

IMPACT OF MINOR IRRIGATION ON AGRICULTURAL LANDUSE
AND CROPPING PATTERN : A CASE STUDY OF HAJO BLOCK

By

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C O N T E N T S

	<u>Page</u>
Supervisor's certificate	i
Acknowledgements	ii
List of Figures, Maps and Photographs	iii
List of Tables	iv
CHAPTER I INTRODUCTION	
1.1a Background of the study	1
1.1b Review of literature	4
1.2 Studies related to irrigation in Assam	12
1.3 Need of the present study	15
1.4 Objective of the study	16
1.5 Research Questions	17
1.6 Method of Study	17
1.7 Limitation of the study	20
CHAPTER II STUDY AREA AND THE PROJECT	
2.1(a) General Geographical feature of the Hajo Block	24
2.1(b) Landform	25
2.1(c) Climate	27
2.1(d) Soil	30
2.1(e) General Landuse Pattern of the Block	31
2.1(f) Agricultural Landuse	35
2.1(g) Intensity of agricultural landuse	42
2.1(h) Cropping Pattern	44
2.1(i) Intensity of Cropping	50
2.1(j) Spatial variation in the intensity of cropping	51
2.2 The system of irrigation	51
2.3 Description of the project	54
2.4 Coverage of the project	56
2.5 Proposed system for release of water	58
2.6 Location of the villages with serial numbers	62
CHAPTER III ANALYSIS OF THE FUNCTIONING OF THE PROJECT	
3.1 Functioning of the Project	65
3.2 Spatial distribution of water	67
3.3 Adequacy of water	69
3.4 Maintenance of the scheme	70
3.5(i) Position of the selected plots	71
3.5(ii) Agricultural landuse	71
3.5(iii) Cropwise use of irrigation	76
3.5(iv) Use of HYV and package Practices	77

3.5(v)Contribution of irrigation in changing the cropping Pattern and diversification of cropping	80
3.6(i) Production and Productivity	86
3.6(ii)Crop combination regions of Hajo Block	89
3.7 Problem in achieving full use of irrigation potential	94

CHAPTER IV PROJECT EVALUATION, SUMMARY AND CONCLUSION

4.1.1 On the programme	98
4.1.2 Functioning of the programme	98
4.1.3 Distribution of water	99
4.1.4 On other inputs	100
4.2 Summary and Findings	100
4.3 Conclusions	102
4.4 Limitations of the study and suggestions for future research	104

BIBLIOGRAPHY 106

APPENDIX A	110
APPENDIX B	112
APPENDIX C	113
APPENDIX D	117
APPENDIX E	121
APPENDIX F	126

PHOTOGRAPHS

Brief Bio-data of the author

LIST OF TABLES

<u>Table No</u>		<u>Page</u>
2.1	Population Composition of Hajo Block	24
2.2	Micro-relief of Hajo Block	27
2.3	Annual rainfall in Kamrup district	27
2.4	Soil Analysis	31
2.5	General Landuse of Hajo Block	32
2.6	Agricultural landuse of Hajo Block	40
2.7(a)	Area under HYV Paddy	41
2.7(b)	Intensity of Agricultural landuse	44
2.8	Mouzawise agricultural landuse and cropping intensity	48
2.9	Intensity of Cropping	50
2.10	Irrigation Schemes of Hajo Block	55
2.11	Area under Irrigation Schemes	56
3.1	Polarise landuse of Gondhmow Village	74
3.2	Cropping pattern of Hajo Block	82
3.3	Productivity of different crops	88
3.4	Crop Combination	93

LIST OF FIGURES, MAPS AND PHOTOGRAPHS

Fig.1	Location of Hajo Block	23
Fig.2	Micro-relief of Hajo Block	26
Fig.3a	General landuse of Hajo Block	33
Fig.3b	Intensity of agricultural landuse	43
Fig.4	Mouzawise agricultural landuse	49
Fig.5a	Intensity of Cropping	52
Fig.5b	Location of villages	61
Fig.6	Cadastral map of Gondhmow village	72
Fig.7	Cadastral map of Monahkuchi Village	78
Fig.8	Photographs	

CHAPTER - I

INTRODUCTION

1.1(a) Background of the study

The incidence of rainfall in the state of Assam is generally moderate to heavy but the distribution is not uniform over space. Nearly 90 per cent of annual rainfall occurs during the monsoon period alone, from June to October. The duration of the monsoon period is also not constant every year, as the timings of the onset and the withdrawal of S.W. monsoon are subjected to variations. Sometimes, the advent of the S.W. monsoon is delayed affecting the timely sowing of the main paddy crop i.e. sali crop and sometimes, the monsoon terminates much earlier, affecting the crop in the flowering stage with consequent reduction in the yield. Occasionally, there are prolonged breaks of rainfall within the monsoon period itself, adversely affecting the yield-potential of the crop. There are some regions in the state where rainfall is meagre due to location of these areas in rainshadow zones. Geographically, the whole of Kamrup district falls within the rainshadow zone of the S.W. monsoon. Rainfall generally increases towards Sibsagar and Dibrugarh districts in the east and Goalpara in the west.

The winter rain is very scanty in the whole of the Brahmaputra valley in general, and Kamrup district in particular. Crop failure in the winter is a regular affair in the district.

Brahmaputra valley is very fertile and the percentage of agricultural population is very high. But, uncertainty of the S.W. monsoon and the scarcity of winter rain have necessitated the introduction of irrigation facilities, particularly in the rainshadow districts.

A good number of minor irrigation projects have been introduced since the sixties. One of such minor irrigation projects has been started in the Hajo Block of Kamrup District in the early seventies.

Before introduction of irrigation schemes, the principal crop cultivated in the Hajo Block was mainly sali paddy, grown in the kharif period (June to November). Bao paddy was also grown in the fringe of the lowlands, the beels which are numerous in the region. Ahu paddy (summer rice), jute cultivation was also practised widely. Rabi crop, such as mustard, tesi, wheat, potato, tomato, onion, garlic etc. were cultivated in a limited degree. Thus, the pre-project cropping pattern can broadly be termed as rice mono-culture only. In view of the meagre rainfall in the region, in some years, the sali paddy suffered from drought conditions, as a result of which,

yield per acre was low and acreage was reduced. With the introduction of irrigation systems, the entire irrigable area was covered with assured Kharif crops and a good part of the total cultivable land with Rabi crops. Gradually a large number of cultivators of this Block took cultivation of Rabi crops in the winter months as a profession, instead of subsistence cropping.

The ultimate objective of different schemes in the Block is to provide irrigation facilities in those areas which are highly deficient of rainfall, particularly in the winter months, so as to enable the peasants to practise multiple cropping. Assured water supply facilitated the introduction of HYV seeds and the use of fertilizers, insecticides in the cropping methods and created a condition of modernisation of agriculture.

With the introduction of irrigation in the Block, the cropping pattern within the command area was changed. As a result of the availability of water from the project, it was seen that the cultivators started practising multiple cropping and as a result, the total cropped area in the Block under different crops in a given year has increased substantially. With the assured water supply, people started to cultivate HYV crops, resulting in an increase of intensity of cropping to 155 per cent. The yield per acre also considerably raised.

A few observations may be made regarding the benefits accrue to the peasants of the Block from the different irrigation schemes, which are

- (1) increase in the purchasing power of the beneficiaries,
- (2) rise in the value of land in the area,
- (3) improvement of health of the people due to consumption of sufficient food and fresh vegetables,
- (4) increase in revenue of the Government, with the introduction of quick transportation, vegetable whole-sale market and other development of the area and prosperity of the people,
- (5) reduction of poverty.

1.1(b) Review of literature

The impact of irrigation has been studied by several scholars in the past in different parts of India. Most of the studies were at the micro-level (i.e. at the village level) with the ultimate aim to bring out the impact at the household level. These studies generally touched upon farm economy, employment generation and other social factors. Studies based on geographical methods are, rather, very limited.

Krishna Murthy¹ has evaluated the influence of

1. Krishna Murthy, S., "Influence of Mettur Irrigation on Agriculture and agro-industries". Planning Commission, Govt. of India, New Delhi, 1959.

the Mettur Irrigation Project on agriculture and agro-industries in Puttokotal Taluk of Tanjor District of Tamilnadu in 1956. The factors included in the study were — area under irrigation, net cultivated area, intensity of cropping, yield rate, food supply, agricultural employment, cultivation practices and indebtedness etc. He observed that the project area has an edge over the non project area.

Hanumantha Rao² compared yields in Telengana between partially irrigated and dry farmers. His findings showed that among the partially irrigated farmers output shows a greater degree to percentage increase in land output than to labour input. Reverse was true for dry farmers.

In 1967, another study was conducted in the Champaran district of Bihar to assess the direct and indirect benefit of the Tribeni Canal Irrigation Project by Divakar Jha³. He considered factors like land ownership utilization, crop pattern, farm investment, imple-ments, assets, livestock, human labour, farm inputs,

2. Hanumentha Rao, C., "Alternative Explanation of the Inverse Relation between Farm size and output per acre in India", *Indian Economic Review*, Vol. 1, No.2, 1966, pp.1-12.

3. Divakar Jha, *Evaluation of the Benefits of Irrigation Tribeni Canal, Bihar*, Orient Longman, Bombay, 1967, pp.60-73.

rural industries and so on and concluded that irrigation has definitely brought prosperity to the cultivators in the project area.

Khan and Tripathi (1972)⁴ in their study in West Godavari district of Andhra Pradesh compared the upland (dry) and delta (wet) irrigations and observed that the overall benefits were more for the delta farmers and also resulted in higher productivity of labour.

Rajpurohit and Pillair (1977)⁵ in their evaluation study in Mandya village observed that irrigation has differential impact among different socio-economic groups. They could find that the wealthiest have become considerably richer and the medium size owner were the great beneficiaries from irrigation.

Another study was conducted by Abdul Aziz⁶ in his own village in Kolar district to see the impact of before and after the introduction of well irrigation. He observed that the changes in the occupational structure and emergence of plurality of occupations in the same

-
4. Khan, W. and Tripathi, R.N., "Intensive agriculture and modern inputs, prospects of small farmers in W.G. district study in A.P.", NICD, Hyderabad, 1972, pp.5-81.
 5. Rajpurohit, A.R. and Pillair, K., **Agriculture Irrigation Transfer and Its Socio-Economic Consequences in Mandya**, Shiny Publishing Co., Bangalore, 1977, pp.1-30.
 6. Abdul Aziz, "Irrigation and Economic Change in Karnataka Village", in Thimmaiah (ed), **Rural Development**, Chugh Publication, Allahabad, 1979, pp.256-264.

house-hold after sinking of wells in the village.

Pandey's⁷ study on impact of irrigation on rural development in Bihar indicated that the overall performance of the irrigated village is far better than that of the unirrigated village.

Alexander⁸ in his study at Attabira and Rengati Block under Hirakud Command Area concluded that introduction of canal irrigation led to intensification of agriculture, multiplication of crop pattern, increase in production, better standard of living and surplus in labour force (mainly due to withdrawal of children, adult and old woman from work).

A similar study was conducted at Bellary district of Karnataka by Misra and Vivekananda (1979)⁹ under Tunga-Bhadra Dam. They observed an inverse relationship between size of holding and the area irrigated. Adoption of new/HYV crops are the result of irrigation leading to higher yield-per acre. Despite high cost, they observed a positive relationship between farm income and irrigation.

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7. Pandey, M.P., **Evaluation of Impact of Irrigation on Rural Development — A Case Study of Command Area**, Concept Publishing Co., New Delhi, 1979, pp.1-120.
 8. Alexander, K.C., "Economic Development and Social Change" **Behavioral Science and Community Development**, NIRD, Hyderabad, 1979.
 9. Misra, G.P. and Vivekananda, M., **Impact of Canal Irrigation in Rural Areas: Case of Bellary District**, Himalaya Publishing Co., Bombay, 1979, pp.130-145.

Two studies were conducted during 1980-'81, one by Patil¹⁰ in the Ghod Command Area of Maharashtra and the other by Rane¹¹ in two village around Delhi. Patil's result indicated that post irrigation was better off over pre-irrigation in all respects. On the other stuy, Rane concluded that problems of unirrigated area was very severe comprising of a very large population below poverty line. Higher Gini Ratio indicated inequalities of income distribution to be more in the irrigated areas than in the unirrigated areas.

Recently, in another study Vasudeva Rao¹² compared the impact of Malapraava canal irrigation at micro and macro levels in the Nargund Taluk in Karnataka state. He observed that family labour participation has come down with the increase of irrigation practices; small farmers have brought more areas (in terms of percentage of holding) under irrigation; farmers attitude have been changed and they could recognise the need of the hour; money invested per acre is increasing with farmsize; labour become more productive; the drought power has

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10. Patil, R.G., **An Investigation into Socio-Economic Condition of Ghod Command Area (Maharashtra)**, Department of Agricultural Economics, M.P., Krishi Vidyapeetha Rahuri, 1980.
 11. Rane, A.A., "Poverty and Irrigation", **Productivity Journal**, Vol. 7-9,p.77.
 12. Vasudeva Rao, D., **Rural Development Through Irrigation**, Ashish Publishing House, New Delhi, 1987, pp.137-144.

been increased six fold and there is considerable rise in the household income.

A study was conducted jointly by N.V.N. Rao and R.Ram Reddy (1985)¹³ on a district in Telengana region of Andhra Pradesh to assess the impact of Minor Irrigation Scheme on tribal development, implemented by the Integrated Tribal Development Agencies. The study concluded that the implementation of various irrigation schemes, people shifted the practices of dry crop cultivation to wet paddy growing and the yield rate and income of the farmers have found to have increased. They were of the opinion that along with the irrigation facilities, without the use of other modern inputs, such as HYV seeds, fertilizers and pesticides better return from agriculture may not bring sufficient impact on productivity. They suggested the formation of some peasant societies, through which the small and illiterate farmers can be trained to adopt appropriate technology to suit their needs.

The findings of the study conducted by Patel¹⁴ in Ajmer district of Rajasthan, indicated that with the implementation of minor irrigation schemes, small

13. N.V.N. Rao and R.Ram Reddy, "Minor Irrigation and Tribal Development", **Kurukshetra**, Vol. XXXIV, No.12, 1985, p.31.

14. Patel, A.R., "Irrigation schemes and Small Farmers", **Kurukshetra**, Vol. XXXI, No.21, 1983, pp.7-11.

farmers have benefitted much in terms of bringing more area under irrigation, increasing cropping intensity, introduction of crops of economic importance and increasing the crop productivity.

In an article on the source of growth of agriculture productivity, Dharm Narain has shown that prior to the Green Revolution, the locational shift of crops had significantly contributed to growth along with the cropping pattern effect, while in the later period, it was responsible for the growth of agricultural productivity. C.G. Ranade¹⁵, while examining the various components of agricultural productivity, demonstrated that even in the absence of modern seeds and fertilizer technology, one can increase the agricultural productivity by encouraging farmers to grow more of high value crops (cropping pattern effect) and by utilizing the advantageous regions.

Sundeep Khanna (1985)¹⁶ while studying the performance of public operated irrigation systems has shown that the ratio between the created potential of the schemes and potential utilized by the farmers were very low. He justified the Command Area Development Programme

15. Ranade, C.G., "Growth of Productivity in Indian Agriculture: Some unfinished components of Dharm Narain's work", Economic and Political Weekly, Vol. XXI, No. 25 & 26, 1986.

16. Khanna, S., "Command Area Development in Chambal", Kurukshetra, Vol. XXXIII, No.6, March 1985.

for rapid utilization of irrigation potential. He was of opinion that for increasing agricultural production, irrigation facilities with HYV of seeds and fertilizers is not enough, it is also necessary to supply it at right time and in adequate quantity.

Bhalerao and Maurya (1985)¹⁷ assessed the importance of labour intensive crops like vegetables etc. to solve the problem of under employment and disguised employment in Indian rural areas. In his view, adoption of labour intensive crops not only occupy comparatively less area but also contribute proportionately more employment and more income accrue to the farmers.

The above views clearly indicate that many attempts have been made in the past to assess and evaluate the impact of irrigation on the economic development of the rural masses. Yet, the evolution studies in the state of Assam is considerably limited. Therefore, there is a need to assess the impact of irrigation on rural areas in general and farmers in particular in the valley of Brahmaputra.

17. Bhalerao, M.M. and Maurya, R.P., "Employment Generation Through Labour Intensive Crops", *Khadi Gramodyog*, Vol. XXXII, No.3, December, 1985, p.199.

1.2 Studies Related to Irrigation in Assam

A limited number of evaluation studies on irrigation schemes were undertaken by the U.P. state government¹⁸, in 1977-'78. These studies revealed that the extent of use of irrigation facilities in Assam were rather limited. The reasons for poor utilization of the facilities created by such projects, according to the reports are -

- (1) lack of demand of irrigation water from the cultivators,
- (2) utilization of water during Rabi Season was poor, as few cultivators have taken the cultivation of Rabi-crops, (change of cropping pattern),
- (3) absence of field canals,
- (4) occasional disruption of power supply,
- (5) absence of command area development schemes in the area served by the irrigation projects,
- (6) lack of coordination between irrigation and agriculture departments of the Government.

