uses in Assam's Agriculture", P. C. Goswami (ed.): *Agriculture in Assam*, Assam Institute of Development Studies, Guwahati, p. 151.

fertilizer. They should guide the farmers how and what quantity of fertilizer should be applied.

- ❖ Creating mass agricultural literacy is need of hour at present situation.

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