CHAPTER 3

SPREAD OF NEW AGRICULTURAL TECHNOLOGY IN ASSAM IN GENERAL AND BARPETA DISTRICT IN PARTICULAR

3.1 Technology in Conceptual Framework

Technology may be defined as systematic application of knowledge to the practical task of production. A particular state of technology is embodied in the manner in which factors of production or inputs are combined to produce output. Technological progress takes place with enhancement of human knowledge and utilization of the same in production process through research and practice. It manifests itself in increased efficiency of production process. Technology shifts production relation between inputs and outputs in such a way that either large output is obtained with given total input of resource or the same output in produced with a smaller amount of inputs.

According to Erdilek (1986), technology refers to a class of knowledge about a specific product or production process and includes the technical skills necessary to manufacture the products or to use the process. An interesting aspect of technology is its 'partial public goods status, when technology as knowledge is made available to another party, that knowledge usually remains available to the transmitting party. However, although one's use of it, the benefit derived from it are generally affected by the number of parties having access of it.

Lionel Goldring (1976) considered technology as any tool or technique, product or process, physical equipment or method of doing or knowledge necessary for the productive functioning of an enterprise. "A technology is designed for instrumental action that reduces uncertainty in the cause and effect relationships involved in achieving a desired outcome" (Thompson 1967).

Agricultural technology in theoretical perspective is a technology that renders farm sector more productive and shifts the production function between farm input and output may be called agricultural technology.

According to Grabowski, Siran and Tracy (1986) to there are two types of agricultural technology:

(i) **Mechanical:** Mechanical technology substitutes capital or labour. It does not generally increase land productivity and is characterized by significant economies of scale. It therefore, allows for greater possibilities for substituting land for labour (land using, labour saving).

(ii) **Biochemical:** Biochemical technology generally involves the development of new seed varieties which are highly responsive to increased application of fertilizer and labour and are yield increasing in nature. It allows for greater possibilities for substitution of labour for land (labour using, land saving).

To Grabowski (1987) mechanical technology involves the application of machinery to the production process i.e., tractors, threshers, irrigation pumps. Some part of it results in increased yields. However, for the most part it is thought that the type has little impact on yields. On the other hand, biochemical technology is generally yield increasing and is really a package of inputs : seeds, fertilizer and irrigation, water. He argued that these two types are independent of each other in terms of their application.

3.2 Nature of Technology

Technology may be either scale-neutral or scale-biased. A technology which brings about an equi-proportionate increase in the productivity of all factor inputs, is scale neutral and it does not change the proportions of factors in a production function. According to Rudra (1982) technology can be called 'scale-neutral' if the responses to the divisible inputs such as water, fertilizer, seed etc. are not found to depend on the size of plots. That technology is scale neutral if it can be effectively and efficiently used on small as well as large farms.

On the other hand, a technology is scale-biased when it changes the productivity of all the factors in different proportions. If a technology increases the productivity of capital more than labour, such a technology will be capital-using and labour-displacing, since the entrepreneurs will find it more profitable to use capital in substitution for labour. A scale-biased technology, therefore, brings about a change in factor proportions with important effects on the structure of output, employment and allocation of resources in the economy.

3.3 Adoption or Application of Technology

In the field of agriculture, adoption of technology means acquisition and adoption of new improved technique and innovations over traditional farming. The essential ingredients of such technique includes use of improved variety of seeds, fertilizers, assured irrigation water, pesticides and improved implements.

It is the adoption or application of technology that leads to technology change. According to Yotopoulos and Nugent (1976) technology is a stock concept and technological change implies changes in this stock. Since, technology can be summarized by an appropriately defined production function, technological changes are reflected in changes in production functions.

Joshi (1979) visualized three broad stages of technological change in agriculture:

(i) It involves rationalization of land use through the enterprise and initiative of farmers as a result of their release from rigidities of manorial system. Most of these changes were labour-intensive and therefore, drew up on labour surplus existing economy. The changes were prompted by the motive to achieve three goals : greater output, better qualities and reserving the crops from natural hazards. In this stage the achievement of these goals calls less for a mechanical revolution but for replacement of existing tools. At this stage, existing system was relatively 'self contained' not having the advantages of break-through in technology achieved outside the system.