Sahu (1984)¹⁹ showed that rice is the dominant crop of Assam, occupying more than 60 per cent of the total cropped area. But there are significant variation in the concentrational and distributional pattern of rice in the Lower Brahmaputra Valley. Cultivation of

18. Das, B.C., **Method and Techniques of Designing Evaluation Studies**, Additional Director, Evaluation and Training Division, State Planning Institute, Government of U.P., 1981.

19. Sahu, R., **Diffusion and Distributional Pattern of High Yielding Varieties of Rice in the Lower Brahmaputra Valley**, Unpublished Ph.D. Thesis, NEHU, Shillong 1984.

HYV of rice seen to be grown mainly in the areas of high concentration of rice. His findings also revealed that a large number of areal units of cropped lands of Assam are poorly irrigated, and higher concentration of rice areas possess a low irrigation potential.

Goswami and Gohain (1968)²⁰ studied the farmers to the HYV programme in paddy. Their findings showed that, though the farmers were encouraged to undertake HYV paddy by the Agro-Extension Agency and the farmers received seeds and other inputs, yet, the farmers devoted only a small area of their holdings for the cultivation of HYV paddy. The reasons for non-acceptance of HYV paddy, as reported by the farmers were high incidence of pests, lack of irrigation facilities, lack of sufficient funds to purchase fertilizer and other inputs.

Another study was conducted by Phukan (1970)²¹ to examine the nature and extent of double cropping in Sibsagar district of Assam. The study revealed that the farmers practised double cropping only in a small fraction of their cropped lands. The percentage of double cropped area to net sown area varies from 3 per cent

20. Goswami, P.C. and Gohain, D., "Evaluation of HYV Programme in Paddy: A Study in Sibsagar District", **Twenty-five years of Agro-Economic Research in N.E. India**, Agro-Economic Research Centre, Jorhat 1968, p.83.

21. Phukan, U., "A Study of Double Cropping in Sibsagar District", in **Twenty five Years of Agro-Economic Research in N.E. India**, Agro-Economic Research Centre, Jorhat, 1970, p.99.

to 20 per cent. The study showed an inverse relation to the size of holdings. Low sized classes having larger proportion of double cropped area than the higher sized classes. The study further showed that most of the rotation in the double cropped area was paddy followed by paddy. Other minor rotations were Ahu paddy (summer rice) followed by vegetables, potato and maize etc. This type of rotation was followed in high lands, where winter paddy (Sali paddy) cannot be transplanted.

Ali Irshad (1975)²² while studying the impact of Mayong Lift Irrigation Project of Nagaon district, showed that with the introduction of irrigation, the rabi crops have been replaced by both traditional and HYV paddy in the winter months. There was a considerable rise in the productivity of land by the adoption of irrigation and HYV seeds. The crop intensity has increased to a great extent.

Phukan (1985)²³ conducted a study on the impact of Tube well irrigation on crop production in Jorhat district of Assam. He observed that Ahu paddy (transplanted variety) was the second crop followed by sali paddy in the irrigated lands of the district. He found that

22. Ali, A.M.M. Irshad, "A Study on the Impact of Mayong Lift Irrigation Project", Ibid., 1975, p.115.

23. Phukan, U., "A Study of the Impact of Deep Tube Well Irrigation on Crop production in Jorhat district of Assam", Op.cit., 1985, p.192.

the use of irrigation was restricted to transplanted HYV of Ahu paddy only. The reason for limited use of irrigation potential, according to him were (i) lack of farmers collective and organised efforts to bring the owners of irrigated land together to cultivate transplanted Ahu paddy, (ii) lack of leadership in the village to enforce restriction on stray cattle between January to May, (iii) lack of an effective agency for motivating and organising the farmers and input supply agencies, etc. The study indicates that Tube well scheme of irrigation helped considerably in increasing the rice production in the district.

1.3 Need of the Present Study

The survey of literature indicates that irrigation has definite impact (i) on crop productivity, (ii) rise of income and standard of living of farmers, (iii) cropping pattern and (iv) employment structure in the command areas of the project. However, such studies conducted by geographers with clear spatial implications are limited. Moreover, at the micro-level (village level) detailed case studies in regards to changes in cropping pattern remains much to be desired, particularly, in relation to (a) extent of change in cropping pattern, (b) sequences in cropping practice and rotation, (c) field patterns, (d) spatial spread of new crops, (e) impact of irrigation

on various groups of cultivator and (g) impact of various ways of irrigation on crop yield and pattern of cropping. Needless to say that such studies in the relatively traditional agricultural profile of Assam are extremely limited in number. It was therefore, contemplated to study the various spatial significance of irrigation in the Hajo Development Block of Kamrup district of Assam in some detail./

1.4 Objectives of the study .

The main purpose of the study would be to examine the functioning of the irrigation schemes, so as to assess the changes that have brought, with respect to agricultural land use and cropping pattern in the Block. The following specific objectives are being set-up for the present study.

- (i) to examine the changes that have been brought by the Minor Irrigation Scheme of Hajo Block, in the agricultural landuse pattern,
- (ii) to assess the impact of the programme on
 - (a) intensity of cropping,
 - (b) diversification of cropping practices,
 - (c) productivity and production.
- (iii) to ascertain the degree of improvement in the standard of living of the beneficiaries with the method, quantity, duration and timing of irrigation and to investigate the problems faced by them, in the better utilization of the irrigation water.

1.5 Research Questions

In order to follow the main objectives of the study, the following research questions have been formulated:

- (i) what is the nature of cropping pattern and agricultural landuse in Hajo Block and what specific changes, in this pattern have been brought about, by the introduction of irrigation?
- (ii) what is the nature of effectiveness of Govt. sponsored minor irrigation and private shallow tube wells?
- (iii) what is the nature of impact of irrigation in motivating farmers to modernise their agriculture?
- (iv) what is the role of an accessible market in encouraging market gardening in specific? and finally,
- (v) are there social preferences among farmers (belonging to the different communities) for cultivating specific crops?

1.6 Method of Study

(i) Sample design : In Hajo block, there are a total of 121 villages, out of which, 10 villages are uninhabited. Irrigation facilities to all these villages are not available. The average household in each village is around 100. Out of the 111 villages in the Block, only 25 per cent villages numbering 29 only are getting

benefits from the existing irrigation schemes. In the benefitted villages, water is provided, in the winter season of the year only. With this background, the sampling of the year only. With this background, the sampling design is based on 'multistaged purposive random technique',

(ii) Selection of the sample villages: Hajo Block consists of 4 Mouzas, Pub-Bongsor Mouza gets maximum irrigation facility, in terms of acreage, as well as number of villages. In terms of percentage of net area sown, the mouza stands second next to Ramdia Mouza. But in terms of percentage of double cropped area, Pub-Bongsor Mouza stands first. This is because of the availability of a large number of private shallow tube wells installed by the farmers, for the cultivation of Rabi-crops, particularly, the winter vegetables.

During the summer, in normal years, farmers are generally reluctant to use irrigation water, since, rainfall is abundant and there is no water scarcity. Rabi is a new concept in the irrigated area, but the spatial distribution is not even over the whole Block.

For the better representation in the study, 29 villages (25 per cent of the total vilalges in the Block) having irrigation facilities are selected, covering

all the irrigation schemes. But, there is not a single village in the Block, where all the households use irrigation facilities. However, villages with irrigation facilities have been considered for the study, even though, some of the households do not use the facilities. Sixteen such villages have been selected for the study. Here, sample households have been selected in such a way that they use irrigation facilities, 10 per cent households have been considered from each of the village.

Another group of thirteen villages, where there is no provision of irrigation facilities have been selected at random, from which 10 per cent of households have been selected for the study. Selection of households was based on simple random sampling, using the random number table. A list of 29 sample villages is given in Appendix B.

Sample villages have been selected from all parts of the Block and under different irrigation schemes, so as to bring out the impact of irrigation.

The result of the study is based mainly on the household survey. Each sample farmer has been contacted and interviewed, in detail with the help of a questionnaire covering all the aspects of his farming life (Appendix-A). Besides this, field data have been collected from the respective fields through personal visits. Data is collected

for the single agriculture year, from March 1986 to February 1987.

Various aspects of individual households have been grouped and average value of different variables in every household of each village are taken as representative figures for each village.

Other information have been collected from the secondary sources like Block Development office, Settlement office, Minor Irrigation Department, etc.

The data so collected have been summarised, tabulated and mapped, wherever necessary. In the following chapters of the study, the data has been analysed and conclusion drawn thereof. Any statement or conclusion drawn in this study is based on the available data collected for the study only.

1.7 Limitation of the Study

There are a few limitations of the present study:

(a) One year reference period is a very short time for generalisation. Though the year was a normal with respect to rainfall, temperature distribution, but, the previous year was a drought year, which had affected the investment capacity of the small farmers of the region. Yet, it may have a strong bearing in the mind

of the cultivators to do better for their survival.

(b) The educational status of the cultivators are very low. The household survey shows that, there are no matriculate cultivators, taking agriculture, as means of livelihood. Cultivators are generally, illiterate, and information are sometimes exaggerated and sometimes understated.

(c) With a wrong idea of imposition of agricultural taxes, people sometimes hide the real facts and figures. There is a general tendency, to over estimate the expenditure and under estimate the production and income. The good neighbour sometimes, out of jealousy, exaggerate the information.

(d) The general apathy of government functionaries at the grass-root level, on keeping records is another reason in getting reliable information at the secondary source. The researcher, therefore, has tried utmost to cross-check information obtained from various sources, before using in the study.

CHAPTER - II

STUDY AREA AND THE PROJECT

2.1 (a) General Geographical features of the Hajo Block

Hajo Block is located in the northern bank of the river Brahmaputra, at a distance of about 15 k.m. from Guwahati city; extending from 91°25'E to 91°40'E longitude and 26°10'N to 26°17'N latitude, covering an area of 360.1 sq.km. (Fig.1). The Block is bounded by the river Brahmaputra in the south, Kamalpur circle in the east, Nalbari and Rangia circle in the north and Barkhetri circle in the west. There are four mouzas in the Block, with 137 villages consisting of 121 inhabited and 16 uninhabited. The population composition of the Block according to 1971 census is as follows:

Table 2.1
Population Composition of Hajo Block, 1971.

Total population	S.C.	S.T.	Lite-rates	Total workers	Culti vatois	non-workers
T=129,996 (100)	T=14,609 (100)	T=2,191 (100)	T=38,490 (100)	T=33,194 (100)	T=20,998 (100)	T=96,802 (100)
M= 68,164 (52.4)	M= 7,538 (51.6)	M=1,088 (49.6)	M=27,786 (72.3)	M=31,311 (94.3)	M=20,963 (99.8)	M=36,853 (38.1)
F= 61,832 (47.6)	F= 7,071 (48.4)	F=1,103 (50.4)	F=10,654 (27.7)	F= 1,883 (5.7)	F= 35 (0.2)	F=59,949 (61.9)

Source: District Census Hand Book, 1971.

T=Total, M=Male, F=Female.

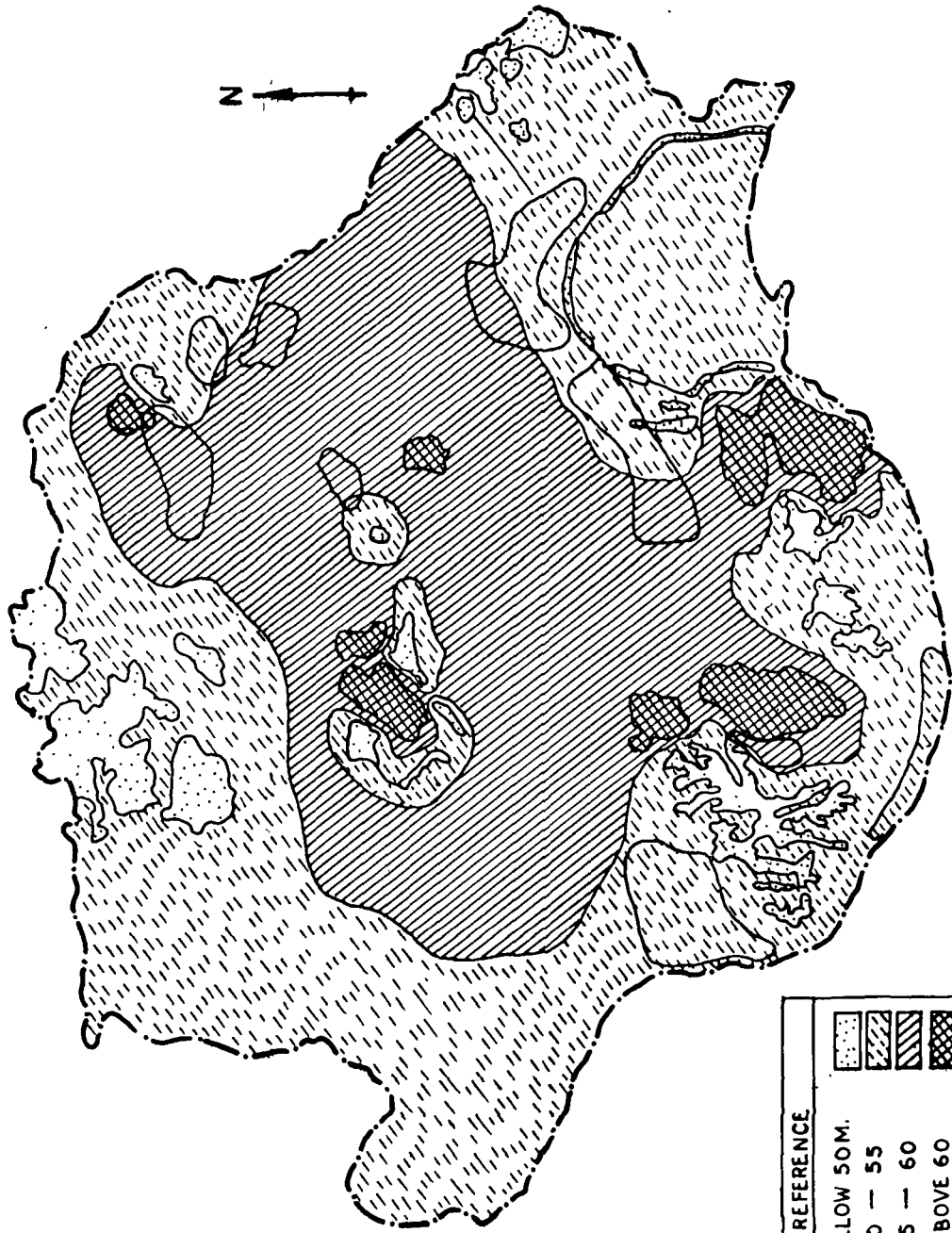
Figures in brackets indicate percentage.

2.1 (b) Landform

Micro-relief: Hajo Block has a smooth level surface with an average elevation slightly exceeding 50 metres from the MSL. The surface is mainly made up of alluvium deposited by the river Brahmaputra and its tributaries, Puthimary and Sessa rivers flowing from the north. The area is dotted with large number of beels (swamps) and a few scattered hillocks. The structure and geological formation of these hillocks are like that of the Meghalaya Plateau. The height of the hillocks vary from 145m to 381m from MSL.

The micro-relief of the Block is characterised by a higher track above 60m contour, covering roughly 3.9 per cent of the total area. Nearly, 6.6 per cent of the total area is occupied by the perennial water bodies, the beels and swamps, lying approximately below 50 metre contour. 49.2 per cent of the total area is to be found between 50 to 55m contours. This strip of land is the rice cultivated area of the Block. 55 and 60m contours cover 40.3 per cent of the total area. The multiple cropping of the Block mainly confines to this belt, (Fig.2).

HAJO BLOCK
MICRO RELIEF



REFERENCE
BELOW 50M.
50 - 55
55 - 60
ABOVE 60
IRRIGATED AREA

Fig. 2

Table 2.2
Micro-relief of Hajo Block

Height in metre		Percentage of total area
More than	60	3.9
	55 - 60	40.3
	50 - 55	49.2
Less than	50	6.6

Source: Calculated from Toposheets.

2.1 (c) Climate:

Climate is one of the principal ecological factors affecting the character and possibilities of agricultural land-use. As weather is the single major limiting factor in crop production, successful farming calls for appropriate decisions in the light of weather conditions at the time of sowing, transplantation and harvesting. Table 2.3 gives an idea about the annual rainfall pattern in the Kamrup district, as a whole,

Table 2.3
Annual Rainfall in Kamrup District.

Month	Monthly rainfall (in mm)											
	J	F	M	A	M	J	J	A	S	O	N	D
Rainfall	14.5	10.2	66.0	201.9	388.9	293.0	400.2	243.0	394.7	66.1	Nil	5.5

monthly average 173.7 mm.

Source: Meteorological Deptt. Barjhar, Guwahati, 1986.

The climate of Assam is characterised by extreme humidity, heavy summer rainfall and winter drought. The average maximum and minimum temperature in the region

is 29°C and 19°C, respectively with the average humidity nearly 82 per cent. The average annual total rainfall of the district is 1632mm. The rainfall in the district of Kamrup is meagre due to its location within the rain-shadow of the Meghalaya Plateau. About 90 per cent of the total annual rainfall is confined to the months of May to October, where as, December, January and February are almost rainless. As a result, two district types of crops can be grown in the region, (1) Kharif - in the summer season and (2) Rabi - in the winter season.

Seasonal Characteristics

A given year in Assam is divided into four seasons — (a) Pre-Monsoon, (b) Monsoon, (c) Retreating Monsoon and (d) Dry winter. This cycle of seasons has a great bearing on the cultivation of various crops in the year. The Pre-monsoon period starts by the middle of March along with the gradual rise in temperature. This is the season, where strong wind blows with occasional thunder-storms, locally known as **Bordoi Chila**. This phenomenon of strong wind with occasional thunder-shower gradually subsides in the later part of April. The occasional rainfall of this season helps the farmers for the cultivation of jute and summer rice, known as **Ahu** (both by broadcasting and transplanting).

The S.W. Monsoon breaks by the middle of June, when the **Ambubasi** is observed by the people and continues upto late September. This season is characterised by cloudy weather, high humidity, heavy rainfall and high temperature. The heavy rainfall keeps the summer temperature comparatively low during the rainy days. This season is the most important period for agricultural activities in Assam, when the staple crop, winter rice (**Sali rice**) is grown; every household directly or indirectly engaged in the agricultural activities.

By the middle of September, S.W. monsoon starts to weaken and is followed by fair weather with the occurrence of morning fogs from middle of November. The intensity of rainfall decreases and the mild rainfall in this period is beneficial to the sowing of rabi crops. Winter starts from the middle of November and continues upto February. The main characteristics of this season are the absence of rainfall, cool weather with low temperature around 10°C and morning fog and dew. The rainless days of this season helps the harvesting of winter rice, but hinders the growth of rabi-crops. In some years, heavy rainfall during November-December can damage the standing **Sali** paddy in the field. Again, in many a times, the occurrence of monsoon is rather irregular. It may result in drought. Similar is the case of retreating monsoon. Winter rain is far more erratic in the district.

Therefore, for successful cultivation of winter crops, viz. wheat, oil-seeds, potato, tomato, brinjal etc. irrigation is highly essential in this region.

2.1 (d) Soil:

The region is composed of alluvial soil, young and immature. The genesis of the soil is of transported origin. Based on the field and laboratory data, on character of sediments, organic matter content, drainage condition and the layers, their features, depths, water infiltration capacity, the soils of the region have been placed under two different groups, namely group 'R' and group 'S'¹ (table 2.4).

Group 'R' — These soils are found on the level flat land. The soils are deep and well drained. These soils have silty-loam to silty-clay-loam texture, followed by fine sand and coarse sand, respectively.

Group 'S' — These are well drained deep soils, found on almost level flat land. These soils have silty-loam texture, followed by fine sand. The significance of this group is the presence of a coarse textured horizon, which starts from 15 to 20 cm. depth from the surface. Most of the soils of the study area belong to this group.

1. Report prepared by Soil Testing Officer, Govt. of Assam, Ulubari, Gauhati, 1986.

These are flatland with good depth and tillage. The available moisture holding capacity is moderate. These land with a better management are suitable for a variety of crops, both in Kharif and Rabi seasons. Adoption of crop rotation practices and provision of assured irrigation are advisable. The crop suitable for these lands are wheat, paddy, sugarcane, mustard, black-gram, lentils and winter vegetables.

Table 2.4
Soil Analysis

Soil group	depths(cm)	ph	T.SS.	% of organic carbon	Available F ₂ O ₃ lbs/acre	Available H ₂ O lbs/acre
Group 'R'	0 - 6	7.2	0.30	0.639	12.4	125
	6 -23	7.25	0.50	0.726	4.8	75
	23-48	7.05	0.50	0.639	12.4	75
	48-75	7.2	0.50	0.484	7.6	75
	75-110	7.0	<0.005	0.672	12.4	45
Group 'S'	0 - 15	6.95	<0.005	0.349	3.2	60
	15-40	6.95	<0.005	0.538	7.6	60
	40-73	7.1	<0.005	0.484	4.8	100
	73-106	7.1	<0.005	0.484	12.4	90

Sources: Soil Testing Deptt. Govt. of Assam, Guwahati, 1986.

2.1 (e) General land-use pattern of the Block:

"Land use is a function of four variables — land, water, air and man. Each has its own role to compose its life history. Land constitutes its body, water runs through its veins like blood, air gives its life and man acts as dynamic factor to reflect its type, pattern and distribution"² (Singh 1981).

2. Singh, R.P., "Concept of landuse" in **Perspective of Agriculture Geography**, (ed) Noor Mohammed, Concept Publishing Co., New Delhi, 1981,p.159.

Therefore, it is necessary to understand the inherent character of these four variables, before making any attempt to find out a general pattern of land use in any area. It can also be easily observed that any mismatch of any of these four factors will lead to the adoption of extra corrective measures in order to bring out an optimal pattern of use. It is in this context, the need for irrigation is to be examined and land use pattern of the Block discussed.

An attempt has been made here to work out the area and percentage of various use of land of Hajo Block in 1985-'86, and the results have been shown in table(2.5). The percentage of the various uses of land to the total area of the Block has been shown in the fig.(3).

Table 2.5
General land use of Hajo Block

Sl No	Land classes	Area in Acre	Percentage of total area	Assam
	Total Geographical area	89,116.9	100	191,12,582.0
1.	Forest	1,504.3	1.69	21.14
2.	Land put to non-agricultural use	6,608.3	7.42	8.31
3.	Barren and uncultivable land	7,099.3	7.97	15.89
4.	Permanent pasture and grazing land	8,824.5	9.90	2.09
5.	Land under miscellaneous tree crops, not included in net area sown	5,534.7	6.2	2.35
6.	Cultivable waste land	5,304.0	5.95	1.54
7.	Current fallows	3,337.7	3.75	1.09
8.	Fallow land other than current fallow	3,777.2	4.24	1.53
9.	Net area sown	47,126.8	52.88	24.58
	Totals:	89,116.9	100.00	-
10.	Area sown more than once	18,198.0	20.42	6.18

Sources: S.D.C. Office, Hajo, 1986.

HAJO BLOCK
LAND - USE
1986

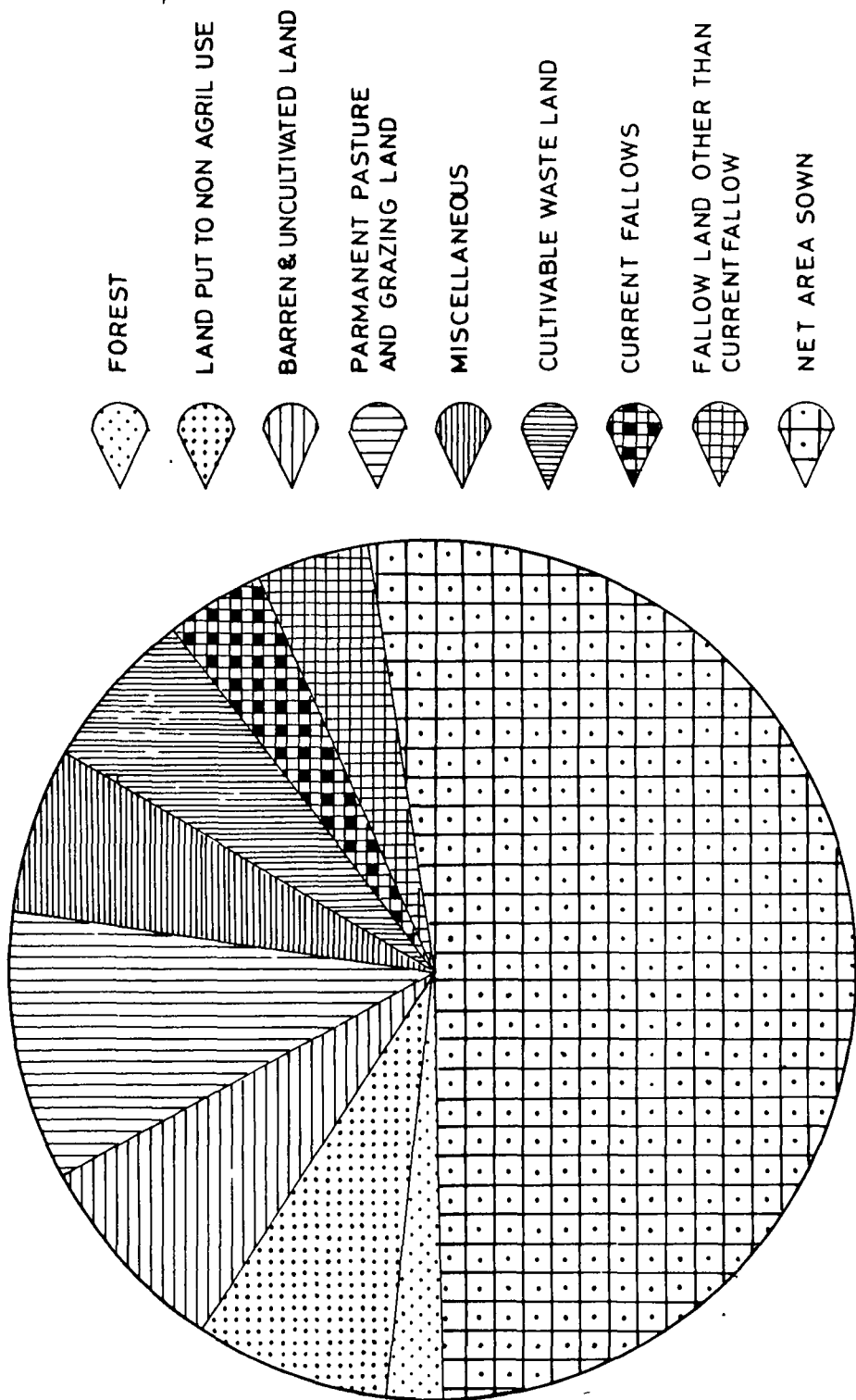


Fig. 3(a)

The above table gives an overall picture of general land use in Hajo Block. The total area of the Block is 89,116.9 acres, out of which 47,126.8 acres or 52.8 per cent is the net sown area. This indicates the significance of agriculture in the Block. The percentage of land put to nonagricultural use is 7.42, indicating again the agrarian nature of the Block. A similar amount 7,099.3 acres or 7.97 per cent of the total geographical area remains barren and uncultivable as there are large number of beels and swamps and the sandy charlands of Brahmaputra. The land under permanent pasture and grazing land is 8,824.5 acres (9.9 per cent), most of which are practically under unauthorised occupation, indicating the demand on cultivated land.

Every Assamese family of the Block, keeps a portion of basti land under miscellaneous tree crops, such as bettlenut, coconut, banana etc. and the percentage of land occupied by such use is 6.2 per cent. Current fallows, fallowland other than current fallows, and cultivable waste land, altogether occupy 13.94 per cent of the total geographical area of the Block. The possibility of agricultural expansion is relatively limited. In order to make this category of land cultivable, land use planning and investment for reclamation is necessary. Beels and swamps about in the area, which can be reclaimed

and may be used for the cultivation of Boro paddy in the winter months. The area sown more than once (generally known as double cropped land) in an agricultural year is 18,198 acres or 20.4 per cent of the total geographical area and 38.6 per cent of the net sown area. The percentage of double cropped land is quite high in comparison to the State's average, which is only 6.1 per cent. Similar is the case with total agricultural activity in the Block, more than half of the total geographical area, 52.88 per cent is put under agriculture. In the following section of this chapter, the agricultural land-use in the Block is discussed in some detail.

2.1 (f) Agricultural Land Use:

Land resources play an important in fostering man's economic, social and cultural progress. Among the land resources, agricultural land resource has played a vital role, engaging highest percentage of the inhabitants of the world³, (Noor Mahammad, 1981). The phenomenal growth of population has increased the pressure on land. Large scale urbanization and industrialization has led to gradual contraction of cultivable land. Therefore, to meet the growing demand of food and raw materials, there is a vital need to use every piece of land to its full potential

3. Noor Mahammad, *Perspective of Agricultural Geography*, Vol.III, Concept Publishing Co., New Delhi, 1981, p.159.

For the overall development of a region, in general and that of agriculture in particular, intensive landuse survey at micro-level is of utmost importance⁴, (Noor Mahammod, 1981). Landuse pattern, particularly agricultural landuse pattern of any region is closely related to its physical environment, including relative relief, soil qualities, drainage condition, availability of water resources etc. and are reflected in the land use, both at macro and micro levels. There are political and economic factors also, which have exerted influence on land use⁵, (Lahiri, 1981). However, to have a clear insight, the study of current landuse practices of any region is of utmost importance.

Agricultural landuse in Assam is characterised by a low percentage of cultivable land, high percentage of rice acreage of the total area sown. This picture of agricultural landuse is not much different in the Hajo Block. Agricultural landuse means the tillage of soil for cultivation of crops. The cultivators left an insignificant portion for grazing, poultry farming, horticulture, pisciculture etc. This is because of the lack of proper knowledge and experience among the cultivators.

4. Noor Mohammad, Op.cit., p.165.

5. Lahiri, S., "Landuse in Eastern Himalayan Region" in **Perspective of Agricultural Geography**, Vol. III (ed) Noor Mohammad, Concept Publishing Co., New Delhi, 1981, p.305.

Rice is the principal food crop and staple food of the people of Assam and in this Block, it is grown extensively. The cultivation of rice mainly follows the traditional methods — broadcasting and transplanting. Three varieties of rice is grown here, they are Winter rice (Sali and Bao), Summer rice (Ahu) and Spring rice (Boro). Out of these varieties, winter rice is grown extensively and mainly by the method of transplantation. There is another variety of winter rice, known as Bao paddy and is grown mainly in flood prone areas. The crop has the special ability to grow higher with the rise of flood water level during the monsoon. It is a flood resistant crop and has many varieties, among which the 'negheri' and 'Kakua' can stand 2 to 2.5 metres of flood water. It is sown by broadcasting method in the months of March-April and harvested in the months of November-December. The summer rice is locally known as Ahu and mainly sown by broadcasting method in the month of March and early April. Ahu paddy of HYV is grown by transplant method in those areas, where irrigation facility is available. This variety is known as Autumn rice, as it is harvested in the Autumn season (September and October). Most of the cultivators prefer this variety of Autumn rice, because after harvesting, they can make preparation of the same plot of land for winter Rabi crops, viz. Brinjal, Potato, tomato, onion,

Garlic, etc.

The spring rice (locally known as Boro paddy) is grown by the method of transplantation, in the months of November-December, and harvested in March-April, before the on-set of the Monsoon. People prefer to cultivate this variety of rice in beels and swamps, where water is available.

Among the four varieties of rice, Sali paddy occupies the largest area of 27,398.4 acres in the Block, accounting for 58.3 per cent of the N.S.A. and 57.5 per cent of total rice acreage in the Block. Most of the areas are double cropped with Ahu rice. Bao rice requires less labour and less care and occupies those areas which are flood prone or where, transplantation is not possible, due to deepness of water. Spring rice or Boro paddy occupies 2,938 acres or 6.2 per cent of the net sown area. During survey time, it has been observed that people gradually turn their interest in the Rabi crops cultivation and it can be expected that, in near future, with the spreading of irrigation facilities, wheat cultivation will cover a large acreage. At present, wheat occupies 1,994 acres or 4.2 per cent of the net sown area.

Pulses are also important food crops, grown

considerably in the Block. The acreage covered by all types of pulses is 3,088.4 acres or 6.7 per cent of the net sown area. The area under pulses fluctuates from year to year. Among the pulses, lentil, pea and Khesari are important. Lentil is sown with mustard, khesari and pea are sown in the rice field as 'relay crops'. Most of khesari is used as fodder.

Jute is an important cash crop occupying 3,128.4 acres or 6.6 per cent of sown area of the Block. Survey shows that jute cultivated area fluctuates from year to year, depending upon the price of jute in the previous year. Jute growing areas can be used for the cultivation of winter rice. On high land, after jute, the field may be used for Rabi cultivation. Rape, mustard and potato are the other cash crops, grown in the Rabi season, occupying 2,068.2 and 679.5 acres or 4.4 and 1.5 per cent of the net sown area, respectively.

Production of winter vegetables on large-scale is an important phenomenon, mostly in the south-eastern part of the Block, particularly, in those villages where irrigation facilities are available. In the south-eastern part of the Block, there are extensive 'Char' lands of Brahmaputra, which are inundated by annual flood. These are the areas where 'chillis, potato, radish, Brinjal, onion, garlic, coriander, tomato, etc. are

extensively cultivated by the immigrant muslim peasants. On the other hand, the native hindu peasants, prefer to grow mainly Brinjal, potato, tomato and other vegetables, where irrigation facilities are available.