(ii) This stage was distinguished by interlinkage of industry to agriculture through the supply of industrially produced implements and inputs to agriculture. This is the stage of "high farming" means "intensive farming producing highest output per acre". A marked characteristic of this stage is the subordination, and in many cases erosion, of peasant agriculture by commercialized large-scale agriculture, and

(iii) The third stage technological change is marked by major reliance on scientific research as the source of technological break-through in the form of 'biochemical technology' as compared to 'mechanical technology' of the second stage. It is also marked by emergency of an institutional framework of supply of inputs and credits, of marketing and irrigation management, of price regulation for support of agriculture by state.

3.4 Appropriate Technology

Appropriate technology is a set of techniques that make optimum use of available resources in given agricultural environment.

According to Sing (1978) a piece of technology may be viewed as appropriate for a society if its design is concerned with real needs of that society in mind, its use fulfils these needs, its continuance and development are based on that society's economic and technical ability to support, service, maintain and even improve upon it. He also presented a model (Fig. 1) to visualize the view of technology, which may be acceptable to people in under developed regions. Sing's model is reproduced below.

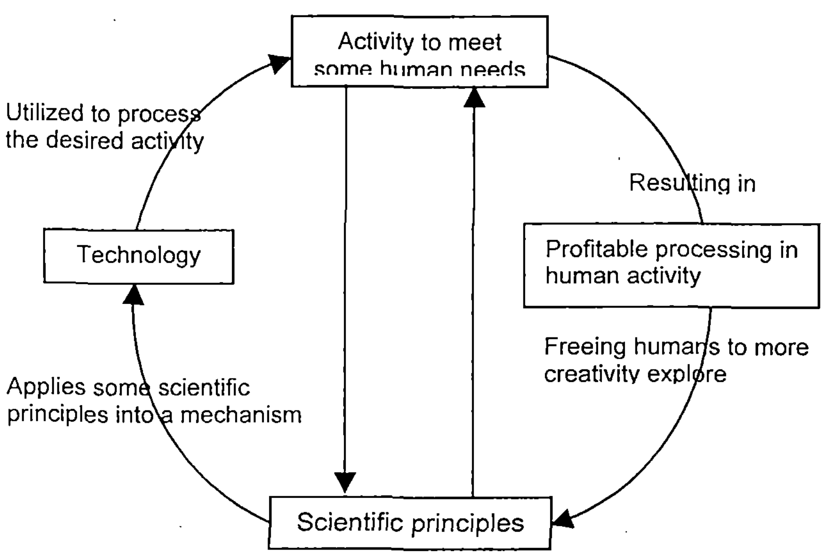

Fig. 1: Sing's Model of Technology

A view of technology which may be acceptable to underdeveloped, or developing countries.

Chattopadhyay (1976) pointed out three attributes, which a new technology must have for making it acceptable to the farmers: (a) economic viability (b) suitability and (c) conformity with socio-economic attributes of the farmer.

Anderson (1979) suggested that the technology must be tested in three conditions of (i) resource appropriateness (ii) needs appropriateness and (iii) goals appropriateness.

3.5 Evolution of New Agricultural Technology in India

The new technology, which was introduced in Indian agriculture in the late 1960s as a part of the new strategy of agricultural development is based on some newly developed crop varieties generally known as the High Yielding Varieties. This new varieties are capable of giving yields much higher than those of the traditional varieties, especially when they are used in combination with a number of complementary inputs such as fertilizers and water. The new varieties prominent among these research centers are the International Centre of Wheat and Maize Improvement (CIMMYT) in Mexico for wheat and International Rice Research Institute (IRRI) in Philippines for rice. In 1942 when India was suffering from acute food shortage and was campaigning for growing more food with those existing crop varieties, agriculture in Mexico was also in a deplorable condition. In 1943 a co-operative agricultural research and training project between the Maxican Ministry of Agricultural and the Rockefeller Foundation was initiated. The scientist chosen by the Rockfeller Foundation in 1944 was Dr. Norman Boarlaug who later became Director of the wheat Department of the International Maize and Wheat Improvement Centre (IMMYT) of Mexico. It was Dr. Borlaugh, the greatest agricultural scientist in the history of agricultural development who produced high yielding varieties capable of responding to very high does of fertilizers and irrigation by incorporating dwarfing genes into these varieties. He produced lines, which were insensitive to daylight and hence fit to be grown over a wide area of the world. The wheat varieties produced by him are remarkably resistant to common wheat diseases. In 1945, Mexico imported to million bushels of wheat but by 1965 it was exporting wheat, yields per acre having tripled.