Table 2.6
Agricultural landuse of Hajo Block, 1985-'86.

	Name of the crops	Cropped area in acres	Percentage of cropped area on net sown area
1.	Rice		
	(a) Autumn rice (Ahu)	17,368.6	36.8
	(b) Winter rice (Sali)	27,398.4	58.1
	(c) Spring rice (Boro)	2,938.1	6.2
2.	Wheat	1,994.0	4.2
3.	Pulses		
	(a) Khesari	990.8	2.1
	(b) Matikalai	956.2	2.0
	(c) Lentil	815.4	1.7
	(d) Pea	326.0	0.7
		3,088.4	6.5
4.	Rape and Mustard	2,068.2	4.4
5.	Jute	3,128.2	6.6
6.	Potato	679.5	1.4
	Net sown area	47,126.8	-
	Area sown more than once	18,198.0	-

Sources: SDC office, Hajo, 1986 (September).

Table 2.6 shows the ratio of cropped area on net sown area, of some important crops grown in the Block, where rice occupies the higher percentage. In some areas, farmers cultivate more than one crop at a time, on the same plot of land. Such relay crops are mostly Khesari, Lentil, Pea, Jeng Behar and Tesi. The standing crops are always either the Sali paddy or mustard.

The early maturing varieties of rice are grown in those parts, where irrigation facilities are available and where, in the post harvest period farmers can use the same plot for the cultivation of winter vegetables. Such as Brinjal, tomato, coriander, onion, garlic, etc. Among the early maturing varieties of rice — Jaya, Pusa (2-21), I.R.-8, Aijung are important. Area under each variety is comparatively low and is shown in the table (2.7).

Table 2.7.a
Area under H.Y.V. paddy, 1985-'86

Sl No	Name of the paddy	Area in acres	Percentage of cropped area on net sown area
1.	Jaya	3291.3	6.9
2.	Pusa (2-21)	2564.8	5.4
3.	I.R.-8	1025.5	2.1
4.	Aijung	3076.4	6.5

Source: B.D.O. office, Hajo Block, 1986.

2.1 (g) Intensity of Agricultural Land use:

The ratio of net sown area to the geographical area of each village expressed in percentage indicates the intensity of agricultural land use. The table 2.7.b shows the grouping of the villages under different intensity of agricultural land use. From the table, it can be seen that one-fifth of the total villages of the Block has very high intensity of land use, accounting for more than 80 per cent of the geographical area; followed by another

one-fifth of the villages having landuse intensity between 60 to 70 per cent. It is interesting to note that the number of villages in the range of 70-80 per cent landuse intensity is relatively low. Considering the Block as a whole, 30.7 per cent of the villages have significantly low intensity of agricultural land use (only 50 per cent or below; appendix F).

Mapping of the villages on the basis of intensity of agricultural landuse in the Block clearly indicates the impact of irrigation projects (Map 3.b). In other words, introduction of irrigation facilities has led to greater utilization of cultivable waste and fallow land in the Block, leading to a higher share of net sown area to the geographical area of the Block.

2.1 (h) Cropping pattern

Cropping pattern means both the time and space sequence of crops. The variation in the cropping pattern may result from variation in physical, economic and social factors. The physical factors like climate, topography, and soil etc. may, to a greater degree dictate as to what crops can be grown or can not be. Among the economic factors affecting the cropping pattern is the relative price of different products, cost of inputs

HAJO BLOCK
 INTENSITY OF AGRICULTURAL LAND USE
 1986

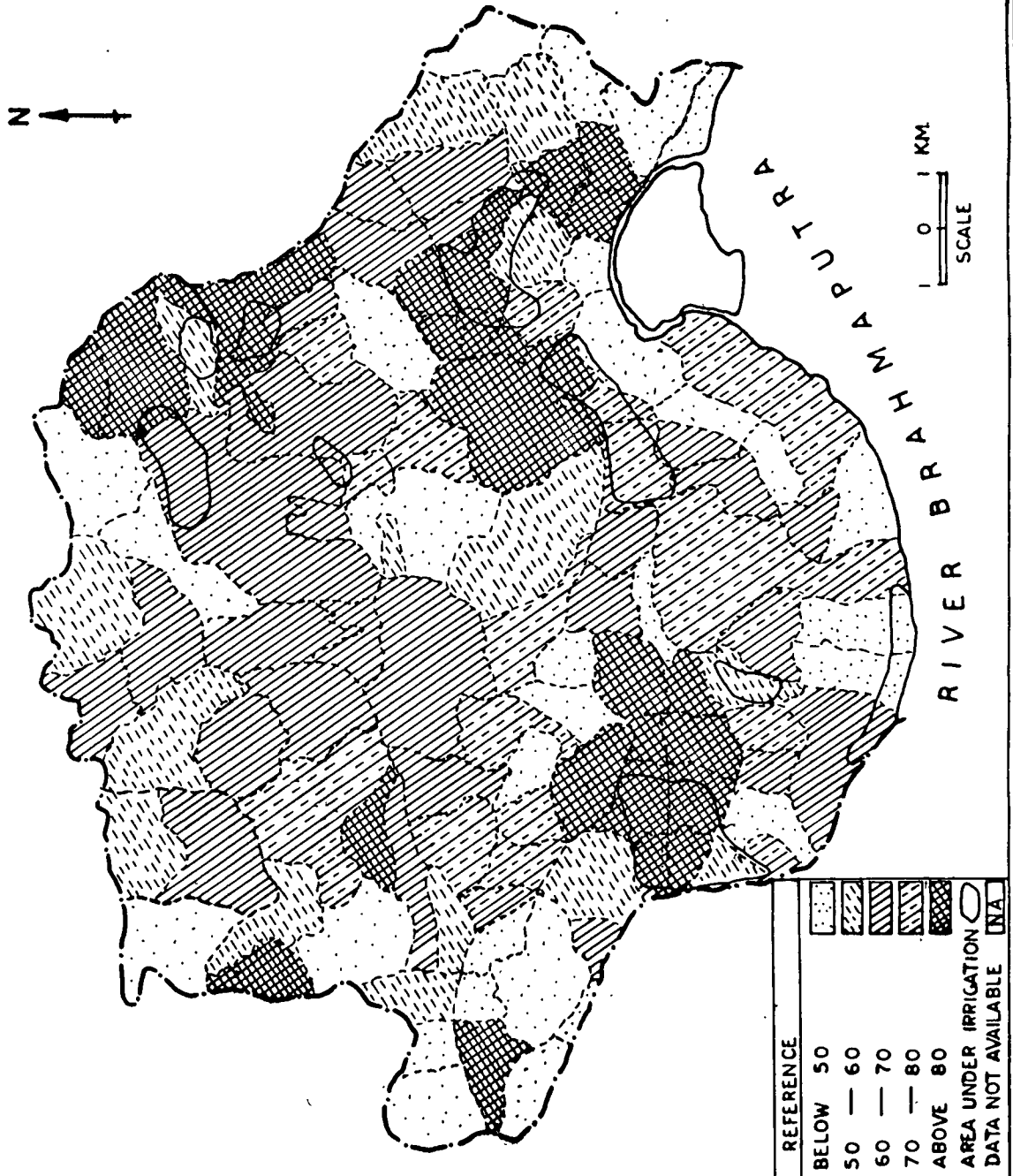


Fig. 3(b)

Table 2.7.b
Intensity of agricultural land use, Hajo Block, 1986.

Categories	Percentage ratio of net sown area to geographical area	Number of villages	Percentage
1. Very low	below 50	34	30.7
2. Low	50 59.9	13	11.7
3. Moderate	60 69.9	24	21.6
4. High	70 79.9	16	14.4
5. Very high	Above 80	24	21.6

Source: S.D.C. office, Hajo, 1986.

and marketability of perishable goods. Similarly, social and cultural values also have influence on cropping pattern like farmers preferences for certain traditional crops, or crops in which they have the traditional skills to grow.

Cropping pattern also depends on nature and availability of irrigation facilities. Where water is available, not only different crops can be grown, but even a double or triple cropping will be possible. Farmer may introduce new and remunerative crops, since the risks factors are considerably reduced. When new irrigation facilities are provided, the whole method of cultivation may also change.⁶

It is therefore, natural that cropping pattern differs from region to region; with the variations of natural conditions, the social and economic factors, irrigation facilities, farmers motivation all explain the present cropping pattern of a region.

All these factors governing the cropping pattern of an area are dynamic in nature. Except, the physical elements which take longer time to change, others particularly, the economic ones change very fast. Example of this kind is to the reduction of jute acreage in

6. Noor Mohammad., **Perspective of Agricultural Geography.**, Concept Publishing Co., New Delhi, Vol. III, p.334.

response to the fall in jute price. The technological development in agriculture, such as irrigation, soil and water conservation, use of fertilizers and other modern inputs, development of quick transportation better marketing facilities etc. have brought a tremendous change in the cropping pattern.⁷

The increasing population pressure on land and corresponding changes in landuse and cropping pattern have been studied by Shastri, at the micro level in the 'cotton belt' by Wardha district, by testing three hypotheses, viz. (i) intensity of cropping increases, with population growth, (ii) cultivated area increases, with increasing pressure of population on land and (iii) the existing cropping pattern of a region may be changed in response to population growth. But the study concludes that the hypotheses putforth are not substantiated as the cropping pattern remains almost the same with the population growth. Cultivated area slightly increased. There has been no change in the intensity of cropping with population growth. Thus, "unless the irrigation potential of an area is fully exploited, population growth would hardly have any impact on intensity of cropping."⁸

7. Singh, G.B., "Transformation of Agriculture", Kurukshetra, Vol. XXXI, 1979, p.12.

8. Noor Mohammod., Op.cit., p.522.

In the Hajo Block, cropping activities go on all the year round and three distinct seasons are noticed viz. (i) Kharif (June to October), (ii) Rabi (October to May) and crops grown between March to June, locally known as Zaid, when only Ahu paddy, jute and summer vegetables, such as, Cucumber, Snake Gourd, Ridge Gourd, Lady's Finger etc. are grown. There are extensive mono-cropping areas, where only either Bao (broadcasting) or Sali (transplanting) are cultivated, generally during May to October, utilising rain water. These are the areas around beels and swamps and are also found in deeper part of the vast paddy fields. Double cropping Ahu and Sali paddy are cultivated. Intensive cropping areas are confined to 55-60 metre contours, where multiple cropping are practised. In this part, where assured water supply is available, one can find crops all round the year. In some villages, relay cropping i.e. one crop sown under a standing crop is also practised extensively. In such type of cropping, Sali paddy is always the standing crop and the companion crops are Khasari (used mainly for fodder), Tesi (one type of oil seed), Jeng Behor (a type of mustard), and pea. In the Rabi season, the standing crop is mustard and the companions are lentils. In some villages, Potato with Pumpkin as companion is noticed, particularly in the Pub-Bongsor Mouza.

Hajo Block comprises four Mouzas. Each Mouza contains a group of villages. The table (2.8) shows the distribution of villages in each Mouza and the fig(4) indicates the various landuse by bar graphs. Among the four Mouzas, Hajo Mouza has a maximum geographical area of 29385.1 acres, of which 39.8 per cent is net sown area with 12.6 per cent double cropped land. The cropping intensity is 131.6 per cent which is quite low. Similarly, Ramdia Mouza, having 9538.8 acres of net sown area (50.7 per cent), with only 16.0 per cent under double cropping shows low cropping intensity, (131.5 per cent). On the other hand, Pub-Bongsor Mouza having less geographical area (22,637.3 acres) contains 48.3 per cent cropped land, shows comparatively higher cropping intensity of 145.4 per cent. Pachim Bongsor Mouza ranks second in the cropping intensity (142.4 per cent).

Table 2.8

Mouza-wise Landuse and Cropping Intensity of Hajo Block

Sl No	Name of Mouza	Number of village	Geographical area in acre	Net sown area (acre)	Double cropped land	P.C.of NSA to geog.area	P.C. of double cropped land	Cropping intensity in p.c.
1.	Hajo	24	29,385.1	11,684.0	3,702.1	39.8	12.6	131.6
2.	Pub-Bongsor	36	22,637.3	10,924.3	4,565.3	48.3	22.0	145.4
3.	Pachim Bongsor	35	19,030.1	8,687.3	3,685.4	45.6	19.4	142.4
4.	Ramdia	26	18,815.9	9,538.8	3,011.4	50.7	16.0	131.5

Source: SDC office, Hajo, 1986.

HAJO BLOCK MOUZA WISE
 AGRICULTURAL LAND USE PATTERN
 1986

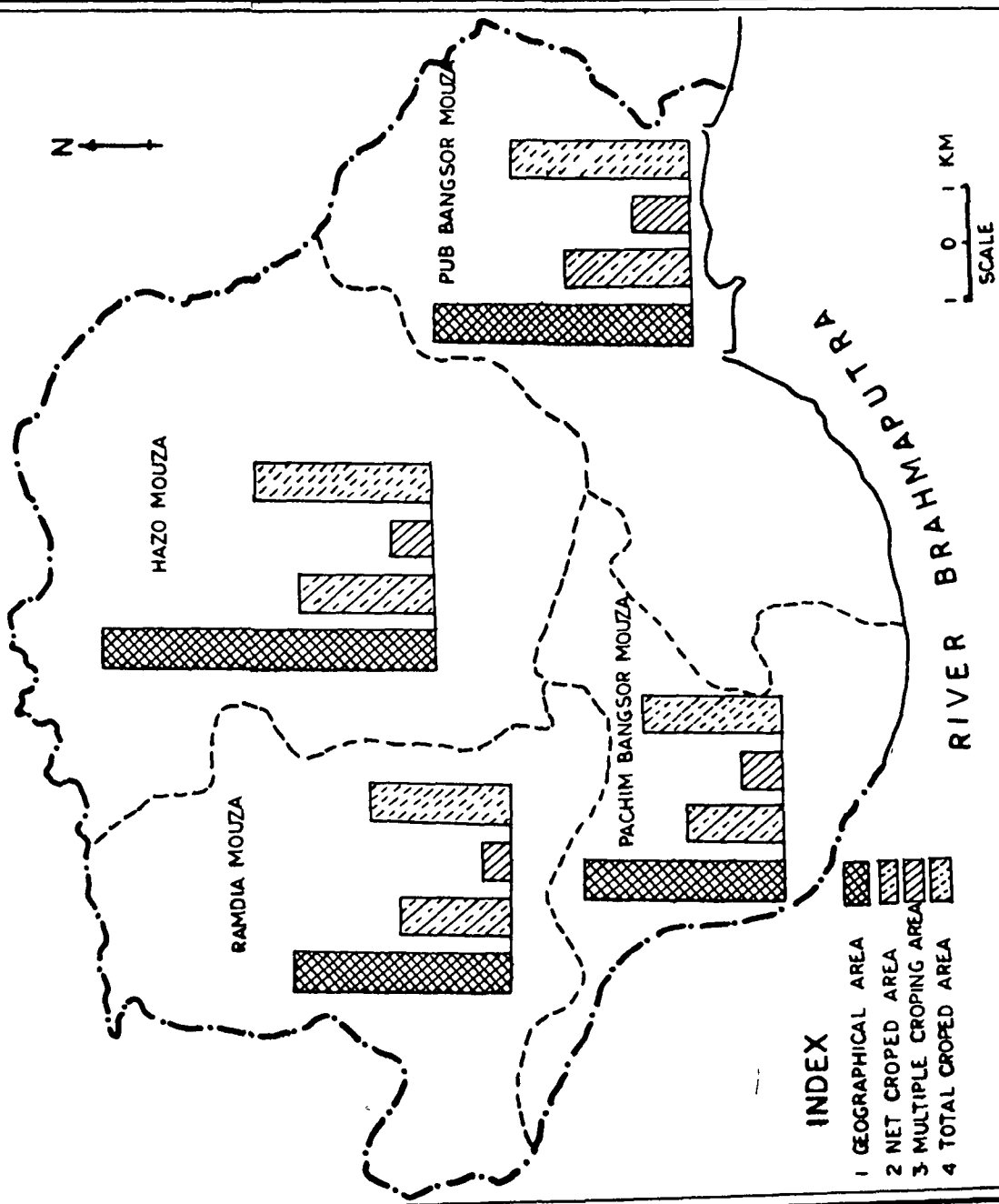


Fig. 4

The cropping intensity of each Mouza is calculated by the formula, $\frac{G.C.A.}{N.S.A.} \times 100$.

2.1 (i) Intensity of Cropping

In Hajo Block, it has been found that the landuse pattern is almost the same throughout the Block and whatever changes took place can be attributed to the development of irrigation, other technological change and positive response of farmers to the new methods and innovations.

The cropping intensity value for each village is calculated by the formula, $\frac{G.C.A.}{N.S.A.} \times 100$; where G.C.A = Gross cropped Area, N.S.A = Net Sown area. The percentage values are grouped into five classes. Table (2.9) shows the grouping of the villages under different intensity. The cropping intensity indices vary from a minimum of 100, to a maximum of 200 or more.

Table 2.9
Intensity of Cropping in Hajo Block, 1986

Categories	Percentage ratio of Gross cropped land to net sown area	Number of village	Percentage
1. Very low	100 - 120	23	20.1
2. Low	120 - 139.9	29	25.4
3. Moderate	140 - 159.9	32	28.0
4. High	160 - 179.9	23	20.1
5. Very high	More than 180	7	6.1

Source: SDC office, Hajo, 1986.

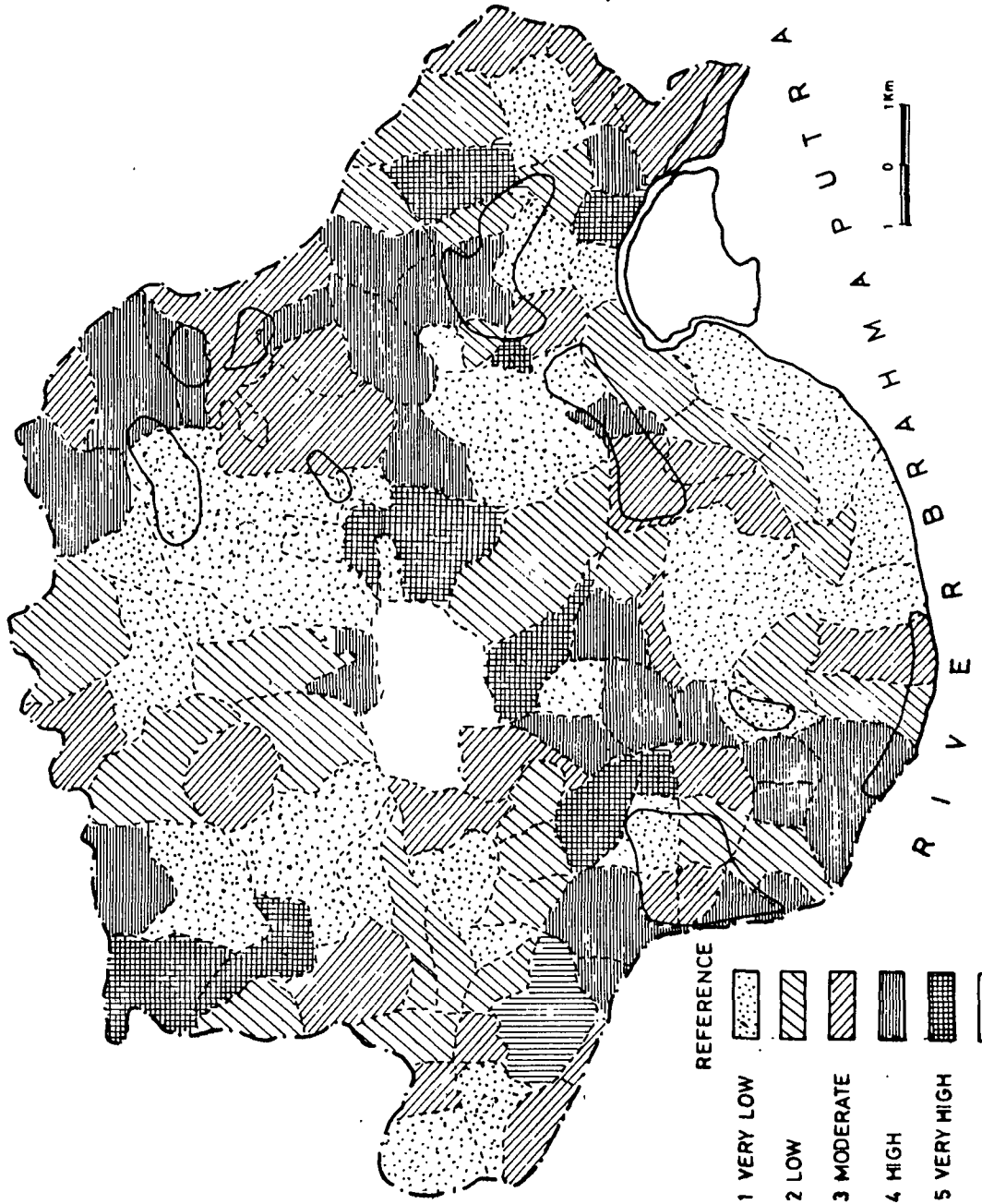
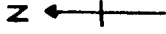
2.1 (j) Spatial variation in the intensity of cropping

Fig.5a representing spatial variation in the intensity of cropping, presents a highly diverse and interesting picture. Nearly 20 per cent of the total villages of the Block has high intensity of cropping and a similar number of villages show very low intensity of cropping. 28 per cent villages have moderate intensity of cropping, ranging from 140 to 159.9 per cent and another 25 per cent villages present low intensity in between 120 to 139.9 per cent. Only 7 villages, comprising 6 per cent of the total villages of the Block, present a bright picture with very high intensity of cropping. This intensity of cropping clearly indicates the impact of irrigation project of the Block.

2.2 The System of Irrigation

Irrigation is a process of artificially supplying water to the soil for raising crops, in areas where the total rainfall is either insufficient, or is ill timed. If a region has a good amount of rainfall well distributed over the seasons, nothing need to be done. But, such conditions are rare. There are some regions where rainfall is sufficient, but does not fall at the proper time, there would be the necessity of some sort of irrigation, assuring water supply in adequate quantity, when needed.

HAJO BLOCK
 INTENSITY OF CROPPING
 1986



- REFERENCE
- 1 VERY LOW [stippled pattern]
 - 2 LOW [diagonal lines]
 - 3 MODERATE [cross-hatch pattern]
 - 4 HIGH [horizontal lines]
 - 5 VERY HIGH [vertical lines]
 - 6 NOT AVAILABLE [NA]
 - 7 IRRIGATED AREA [circle]

Fig. 5(a)

For the agriculture development of Hajo Block, the Irrigation Department, Government of Assam, have taken up five irrigation schemes, under Minor Irrigation Project. During the last few years, particularly, in the sixth Five Year Plan period, a number of Rural Development Programmes have been initiated by the Government of India. The Rural Development Department, at the State level are the implementing agencies of these programmes. Minor Irrigation Schemes of Hajo Block under the Rural Development Programme, includes three units of lift irrigation schemes, using the water of Puthimari River, Dadara-Pacharia Tube Well scheme with 12 wells and Bongsor-Halogaon Tube well scheme. Some of the wells are not workable due to some defects in boring or some mechanical failures. Out of the 12 tube wells of Dadara-Pacharia Scheme, only 5 are now in working condition. However, the performance of these public operated irrigation systems are found wanting in management. There is a large gap between the installed irrigation potential and the amount of irrigated water used by the farmers.

As a measure of providing assistance to the Small and Marginal farmers, for agricultural production, the Government of India has introduced a Project for Assisting Small and Marginal Farmers for Agricultural Production (PASMFP)⁹. This programme is implemented in the

9. **Agricultural Guide Book**, Department of Agriculture, Government of Assam, 1985-'86.

four districts of Assam, i.e., Goalpara, Kamrup, Nagaon and Karbi-Anglong. The allocation for this programme has been fixed at Rs.5.00 lakh per Block, during 1983-'84, and out of the five lakh Rs.3.5 lakh has been earmarked for minor irrigation schemes. A number of beneficiaries, under this scheme has been selected for installation of shallow tube wells and pumpsets in this Block. The beneficiaries were provided with bank loan and a subsidy for installation of tube wells. In the Singimari and Gandhmow villages, there are 11 such tube wells. These tube wells are found to be more suitable for raising the agricultural production, particularly, the production of Rabi crops.

2.3 Description of the Project

For the agricultural development of Hajo Block, the Minor Irrigation Department, Government of Assam, have implemented a number of irrigation schemes during the Sixth Five Year Plan. The project includes different schemes as shown in the table (2.10).

Out of the five schemes, the Bagta-Boromboi and Guwahati Electric Lift Irrigation Scheme are electrically operated and use the surface water of Puthimari river. The remaining schemes are tube well system, tapping the ground water for irrigation. In the lift irrigation

Table 2.10
Irrigation Schemes of Hajo Block.

Sl No	Name of the Scheme	Sub-Scheme	Type of irrigation
1.	Bagta-Boromboi	-	Electric Lift Irrigation
2.	Guwahati, E.L.I.S.	(a) Ketakibari (b) Mokhonia (c) Monahkuchi	-do- -do- -do-
3.	Bangsor-Halogaon	-	Deep Tube-Well.
4.	Dadara-Pacharia	-	-do-
5.	Singimari and Charmjuli	(a) Singimari (b) Charmajuli	Shallow Tube well -do-

Source: Irrigation Department, Govt. of Assam, 1986.

system, concrete hume pipes and brick drains are used for bringing water to the field. There are no distribution channel from the main canal, which is one of the drawbacks felt by the farmers. In the tube well system, there are only 100 metre long and 0.6 metre wide drain for the distribution of water to the field. Over and above these irrigation schemes sponsored by government, there are a good number of private minor irrigation works under the IRD Programme, sanctioned to the progressive farmers, on the approved rate of subsidy, applicable to the small and marginal farmers.

Out of all the schemes, the individual minor irrigation works are found to be suitable and much beneficial to the farmer and the working are satisfactory.

2.4 Coverage of the Project

Together, five irrigation schemes, under the minor irrigation project, covering gross command area of 3028 acres is operative in the Block. This is nearly 6.4 per cent of the net sown area of the Block. (Table 2.11). From this point of view, it may be said that the irrigation activity in the Block has yet to cover a significant amount of land put under agriculture. In other words, one may observe that the whole irrigation activity of the Block is at its very initial stage.

Table 2.11
Area under Irrigation Schemes

Sl No	Name of the Scheme	Gross command area in acre	Net irrigated area		Length of canal in metre
			Kharif	Rabi	
1.	Bagta-Boromboi	800	600	550	2800
2.	Guwahati E.L.I.S.				
	(a) Ketakibari	160	115	125	300
	(b) Mokhonia	-do-	115	125	
	(c) Monahkuchi	-do-	115	125	
3.	Bangsor-Halogaon	593	210	205.4	150
4.	Dadara-Pacharia	1025	86.5	36.8	Very small
5.	i) Singimari	65	Nil	50	Very small
	ii) Charmajuli	65	Nil		

Source: Minor Irrigation Department, Govt. of Assam, 1986.

(1) Bagta-Boromboi lift irrigation scheme, uses the water of Puthimari River, near the Bagta chok. Water lifted from the river through electrically operated pumps and supplied to the fields, through canals. Hume pipes are used for a length of 150 metres and the remaining portion

of the canals are of B.C. structure. The total length of the canals are 2800 metres. From the main canal, there is no distributing drains. Therefore, water is not easily available to all the plots of the command area.

(2) Ketakibari-Mokhonia-Monahkuchi Scheme, includes three centres with canals of 300 metre length each. There are no subcanals constructed and water accumulates in the depression. In these three units the discharge of water has been made with three separate electrically operated pump-sets and lifting of water is done from the same river.

(3) Bongsor-Halogaon tube well scheme has 1025 acres of command area. Here also, the lack of branch canal from the point in different direction makes the scheme less effective.

(4) Dadara-Pacharia tube well scheme has 593 acres of command area. Water is supplied through a single drain of 150 metre in length. Most of the farmers supplied water to the field by making temporary channel through their plots. But lack of proper gradient in the field reduces the importance of the scheme.

(5) Singimari-Charmajuli Shallow tube well scheme contains

12 number of tube wells under two units having a command area of 70 acres each. Electrically operated pumpsets are used. Frequent current failure, lack of proper field distribution make the scheme of limited success.

Proposals of other two schemes of this kind is made by the Irrigation Department, Government of Assam, and the installation will be completed during the Seventh Plan Period.

Among other irrigation schemes, mention may be made about the private shallow tube wells, which are found to be beneficial to the cultivators. The general feeling of the beneficiaries is that they can irrigate their field, whenever necessary from the private well with the help of Diesel pumpsets and drain water to the plots, through iron pipes without field canals. In the public tube wells and lift irrigation systems, water becomes available at a time, but, during that time, water may not be needed to the crops of all the farmers of the command area.

2.5 Proposed system for release of water:

The irrigation schemes of Hajo Block are in an advanced stage of implementation in the on-going schemes and are capable of yielding, at present, only an insignificant benefit to the farmers. It is expected

that, the works of these on-going schemes will be completed during the Seventh Plan Period.

For better utilization of the existing irrigation potential, construction of field canals, levelling and shaping the fields are urgently necessary. This will increase the number of beneficiaries and irrigation facilities can be extended to the last point to which it is proposed to be irrigated.

It goes without saying that for successful implementation of any scheme undertaken by the Government, peoples' participation is essential and it will accelerate the completion of the proposed works.

In irrigated farming, water is the main input. The use of other inputs depend only on the availability of water. So, equitable distribution of water to all parts of the field should be planned.

There are some other proposals of installation of Deep Tube Wells in the Khetri-Hardia and Bamundi area of the Block. The preliminary survey works of these proposed schemes have been completed.

Another Minor Irrigation Scheme the sprinkler system has been proposed to start in the Laheswri Char

area. Brahmaputra char areas are generally fertile with young alluvial soil renewed every year by regular floods of the river. These char lands are the important areas for the cultivation of vegetables in the winter season. If water is made available by installing irrigation works, these areas will be grainaries of vegetables and crops like mustard, potato, onion, garlic etc. can be grown in plenty.

The benefits derived out of irrigation, particularly, in the Pub-Bongsor Mouza, where the farming practices have been changing gradually from subsistence to market oriented cropping system, encourages the farmers of the area to install private tube wells. Thus, there are proposals from the Government to sanction institutional credits and admissible subsidy to the small and marginal farmers for the installation of private shallow tube wells.

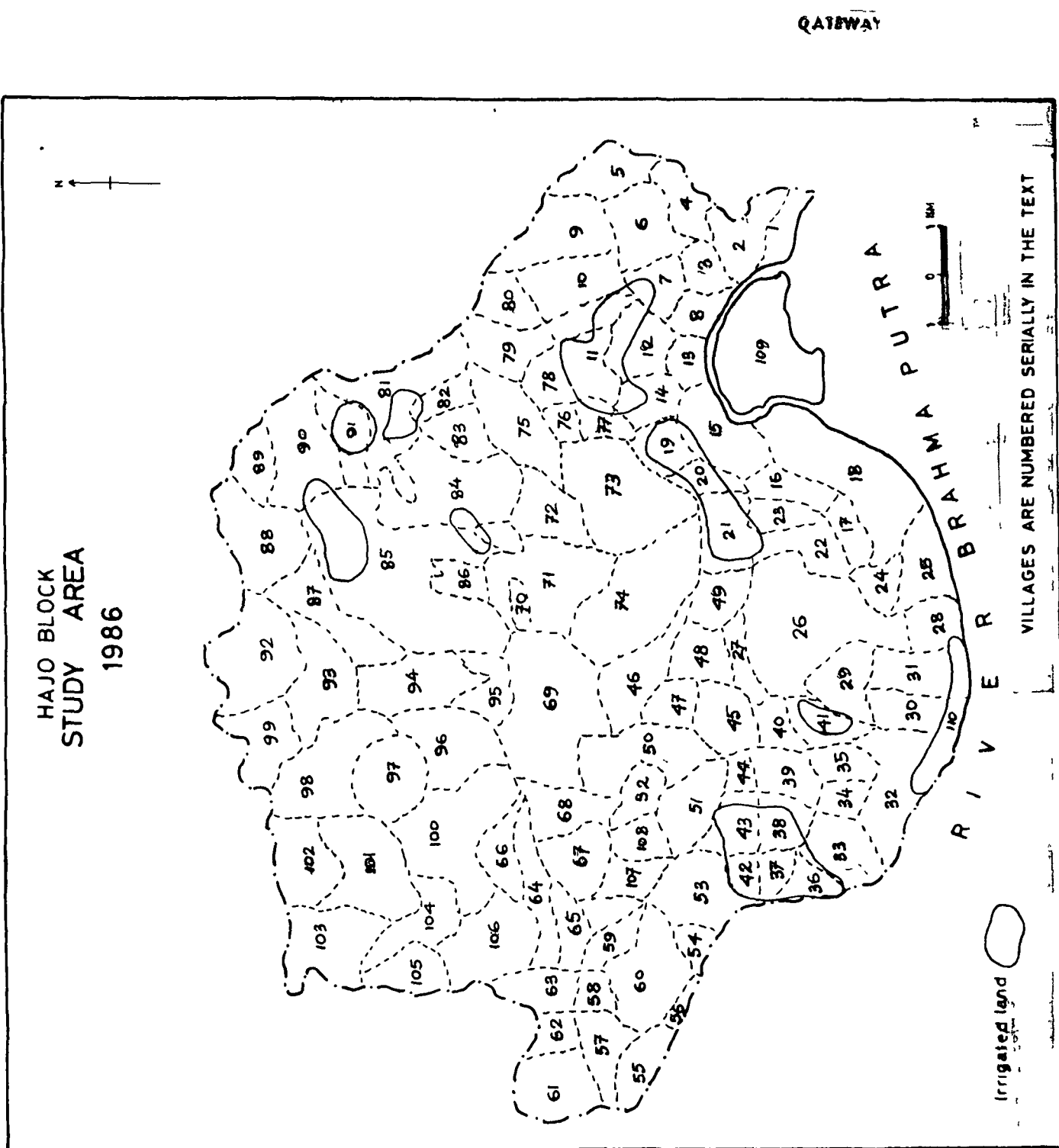


Fig. 5(b)