Indian government imported 250 tones of wheat seed from Mexico in 1965. In 1966, the government sent a team of three scientists to Mexico to get a bulk of shipment of seeds of improved varieties. They visited a number of farmer's field in Mexico and arranged for the import of 18000 tones of seed of the dwarf varieties. This made it possible to spread the high yielding varieties quickly all over the country.

By seeing the tremendous success of wheat cultivation in India Dr. Borlaugh (1966) said, "Never before in the history of agriculture has a transplantation of high yielding varieties coupled with an entirely new technology and strategy been achieved on such a massive scale, in so short a period, and with such a great success".

The success of the co-operative wheat and maize programme in Mexico encouraged the Rockefeller Foundation to launch a similar research programme in rice in which the Ford Foundation joined. As a result of the deliberations between the two foundations and the government of Philippines the International Rice Research Institute (IRRI) was established in 1959 in Philippines. Scientists working in this research institute produced different types of semi-dwarf and dwarf rice variety seed.

India has the world's largest resources of rice germ-plasm and from the very beginning India has co-operated in sharing its germ plasm resources with the IRRI. India was one of the countries to make up the cultivation of IR-8 the first of the new varieties Produced at the IRRI on a massive scale. Several other IRRI varieties and breeding lines have since been recommended for cultivation in different parts of the country. 'IR-8' and other improved breeding lines were used as parents in the breeding programmes not only at the Central Rice Research Institute of Cuttack and the All India Coordinated Rice Improvement Project (AICRIP), Hydrabad, but also in various states of the country. Numerous dwarf varieties of rice seeds have resulted from these crosses. Most of the high yielding varieties of rice released in various parts of India are the descendents of crosses involving 'IR-8' or other breeding lines with improved plant types introduced from the IRRI. India has now become able to produce different types of high yielding crop varieties suitable for different region of the country and it is the various research institutes and agricultural universities that are rendering this tremendous job. In fact Indian agricultural sector has made a major breakthrough by using these different types of high yielding varieties of seeds.

3.6 Spread of New Agricultural Technology in Assam and Barpeta District

The Department of Agriculture in Assam introduced the High Yielding Variety of Paddy in the state in 1965-66. But the spread of high yielding paddy and area under high yielding paddy are very low. Of course the area under High Yielding Varieties (HYV) of rice has been showing a gradual increase over the years. The total area under HYV of rice (Autumn, Winter and Summer), which stood at 11.44 lakh hectares (29.14. percent) during 1993-94, has increased to 14.82 lakh hectares (36.65 percent of the total cropped area) in 2001-02.

The table 3.1 shows area under different HYV Rice from 1993-94 to 2001-02:

Table 3.1 Area Under High Yielding Variety Rice in Assam (In lakh hectares)

Period	Autumn	Winter	Summer	Total	Total cropped area	%
1	2	3	4	5	6	7
1993-94	2.35	7.95	1.14	11:44	39.26	29.23
1995-96	2.39	7.97	1.16	11.52	39.28	29.35
1996-97	2.52	8.21	1.27	12.00	39.31	30.52
1997-98	2.34	8.75	1.36	12.45	39.33	31.65
1998-99	2.18	8.80	1.74	12.72	39.34	32.33
1999-2000	2.08	9.15	2.17	14.00	39.36	35.56
2000-2001	2.16	9.72	2.59	14.47	39.37	36.75

Source: (i) Directorate of Agriculture, Govt. of Assam. (ii) Economic Survey, 2002-2003
(iii) Statistical Hand book, Govt. of Assam, 2002 and earlier issues.