HAJO BLOCK

Villages with serial numbers

- | | |
|------------------------|------------------------|
| 1. Charmajuli Pam | 31. Srihati No.3 |
| 2. Charmajuligaon | 32. Barlah |
| 3. Dalibari No.1 | 33. Bamundi Hatimura |
| 4. Dalibari No.2 | 34. Halogaon No.1 |
| 5. Bargaon | 35. Halogaon No.2 |
| 6. Pub Dadara | 36. Bamundi |
| 7. Dadara | 37. Sabansah No.1 |
| 8. Pachim Dadara | 38. Sabansah No.2 |
| 9. Pacharia Dalarpahar | 39. Sabansah No.3 |
| 10. Pacharia | 40. Sabansah No.4 |
| 11. Goriapara Pacharia | 41. Sarudampur |
| 12. Singimari No.1 | 42. Khetri Hardia No.1 |
| 13. Singimari No.2 | 43. Khetri Hardia No.2 |
| 14. Rowmari | 44. Hardia |
| 15. Niz Gondhmow | 45. Maldahar Pam |
| 16. Gondhmow No.1 | 46. Ujan Takradia |
| 17. Gondhmow No.2 | 47. Bangaltola |
| 18. Bamun Soalkuchi | 48. Takradia |
| 19. Bongsor No.1 | 49. Bongsor |
| 20. Bongsor No.2 | 50. Nadia |
| 21. Niz Bongsor | 51. Ujan Kuri |
| 22. Sanpara gaon | 52. Major Kuri |
| 23. Ambari | 53. Hardia Pam |
| 24. Bathan | 54. Hardia gaon |
| 25. Bathan Pam | 55. Dakonia No.1 |
| 26. Sanpara parbat | 56. Dakonia No.2 |
| 27. Sanpar | 57. Solmari No.1 |
| 28. Sarulah | 58. Solmari No.2 |
| 29. Srihati No.1 | 59. Bongal para |
| 30. Srihati No.2 | 60. Tarabari |

61. Kholiahamari No.1
62. Kholiahamari No.2
63. Andhupara
64. Bhalkor No.1
65. Bhalkor No.2
66. Bihdia
67. Gondhlitari
68. Haria
69. Niz Hajo
70. Abhayapur
71. Garua
72. Bardadhi
73. Kulhati No.1
74. Kulhati No.2
75. Bahana
76. Uttar Pakor Kona
77. Dakhin Pakorkona
78. Khudra Kulhati
79. Niz Pacharia
80. Borijani
81. Ketakibari
82. Bausi
83. Tetelia
84. Monahkuchi
85. Bagta No.1
86. Hadala
87. Bagta No.2
88. Japia
89. Dikhu Helsa
90. Ukhru
91. Mokhonia
92. Dihina
93. Akadi
94. Bagta No.3
95. Rajabazar
96. Khopanikuchi
97. Kalitakuchi
98. Kumarpur
99. Dakhin Singra
100. Soniadi
101. Hajo chanal
102. Chorabari
103. Hablakha
104. Dawar Kuriha
105. Kismot Kuriha
106. Bornigaon
107. Barbakra
108. Sarubakra
109. Rakhasini char
110. Laheswri char

C H A P T E R - I I I

ANALYSIS OF THE FUNCTIONING OF THE PROJECT

3.1 Functioning of the project

Availability of water:

The importance of irrigation to improve the intensity of agriculture hardly needs any emphasis. It is realised that more supply of water with HYV of seeds and fertilizers will not serve the purpose, but supply of water at the right time and in adequate quantity is necessary¹. From the total water supplied to the land, a portion passes across the field, a part is absorbed by the soil and a portion of the water supplied evaporates. Thus, only a fraction of the irrigated water is used for the nourishment of the crops in the field.

Surface runoff of irrigated water can be reduced by levelling and consolidation of the cultivated land. But, the fragmentation of landholdings makes it impossible for scientific utilization of the irrigated water. Again, the application of water to the crops needs some knowledge of agricultural engineering and agri-botany. In the Block, with 29.5 per cent literacy and with nearly no literate cultivators, it is hardly expected that they could use

1. Khanna, S., "Command Area Development in Chambal", Kurukshetra, Vol. XXXIII, No.6, 1985.

the irrigated water judiciously. All the above factors make it very uneconomic to distribute water to all parts of the fields in the command area in a more scientific and economic way. During the field survey, some cultivators showed dissatisfaction in respect of the supply of water to their field. Dissatisfaction among the farmers of Bagta-Boromboi scheme is created by the defective alignment of the canals. The canals do not follow the gradient of the field. The alignment of the canal in some places has been made in such a way that, it has been passing through depressions, without touching the highland plots. In order to eliminate such defects, proper levelling of the fields are necessary to which little attention has been paid in the command area of the lift irrigation scheme.

In the Singimari village, where, out of twelve number of tube wells, distributed evenly in the field, without field channel or channel with limited length, only 5 are in working condition and the rest are lying idle due to nonrepair and lack of maintenance. Thus, absence of repairing facilities make it impossible for cultivators to set things right quickly when major breakdown in the system takes place. Frequent current failure is another factor which very often stands as an obstacle in the supply of water to the fields in time of need.

Farmers with adequate agricultural land (more than 3 acres) can acquire Bank loans with 33 per cent subsidy and thereby, can install a number of tube wells with diesel pumpsets. These tube wells are found to be suitable as the farmers can irrigate the plots at the time of need and at their convenience, although, the working capital works out to be relatively more.

3.2 Spatial distribution of water

The physical conditions have caused spatial variations in distribution of the water resource. Canal is the major source of irrigation in India, but, it is a large-scale adventure and is out of the reach of individuals. Further, it cannot reach every point of the cultivated area².

The various schemes of Minor Irrigation Project of Hajo Block are in its initial stage. According to an estimate, command area with 3028 acres of land having irrigation potential till 1987, only 1231 acres have actually been irrigated. The low potentiality is mainly due to the absence of field channel and lack of proper management and development of the command area.

2. Sharma, S.K. and Jain, C.K., "Use of water resource for Irrigation and Agricultural Development: A Case study of Madhya Pradesh", Perspective in Agricultural Geography, (ed) Noor Mohammad, (Concept Publishing Co., New Delhi), 1981.

Elaborate extension of field channel are needed to facilitate the use of irrigation nearly to all the corners of the field. But, the absence of such channels in the scheme for the fields lying away from the main canal puts restriction on the supply of water and thereby limiting the utilised potential of the project.

With a view to increasing the yield rate, modern inputs in agriculture are used, but when the use of such inputs, viz. water, HYV seeds, fertilizers etc. are not available in adequate quantity and in time, the reverse will be the result. During the field survey, some farmers were found to be reluctant to use HYV seeds, as it sometimes results in decline in the yield. Similarly, use of fertilizers without testing the soil may lead to and may disturb the soil balance. With the application of fertilizers and use of HYV seeds to the land, supply of water at right time and in adequate quantity is of equal necessity for increasing productivity.

Ractification of all these drawbacks of modern agriculture needs a command area development programme, which includes — levelling and shaping of the plots, maintenance of crop specific routine for supplying water and to educate the farmer for practising agriculture on modern line, the service of Village Level Extension Workers (VIEW), in this stage of development is highly

essential for creation of an impression in the minds of the farmers, so that, not only the farmers but the young generation may take up agriculture as a remunerative occupation.

3.3 Adequacy of water

During summer months high rainfall keeps the soil saturated with water, except in the field at higher elevation or in the slope. At that time, importance of irrigation becomes secondary for the farmer. But, at the time of Rabi cultivation (during winter months), irrigation gets top priority. Practices of scientific method of agriculture is gradually becoming popular among the farmers of the Block. Farmers, whose economic status are sound and whose plots are located on the irrigable zone of the wells or canals, intensity of cropping is found to be high.

Lack of proper gradient in the cultivated fields, irrigation water accumulate in depressions and the coverage becomes limited. Particularly, in the Bagta-Boromboi area, absence of branch canal, coverage of irrigation water is found to be less and accumulation of water in depression is often harmful. In other areas of the Block, where source of water is shallow tube-wells, farmers use iron pipes for draining water to their fields from

the source and by keeping the lower end of the pipes on the higher portion, they generally irrigated their fields. But, this practice of distribution of water requires extra labour and planning for distribution of the irrigated water.

3.4 Maintenance of the scheme

Maintenance of drainage system is found to be defective. In case of canal irrigation, the brick floor of the canal with innumerable leaks permit water to percolate down the soil, as a result, the excess water in the leaking section of the canal damages the crop, wash away the fertility and thereby leading to low production. The tail-reach farmers suffer from failure of crops for non availability of water. Again, development of cracks in some part of the canal wall, creates scarcity of water for the tail-enders, which results in under utilization of the potential created by the scheme. Thus, it is found that, for proper functioning of the canal, maintenance is of crucial importance.

From field survey, in the well irrigated region of the Block, it is found that only 42 per cent of the tube-wells are presently in working condition. Absence of repairing facilities nearby, makes it impossible for the cultivators to keep the crop schedule.

3.5 (i) Position of the selected plots

Fig.6 is a cadastral map of Gondhmow village showing the layout of the cultivated plots and the position of the Shallow Tube-Wells. There are 253 cultivated plots, owned by 85 families, settled in linear pattern along the road joining Guwahati with Soalkuchi. The pattern of the village is quite different from an ideal Assamese village, where the basti lands are full of betelvine, arecanuts, coconuts, banana, Jeakfruit, mango and other trees and citrus lemons. Here, people use the land mainly for cultivation of crops and vegetables.

In the north-eastern part of the village, there is irrigation facility with five tube-wells and in the south-western part of the village, there is no irrigation facility. Thus, while both the part of the village enjoy the same geo-climatic conditions, irrigation makes the major factor of difference in the farm practice.

3.5 (ii) Agricultural land use

Three distinct types of agricultural land use is noticed in the village, they are, (a) Summer or Ahu paddy and jute during March-April, Sali paddy and summer vegetables (from April to October), and cultivation of winter vegetables as Rabi crops. Fig.6, shows that around the tube-wells cultivated plots are occupied by rabi crops, mainly of winter vegetables, such as Brinjal,

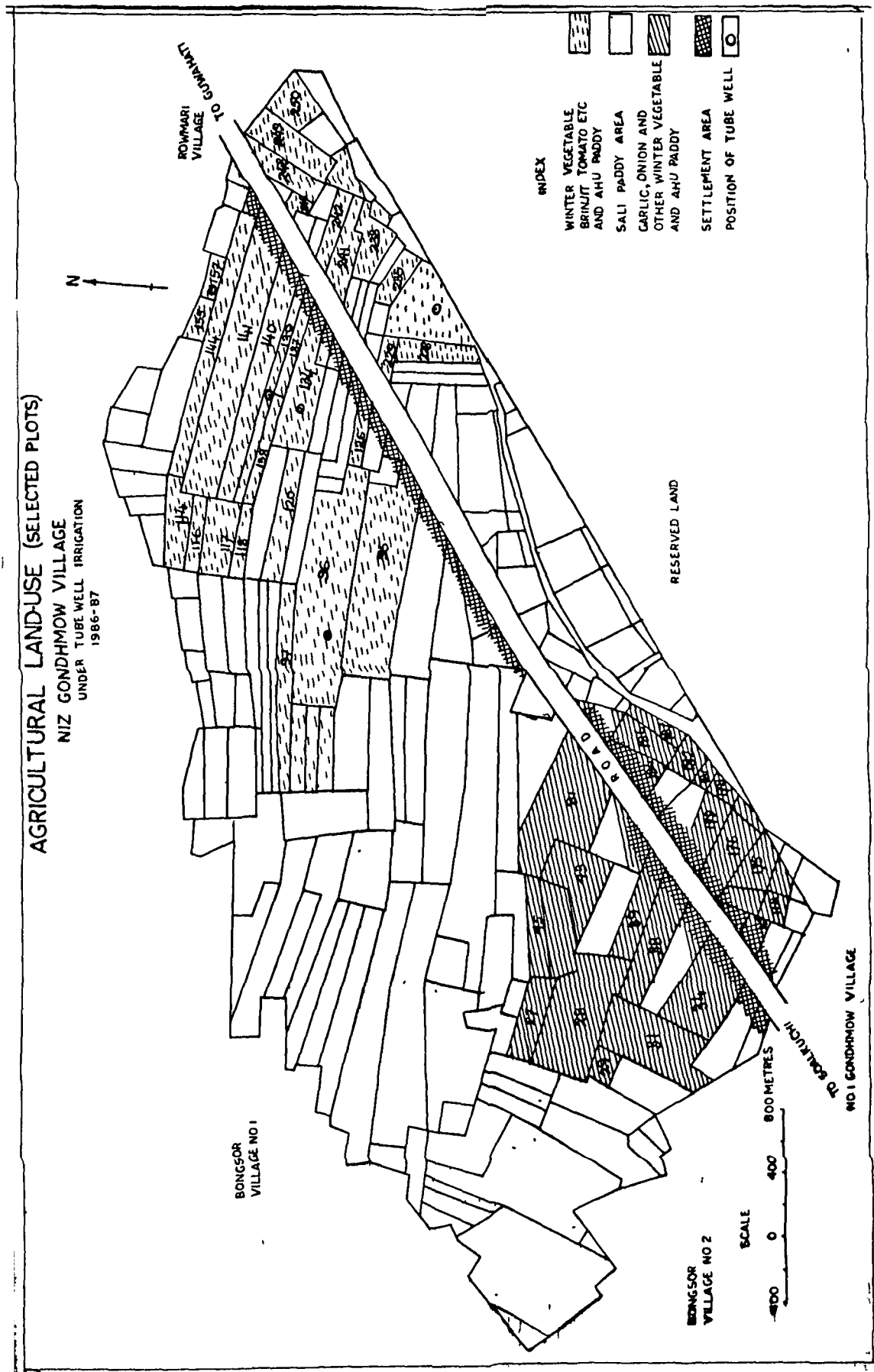


Fig- 6

Tomato, peas Potato, Pumpkin, etc. which require more water, more fertilizers, better care and other modern inputs. These plots are located to the settlement area. At the time of plucking of brinjal, green peas, tomato and coriander leaf, the whole family works to supply atleast one to two quintals of such vegetables to the nearby Singimari wholesale vegetable market.

The cultivated plots are mostly occupied by brinjal and tomato plants during the survey period and when asked about their selection of crops, they were of opinion that a brinjal plant produces 15 to 20 kg of vegetable, during the period from November to March, (before the sowing of **Ahu** and jute), and the farmers can pluck atleast one to two brinjal from each tree within a day or two. Thus, the output of these vegetables are quite high, at the same time, the crop requires more inputs than other crops. From the later part of March, farmers cultivate **Ahu**, jute on these plots. After the harvesting of **Ahu** paddy, the same land may be put under **sali** crop of early varieties so that, they may use the plots for winter vegetables again.

The unirrigated south-western part of the village is settled mainly by Assamese Muslim population. In this part, agricultural land use and cropping pattern is quite different from the Hindu settlement area of the village.

In this part, there is no irrigation facility, except from the road side depressions or from some backwaters of small streams of the flood plain areas of Brahmaputra. On such young alluvial fertile land, people cultivate

Table 3.1
Plotwise land-use: Some selected plots of Gondhmow village

Hindu house holds	Cropped area in acre	Plot numbers use for cultivation of winter vegetables and <i>Ahu</i> paddy	Winter vegetables cultivated	Total acreage
1	0.7	117, 144, 157, 246, 248.	Brinjal	0.5
2	1.7	114, 116, 140, 141, 241, 242, 249.	Tomato	1.3
3	2.0	120, 133, 138, 139, 228, 235	Potato pea	1.5
4	1.7	119, 132, 195, 229, 232	Pumpkin	0.8
5	0.9	126, 197, 233, 234	Pulses and other vegetables	0.6
Total	7.0	28 plots		4.7
Average	1.4	5.6		0.94
Muslim household				
1	1.32	182, 184, 187, 43		1.0
2	1.65	27, 45, 81, 186, 191	Garlin	1.2
3	1.3	28, 39, 178, 179, 183	Onion	1.0
4	3.3	23, 29, 31, 38, 176	Coriander, Pea,	2.4
5	2.0	34, 165, 168, 175	Potato, Tomato Pumpkin and other vegetables	1.8
Total	9.7	23 plots		7.4
Average	1.9	4.6		1.48

Source: Field Survey, 1986.

mostly Garlic, onion, coriander, Pea and wheat. Production of garlic per acre is about 1200 to 1500 kg. It is natural

that agricultural landuse, cropping pattern, crop combination etc. vary with the community, reflecting indirectly the caste/community in a village³. In Gondhmow village, out of the 85 families, 45 families belong to Muslim community and the rest are Hindu. Hindu settlements are in the approach of the village.

Cultivated plots are open field systems. The fields are rectangular or square, long strips and at some places triangular. One marked difference of the plots are that in and near the settlement areas, the size of the plots are smaller than those located away from the settlement zone. Second important point to be noted is that those crops need special care and more inputs and therefore, are cultivated near the built up areas of the village. Plots of each farmer are fragmented and scattered, which is a major drawback in modernisation of agriculture.

Along the flood plain of Brahmaputra, in the areas outside the embankment, cultivation of Onion, Garlic, Coriander, wheat and Pulses are extensive due to the favourable edaphic condition for cultivation of these crops.

3. Negi, B.S., *Rural Geography*, (Kedar Nath Ram Nath), Meerut University, p.93.

3.5 (iii) Cropwise use of irrigation

There is no reliable data on cropwise use of irrigation. The selected cultivators are able to give information only on how many times, they usually supply water to their crops. During normal rainy season, for sali paddy cultivation, use of irrigation is practically nil, but, before the onset of the monsoon, for cultivation of Ahu paddy, jute and summer vegetables, viz. cucumber, ridge gourd, snake gourd, bitter gourd, pointed gourd, ladies' finger and others, farmers irrigate the fields one or two times per crop in the areas where irrigation facility exists. During winter months, when rainfall is practically less or nil, for the cultivation of winter vegetables, irrigation is most essential during this period. Farmers irrigate the fields for 4 to 5 times at an interval of 12 to 15 days. But, it is noticed that fragmentation of holdings and scatteredness of the plots make it difficult to irrigate the fields adequately. In the absence of field canals, farmers use G.I. pipes for distributing water to the cultivated plots, which makes the work troublesome and time consuming. On the other hand, farmers of the lift irrigated areas, mostly cultivate two crops Ahu and sali paddy. Relay cropping is done and the seeds sown under a standing crop and is practised extensively in the villages where canal irrigation facilities are available. In such type of

cropping, sali paddy is always the standing crop and the companion crops are khesari, Tesi, Jeng-Behar and pea. In the Rabi season, the standing crop is mustard and the companion is lentil, Potato with Pumpkin etc. wheat is cultivated alone.

In the unirrigated fields of these villages, only mono-cropping is practised with sali paddy, particularly in those plots which are located away from the settlement zone of the villages. Near the settlements, however, a small portion of the cultivated plots, Ahu paddy is cultivated. Use of HYV seeds and fertilizers, in the unirrigated areas are found to be very limited. Fig. (7) is a cadastral map of Monakhuchi village, showing the relay cropping areas on the selected plots with irrigation facilities and traditional mono-cropping in the unirrigated plots.

3.5 (iv) Use of HYV and Package Practices

A change from the subsistence farming to market oriented cropping system, along with HYV seeds and insecticides is evident in the said villages. In irrigated farming, water is the main input. The use of other inputs like fertilizers, HYV seeds, insecticides and other packages of modern farming depends entirely on the availability of water⁴. It is seen that the farmers of the irrigated

4. Govindaiah, T., "Warabandi: The New System of Irrigation Management", Kurukshetra, Vol. XXXIV, No.11-12, 1986, p.25.

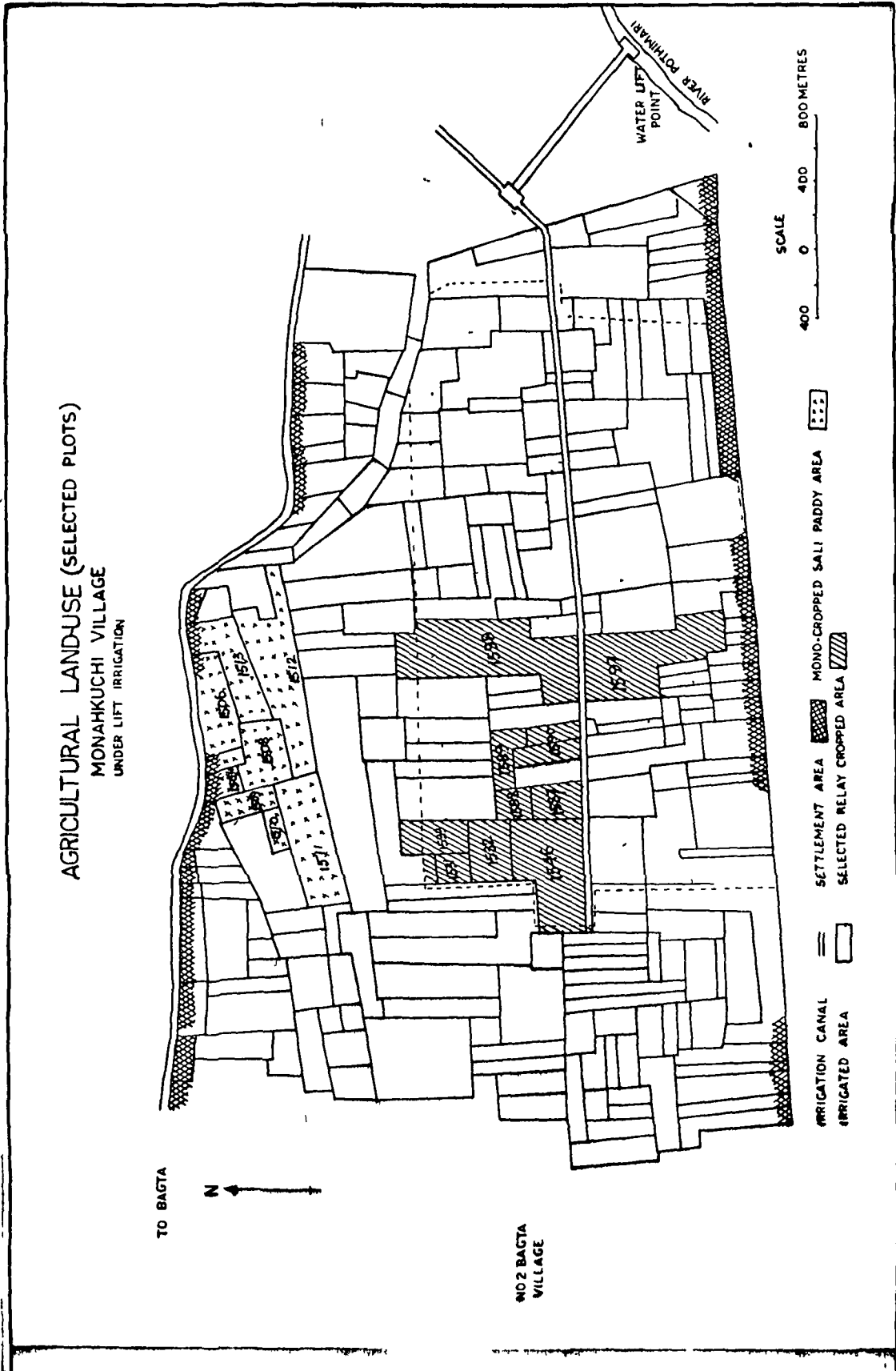


Fig. 7

plots are greatly benefitted by the use of various fertilizers and other inputs supplied by the agricultural cooperatives. But, in the non irrigated areas intensity of cropping and production per unit area is found miserably low. Thus, it can be said that the intensity of irrigation has a direct and strong bearing on the intensity of cropping and cropping pattern⁵. Thus, from the preceding discussion, it is evident that in the irrigated villages the intensity of cropping is moderately high.

Two different types of cropping pattern have been noticed in the irrigated villages. The irrigated villages which are located in the interior parts of the Block and away from the main line of communication, multiple cropping with rice as the principal crop is practised in these villages, since, vegetables cannot be easily transported to the major markets. Prevalence of relay cropping dominates in those villages. High intensity of cropping and the cultivation of winter vegetables have been noticed in the villages of Pub-Bongsor Mouza along with the cultivation of Ahu paddy of transplanted varieties. Acreage under sali paddy is comparatively less in those villages, because, the farmers cultivate the early varieties of winter vegetables, viz., brinjal,

5. Qureshi, M.H. and Mathur, A., **Geo-Economic Evaluation for Micro-level Planning**, Concept Publishing Co., New Delhi, 1985, p.69.

radish, tomato, potato, etc. right from the month of August. Another point to be noted is that Pub-Bongsor Mouza lies along the north bank of Brahmaputra having favourable edaphic condition for the cultivation of these crops.

As a result of changing cropping pattern in the Pub-Bongsor Mouza and prevalence of intensive Rabi cultivation, a daily wholesale market of vegetables have developed at Singimari, located in the middle of the Mouza and at a distance of 15 km from Guwahati. Guwahati is the main consumer of the vegetables that are produced in those villages.

3.5 (v) Contribution of irrigation in changing the cropping pattern and diversification of cropping

The benefits derived out of irrigation can be broadly termed as direct and indirect. Direct benefits include the change in cropping pattern, higher intensity of cropping, use of HYV seeds, investments and the others in the form of trade, health, education, transport and communication links etc.⁶

The concept of intensity of cropping and its pattern implies high degree of intensity of landuse during a given agricultural year. It shows the extent to which

6. Rao, D. Vasudeva, "Irrigation: A clue for Rural Development", *Kurukshetra*, Vol. XXXIV, No. 11-12, 1986, p.14.

the land is being utilised again and again within a given year. Assurance of water supply is the single most important infrastructure which enables the farmer to utilise the same plot of land again and again and thereby help in the increase of gross acreage of the farmer.

The observations on cropping pattern which are presented in the Table 3.2, not only speaks out the difference in the intensity of cropping, but also, the nature of difference in crops cultivation between two situations, one in the villages with the availability of irrigation facility and the other without any irrigation facility. It is observed that in the Hajo Block, since rice is the principal food crop of every Assamese people, every farmer cultivates this crop. However, it is evident that the farmer with some irrigation facility have become more forward looking by using HYV rice and other associated package while, the non irrigated area the farmers still cultivate the traditional rice varieties. The net result is, though there is no change in the cropping pattern as such, there is an economic change in the cropping method and this makes the standard of living of the farmer better. Field survey shows that about 87 per cent farmer use HYV seeds mainly PUSA (2-21), IR-8 and the transplanting method with sufficient use of fertilizers, whereas, in the non irrigated villages, broadcasting method is practised.

Table 3.2
Cropping pattern of Hajo Block, 1986

Crops	Irrigated			Unirrigated		
	Percentage of farmers engaged	Percentage of farmers use HYV	Percentage of farmers use fertilizer	Percentage of farmers engaged	Percentage of farmers use HYV	Percentage of farmers use fertilizers
Ahu paddy	100	87	100	100	15	0
Jute	62	100	100	69	55	0
Sali paddy	100	81	62	100	53	0
Bao paddy	0	-	-	30	0	0
Potato	25	50	-	30	75	0
Brinjal	62	0	90	46	0	33
Tomato	50	0	100	23	0	33
Wheat	68	100	90	61	100	12
Mustard	62	0	50	46	0	0
Pea	68	0	100	38	0	0
Pulses	56	0	0	61	0	0
Corinder	43	0	100	38	0	40
Garlic and onion	25	0	100	23	0	66
Pumpkin & vegetable	50	0	20	61	0	0

Sources: Field Survey, 1986.

Only 15 per cent farmer use HYV seeds without chemical fertilizers, except animal manure.

Cultivation of cash crops like jute depends upon the price of that commodity in the preceding year and it has been observed that the farmers engaged in jute cultivation are comparatively low, less than 60 per cent in both the situations. But, in case of irrigated villages, all the farmers use HYV seeds of jute and chemical fertilizers,

whereas in the dry situation only 55 per cent use HYV (Jute 632, and 524) seeds.

Sali paddy is extensively cultivated in both the situations and in case of irrigated villages 81 per cent of farmers use HYV, and in the other only 53 per cent use HYV seeds. Joya, Aijong are the important HYV paddy varieties, generally cultivated in the Block. Percentage of cultivators using fertilizers in sali paddy is 62. Bao paddy is generally cultivated on the depressions, where water is available till October. In the irrigated region, cultivation of Bao paddy is practically absent.

Potato is an important vegetable and a cash crop grown in some villages of the Block, engaging 25 per cent farmers in the irrigated and 30 per cent in the unirrigated villages. This shows that potato requires relatively less irrigation facility, depends mainly on edaphic condition for its cultivation.

Brinjal is one of the important and popular winter vegetables, cultivated by more than 62 per cent farmers with local seeds, in the irrigated villages. In the unirrigated villages only 46 per cent farmers produce this vegetable. The crop requires more application of fertilizers for better production and as such, in the non-irrigated villages, also, farmers apply fertilizers to the crop.

Cultivation of tomato on large scale is noticed in the irrigated villages engaging more than 50 per cent farmers in the wetland and 23 per cent farmers in the unirrigated villages. In the Pub-Bongsor Mouza, nearly farmer having irrigation facility produce tomatoes which is one of the most important marketable items of the Singimari vegetable market.

Wheat is a new crop and is cultivated uniformly in the villages under both the situations, using completely HYV seeds, since, its irrigation requirement is relatively less and the soil and atmospheric moisture in Assam, in the winter months, are sufficient for the crop. In the irrigated villages most of the cultivators (90 per cent) use fertilizers, whereas, in the non-irrigated villages only 12 per cent use fertilizers.

More than 55 per cent farmers engage in the cultivation of traditional crops, viz. mustard and pulses as relay crops, in the irrigated areas, particularly in the Bagta-Boromboi region, whereas in the unirrigated areas and 'charlands' the percentage of farmers using this technique is relatively higher (46 and 61 per cent respectively).

Green coriander leaves is one of the important marketable items, produced by nearly 43 per cent farmers using local seeds. In the non-irrigated villages 33 per cent cultivators produce this vegetable. After 20-25 days

of sowing, small plants grow up and the farmers sell them in the market in small bundles. Thus, within a period of 4 to 5 months, farmers can produce this vegetable at least three times from the same plot.

Garlic and onion are extensively grown in the 'char' lands of Brahmaputra and most of the farmers use fertilizers in both situations, for better production, farmer irrigate the crops, from the water of the road-side depression or back-waters of flood plains of Brahmaputra by using diesel pumpset. During field survey, it was observed that the cultivation of garlic, onion chilli etc. are mostly confined to the farmers of the Muslim community.

Other vegetables of less importance are grown mainly for household consumptions. Cultivation of pumpkins and cucumber were observed during the field survey. Pumpkins are grown with potato as relay crop. About 50 per cent cultivators of irrigated village and 60 per cent in the unirrigated villages produce these crops.

During field survey, it was observed that depending upon the edaphic conditions, some crops are concentrated in some particular areas. For example, in the Singimari, Gondhmow, Dalibari, Charmajuli and other villages of this locality acreage under traditional crops, like mustard and pulses have been reduces giving way to cultivation of vegetables. This shift, clearly indicates that,

the farmers with improved water condition move from cultivating traditional, non profitable crops to commercial and high valued crops. The analysis clearly shows that irrigation system has brought about a major change in cropping pattern. It indicates the impact of irrigation in changing the cropping pattern, provided marketing facility for green grocery is available.

3.6 (i) Production and Productivity

In general, it can be observed that, there is a positive correlation between irrigation and crop productivity leading ultimately to overall increase in production. In the concerned Block, as there is no upto date data on irrigation along with data on productivity, field information was collected. In the following paragraphs of this section, the field data, so collected has been analysed.

In Appendix C, data relating to area of cultivated land, area sown more than once, production per acre of land on all the crops grown on irrigated land as well as on unirrigated lands of the sample villages of the Block have been summarised. Figures for each village are the average of all sample households of that particular village comprising part A and B of Appendix C.

(1) Considering the total cultivated area, it is found that the average acreage irrigated is approximately double

(8.04 acres) than that of the unirrigated land (4.35 acres). Similar is the case for area sown more than once (average 5.8 acres in irrigated land and average 3.67 acres in unirrigated land).

(2) The average production of various crops in both irrigated and unirrigated lands have also been calculated from the field data on 29 sample villages of the Block. For comparability, crops those are grown in both the areas have been considered.

The average acreage put under **Ahu** paddy is higher (3.43 acres) in irrigated lands than in the unirrigated lands (2.32 acres). But, per acre production is significantly higher (671.8 kg), for irrigated lands than that of unirrigated lands (557.7 kg). This, clearly indicates the positive impact of irrigation on productivity.