It appears from the table that it is the winter paddy that counts the highest acreage under HYV paddy followed by autumn paddy. This is because of the reason that major part of Assam in flood affected and flood occurs during summer season (between May to August) rendering summer paddy unconducive for high yielding varieties seeds. Apart from that the area under High Yielding Variety of Paddy is not uniform across the districts of Assam. Some districts share more acreage under HYV while some others are lagging behind.

The table 3.2 shows district-wise area under High Yielding Variety of Paddy in Assam, 2000-2001.

Table 3.2 DISTRICT-WISE AREA UNDER HIGH YELDING VARIETY OF PADDY IN ASSAM, 2000-2001

(Area in hect.)

District	Autumn Paddy	Winter paddy	Summer paddy	Total area under HYV paddy	Total cropped area	%Area under HYV paddy
1	2	3	4	5	6	7
Dhubri	2500	32000	32428	89428	236314	37.84
Kokrajhar	15260	24514	6876	46650	136805	34.09
Bongaigaon	11900	31260	9650	52810	151627	34.82
Goalpara	7226	16570	12306	36102	102229	35.31
Barpeta	**25786**	**53446**	**22527**	**101759**	**312331**	**32.58**
Nalbari	5188	72925	14009	92122	199745	46.11
Kamrup	6792	67315	33525	107632	253195	42.50
Darrang	36411	58674	15157	110242	266814	41.31
Sonitpur	12217	86974	8856	108047	246512	43.83
Lakhimpur	3382	37140	3645	44167	155229	28.45
Dhemaji	3240	19280	440	22960	89447	25.66
Morigaon	10850	18213	38808	67871	164132	41.30
Nagaon	35356	92739	46332	174427	364518	47.85
Golaghat	7099	48360	3151	58610	153965	38.06
Jorhat	1892	48327	540	50759	152379	33.31
Sibsagar	444	43081	409	43934	142798	30.76
Dibrugarh	5963	36650	59	42672	165825	25.73
Tinsukia	7053	23090	395	30538	133477	22.87
Karbi Anglong	8470	70389	459	79318	175785	45.12

N.C. Hills		4804	34	4838	35039	13.80
Karimganj	4816	28792	1953	35561	98145	36.23
Hailakandi	6477	17500	2100	26077	59192	44.05
Cachar	10692	39814	5812	56318	142146	39.61
Assam	**251514** **(16.96)**	**971857** **(65.54)**	**259471** **(17.50)**	**1482842**	**3937449**	**37.65**

N.B: Figures within brackets show percentage of total area under HYV paddy.

Sources: (i) Directorate of Economics and Statistics, Assam, 2002

(ii) Directorate of Agriculture, Assam.

The table shows that only 37.65 percent of total cropped area in Assam is under high yielding variety of paddy. More than 60 percent land in Assam is still under traditional variety of paddy whose productivity is much lower than the high yielding variety of seeds. The table also shows that only 32.58 percent acreage is under HYV paddy in Barpeta District, which is lower than the state figure. Among the districts of Assam the district of Nagaon surpasses other districts in respect of cultivable land used for HYV seeds (47.85 percent) followed by Nalbari district (46.11 percent).

Productivity of HYV seeds depends upon the inputs of water and fertilizer. But availability and application of these two inputs are not satisfactory and sufficient which hampers the productivity of HYV seeds in Assam as well as in Barpeta district. Irrigation potential created at govt. level up to 31.3.96 is only for 480078 hectares of land, which constitute only 14.53 percent of the total cropped area. As regards Barpeta district the irrigation potential created up to 31.3. 97 are only for 55505 hectares, which constitute only 17.73 percent of the total cropped area. Again so far as fertilizer consumption is concerned it is only 10.41 kg per hectare in Barpeta district and 16.69 kg/hac. in Assam of which both figurers are lower than the national figure.

Such being the condition in Assam in general and the district of Barpeta in particular the adoption of improved agricultural/farming technology has been very low and slow for which production and productivity is still found to be the lowest among the Indian states.