(3) In the same light, when all the crops are compared, following picture emerges (Table 3.3). From the table 3.3, it can be clearly seen that the average acreage put under each of the crops is considerably higher for all the crops except only pulses. Similarly, average productions per acre of land, either in terms of weight or in terms of value are considerably higher for all the crops grown in the irrigated lands than that of the unirrigated areas. In this case, per acre production of pulses is higher in the unirrigated areas. This may be, because, pulses

are grown in marginal lands in the irrigated areas, the best land going to high value crops.

Table 3.3
Productivity of different crops 1986

Sl No	Crops	Irrigated		Unirrigated	
		Average acreage	Production /acre	Average acreage	Production /acre
1	Ahu paddy	3.43	671.8 kg	2.32	557.7 kg
2	Jute	1.29	981.0 kg	0.79	802.2 kg
3	Sali paddy	2.38	1140.0 kg	2.55	687.6 kg
5	Potato	0.80	2300.0 kg	0.24	1395.0 kg
6	Brinjal	0.97	Rs 8500.0	0.68	Rs 4250.0
6	Brinjal	0.97			
8	Wheat	0.8	1288.0 kg	0.5	625.0 kg
9	Mustard	1.11	381.1 kg	0.60	228.0 kg
10	Pea	0.77	Rs 3600.0	negligible	-
11	Pulses	0.79	367.5 kg	0.83	380.0 kg
12	Coriander	1.60	Rs 4600.0	1.10	Rs 3833.0
13	Onion	1.07	Rs 2066.60	0.30	Rs 840.0
14	Garlic	0.82	908.3 kg	0.60	760.0 kg
15	Pumpkin	0.70	Rs 3300.0	negligible	-
16	Vegetables	0.30	Rs 2462.0	-do-	-
4	Bao paddy	-		1.1	1020.0 kg
7	Tomato	1.35	Rs 16000.0	1.3	Rs 4666.0

Source: Field Survey 1986.

The average production of sali paddy in irrigated land is remarkably higher, the yield is almost double (1140 kg), that of the unirrigated land (687.6 kg). Similar is the case of Brinjal (Rs.8500.0/acre), (Rs.4250/acre); and Potato (2300 kg/acre) and (1395 kg/acre) in irrigated and unirrigated land, respectively. Another crop Onion

is grown in irrigated land bringing more than double the value of the returns (Rs.2066/acre) to the farmers compared to that of the unirrigated land (Rs.840/acre).

The average production of wheat in the irrigated land is remarkably higher, almost double (1280 kg/acre), than that of the unirrigated land (625 kg/acre). Similar is the case of Tomato (Rs.16000/acre) in the irrigated land, compared to the unirrigated land (Rs.4666/acre). There are some crops, such as pumpkins, cucumbers and winter vegetables of lesser importance cultivated in the unirrigated villages, but, they have little market importance.

The above analysis clearly indicates the positive impact of irrigation on the agricultural land use, as well as on production and productivity of various crops. Therefore, it may be concluded that, if the irrigation facilities are used in a judicious way, it will bring much more economic benefits to the farmers, leading to a total transformation of the rural society.

3.6 (ii) Crop Combination regions of Hajo Block

In the present day, the rising population need more and more of agricultural crops. But the supply of land is fixed and suitability of cultivation depends largely on physical conditions, yet, the human wants and abilities

are also very important factors. The modernisation of agriculture extended the boundary of cultivable land and its productivity⁷ Therefore, the cultivability and productivity of land depends upon the art and organisation of agriculture. Moreover, the practices of scientific rotation of crops, and mixed farming may widen the scope of cultivability and productivity of land.

The crops combination or association of crops is not a chance, but a choice of the farmers. The choice of crops cultivation in a particular geo-ecological set-up depends upon the socio-economic systems of the region.⁸ Therefore, a study of crop combination of a particular region reflects the human response upon the socio-economic system as well as the complex environment and edaphic factors of the locality.

During field survey, it was observed that excepting the cultivation of cereal crops, there is a strong cultural control on the production of cash crops and vegetables. In the Pub-Bongsor Mouza, where the farmers produced large-scale winter vegetables in the riverine areas, the cultivation of Garlic, onion, chilly etc are mainly confined to the farmers of Muslim community. In the lift irrigated

7. Guha, J.L. & Chattoraj, P.R., *A New Approach to Economic Geography*, The World Press Private Ltd., Calcutta, 1985, p.31.

8. Negi, B.S., *Rural Geography*, Kedar Nath Ram Nath, Meerut, p.254.

areas of Hajo Mouza, relay cropping such as pulses, Jeng Behor and Tesi with the sali paddy is practised extensively.

Keeping aside these minor variations, in the Hajo Block under homogeneous physical and socio-economic conditions, one can find homogeneity in cropping pattern. Again, under subsistence agriculture, farmers want to produce every possible item needed for their consumption. Therefore, it has been observed that the farmers prefer some of the crops, which are in average, common in all parts of the Block, with rice as the principal crop.

The village-wise crop combination is calculated for 29 selected villages of the Block. The first 14 villages (Table 3.4) having irrigation facilities and the rest are unirrigated. Using the Weaver's method⁹, crop combination of each village is calculated and the values are shown in the Table 3.4

For the purpose of finding the impact of irrigation on crop combination, some of the important Rabi crops along with the percentage of sali paddy acreage are selected. The area under each crop is shown as the percentage of net sown area of each village.

9. Weaver's combination method,

$$\frac{(X_i - X)^2}{N}$$

where, X = theoretical percentage
 X_i = Actual percentage
 N = No. of crops

The table shows that, in the irrigated villages, crop combination is more, with two to three crops grown with the sali paddy as the principal crop in all the villages. The second important crop on the irrigated land are different in different zones of the Block. Generally, in the villages of the Pub-Bongsor Mouza, winter vegetables and Rabi cash crops, viz., Mustard, Potato, onion, Garlic stand second, next to sali paddy. In the Singimari No.2 and Singimari No.3 villages, area under sali paddy is very small, due to the area being flood affected often and therefore, farmers prefer to cultivate winter vegetables, wheat and cash crops like mustard, Potato, etc. mainly because of the edaphic condition of this region. The villages, just to the north of this belt, viz., in the villages of Dadara, Pacharia and Bongsor, the second important crops are Potato, onion, etc. and in the interior villages, such as Bagta, Boromboi, Mokhonia, etc. pulses and wheat stand next to sali paddy.

In the unirrigated villages, sali paddy occupies the highest percentage of net sown area and stands as the principal and most favourable crop. In some unirrigated villages, particularly in the north-western part of the Block, a significant amount of cultivated land is occupied by wheat. This part of the Block is under Ramdia Mouza having a high percentage of net sown area to the geographical

Table 3.4
Crop Combination (Some selected villages): 1985-'86

Villages	p.c. of SP	P.C. of W	P.C. of P	P.C. of CC	P.C. of WV	Crop combination	Least value obtained	Name of crops Irrigated
1. Singimari No.1	52.2	9.7	5.2	8.3	24.2	II	WV	SP, WV.
2. Singimari No.2	17.5	28.5	25.8	12.0	15.7	IV	WV	W, P, SP, WV
3. Singimari No.3	-	9.0	26.7	28.6	35.3	III	P	W V, C C, P
4. Rawmari	68.8	5.9	4.5	5.3	15.4	I	SP	SP.
5. Gondhmow	40.8	15.9	7.2	7.1	28.3	III	W	SP, WV, W.
6. Bagta	64.5	9.4	9.8	12.8	4.0	I	SP	SP.
7. Mokhonja	60.2	13.2	14.1	5.1	3.4	II	P	SP, P
8. Monahkuchi	61.8	9.5	12.3	8.6	5.8	II	P	SP, P
9. Ketakibari	55.0	17.3	21.0	4.1	2.4	II	P	SP, P
10. Pub-Dadara	41.7	16.3	19.1	12.3	10.5	III	W	SP, P, W.
11. Pacharia	56.1	13.0	2.6	15.4	12.3	II	CC	SP, CC.
12. Pachim Dadara	45.7	9.5	10.2	20.1	13.8	II	CC	SDP, CC
13. Bangsor	55.8	6.9	8.1	15.4	13.0	II	CC	SP, CC.
14. Dadara	46.7	11.4	10.1	16.9	14.1	II	CC	SP, CC
15. Bardadhi	63.9	12.7	12.0	8.3	3.1	I	SP	SP
16. Garua	60.8	15.3	10.1	8.5	5.0	II	W	SP
17. Abhayapur	65.3	12.8	13.2	3.7	4.3	I	SP	SP
18. Soalkuchi Pathar	75.1	6.4	12.3	4.0	1.2	I	SP	SP
19. Maldahar Pam	66.0	18.2	12.5	1.0	1.5	II	W	SP, W
20. Hardia	75.2	3.6	7.8	8.6	3.7	I	SP	SP
21. Khetri Hardia No.1	67.2	13.9	12.6	4.3	1.2	I	SP	SP
22. Khetri Hardia No.2	72.6	9.0	5.9	8.5	3.8	I	SP	SP
23. Bamundi	67.1	12.2	12.0	3.8	4.3	I	SP	SP
24. Shri Hati No.1	65.5	10.7	12.8	4.2	5.1	I	SP	SP
25. Shri Hati, No.2	74.8	6.4	8.5	4.5	4.8	I	SP	SP
26. Barlah	62.3	16.3	12.2	4.2	4.7	II	W	SP, W
27. Kholiahamari	61.6	17.6	14.0	3.3	3.1	III	W	SP, W.
28. Sonladigaon	62.8	15.3	10.6	8.2	2.7	II	W	SP, W
29. Bornigaon	66.1	10.2	15.5	6.4	1.5	I	SP	SP

Source: Field Survey

SP = Sali paddy,

W = Wheat

P = Pulses

CC = Cash-croon (Potato, Mustard, Onion, Garlic, etc.)

area, and settled mostly by the industrious peasants of the Muslim community.

3.7 Problem in achieving full use of the irrigation potential

Peoples' active participation in any programme ¹⁵ the key to success, in rural areas. Group or community decisions are very important in the proper use of physical resources of the village, i.e. land, water and forest,¹⁰ etc. Agriculture is the main occupation of the villages. To increase the yield potential of crops, and thereby, raising the socio-economic condition of the rural masses, provision should be made to transform the practices of subsistence agriculture to market oriented cropping system. The existing irrigation potential of the Block has not been fully utilised due to a number of drawbacks mentioned earlier. For the rectification, the farmer should be educated about the nature and benefits of the irrigation scheme. Thus, agricultural technologies have to be transferred to the rural masses in such a simple way that, poor and illiterate farmers may easily understand the usefulness and application and in turn, be able to apply the practices in farm conditions. Management of output system, is an important component of agricultural development process. Good marketing facilities with quick transport system to nearby urban centres, help the farmers for getting good return, out of their farm produce.

10. Singh, N.P., "Important Issues Relating to Rural Development", Kurukshetra, Vol. XXXIV, No.11-12, 1986, p.4

The Seventh Plan strategy mainly aims at increasing productivity in the unirrigated areas which is low at present. The utilization of existing irrigation potential will also be given priority in the Plan Period by expediting construction of field canals, levelling of the land, making field drains, etc. For this purpose, on-going command area development projects are needed to be completed in the plan period.¹¹

In Hajo Block, the irrigation potential of the public tube wells are very low, because of the limited provision of the field canals. Temporary earthing channels through cultivated plots are not allowed by the owner of the plots. The need for elaborate extension of field channels is essential. Frequent power failure, theft of overhead electric cables and equipments of pumping stations are endemic and are the basic reasons failure of the scheme. It is also necessary on the part of the Department of Irrigation, to maintain pumpsets in efficient conditions to ensure confidence of the farmers.

With the establishment of the daily whole-sale vegetable market at Singimari, located at a distance of 15 km from Guwahati, with bus services at the frequency of half an hour is a great advantage to the farmers. The

11. Objective and Strategies of Seventh Five Year Plan, 1985-'90, (Planning commission, New Delhi).

development of the marketing facility, encourages the farmers for large-scale cultivation of vegetables in the locality and the growing demand for fresh vegetables in the near by Guwahati city, makes the farmers to use their full potentiality on agriculture.

CHAPTER - IV

PROJECT EVALUATION, SUMMARY AND CONCLUSIONS

4.1.1 On the programme

The impact of irrigation schemes in Hajo Block is found to be encouraging. Normally, farmers raise Ahu paddy (broadcasting), jute and sali paddy during summer months and traditional mustard and pulses with some other minor crops are cultivated in the Rabi season. With the introduction of irrigation, the practice of rabi-cropping has increased considerably, particularly, the winter vegetables and wheat. There is a considerable increase in the productivity of land by the adoption of irrigation, HYV seeds and fertilizers. The investigation shows that the farmers are successfully growing HYV paddy, wheat and high value vegetables during the winter months, with the help of irrigation.

The study shows that the farmers have adopted some improved agricultural practices, viz., hiring of tractors from the Government Agriculture Department, use of insecticides through sprayers and the use of weeders etc. Thus, by the use of modern implements, improved methods of cultivation, the farmers have been able to derive substantial benefits.

4.1.2 Functioning of the programme

It has been observed that there is a limited use

of irrigation potential by the farmers; and is used for the cultivation of winter vegetables, only in some pockets. Use of irrigation on sali paddy is not likely to take place in normal year. However, it would ensure sali crop in a drought year.

The constraints that inhibit full utilization of irrigation potential are -

- i) lack of farmers collective and organise efforts to cultivate HYV paddy and other high value and marketable crops;
- ii) lack of organise move to enforce restriction on stray cattles for facilitating the cultivation of wheat, Ahu paddy of transplanted variety, without using fancing, which is expensive.
- iii) lack of co-ordination among the farmers and Irrigation Department for the supply of water regularly.

4.1.3 Distribution of water

Though, the Minor Irrigation Schemes of Hajo Block are in the initial stage, the existing irrigation potential, has not been fully utilised, due to the following reasons:

- i) absence of elaborate field channels for supplying water to the plots;
- ii) fragmentation and scattered holdings complicate the situation. Supply of water using G.I. pipes from the tube wells to the plots is very expensive and time consuming;
- iv) absence of repair and maintenance of pumpsets of the tube wells.

4.1.4 On other inputs

The study shows that the use of modern inputs like fertilizers, pesticides and HYV seeds are very limited. Similarly, use of modern implements like tractors, power-tillers are also negligible. Limited number of progressive farmers are the owner of sprayer machines and diesel pump-sets. They can earn some extra income from these implements by renting out to other farmers.

The study also indicates that the farmers devote only a fraction of their holdings for the HYV seeds. The coverage of such crops are comparatively high in the irrigated areas. Some farmers reported higher incidence of pests in such crops and lack of funds to purchase fertilizers and pesticides.

4.2 Summary and Findings

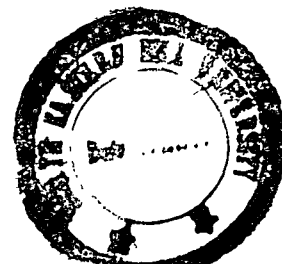
The above analysis reveals that there is a positive impact of Minor Irrigation Project (in Hajo Block) on agricultural land use. Besides, increase in gross cropped area in the irrigated villages, farmers are getting direct benefits in term of change in the cropping pattern. In some villages, acreage under some traditional crops have significantly been reduced and is replaced by market oriented high value crops.

In some villages depending upon the edaphic conditions, practice of relay cropping is also noticed. This

shift in farming practice, also indicates the impact of irrigation. Acreage under Ahu paddy of transplanted varieties have been found to increase in the irrigated areas.

Regarding the production and productivity, it can be said that the production of various crops in the irrigated villages have increased significantly as compared to the unirrigated villages. Yield rate of some important crops, viz. paddy, wheat and cash crops of Rabi season are remarkably higher, almost double in the irrigated villages, than in the non irrigated ones. This in turn helps the farmers of irrigated villages in accruing incremental income from agriculture.

The extensive vegetable farms of Pub-Bongsor Mouza enhances the seasonal employment opportunities for the agricultural labourers. The findings of the study reveal that, with the implementation of Minor Irrigation Scheme in the Block, farmers are willing to invest more in labour, HYV seeds, fertilizers and insecticides to their crops and generally are forward looking to yield growth. The irrigation schemes of the Block are in their initial stage. It can be expected that, in near future, the situation will improve further, and the farmers will be much benefited by bringing more area under irrigation and increasing the change in favour of crops of economic importance, which is relatively limited at present.



102170

Another interesting finding that emerges from this study is that the cropping pattern and crop combination not only depend upon the irrigation facility and adoption of modern technology but also on caste/community of farmers. The area inhabited mostly by assiduous muslim peasants, shows different cropping pattern and crop combination and having higher percentage of re-use of farm land. This is a reflection of the social and cultural preferences of crop choice on the material culture, (i.e. agricultural practices).

4.3 Conclusions

A shift from the subsistence farming to market oriented cropping pattern along with HYV seeds and more remunerative crops is evident in the irrigated villages. Based on the observations of the analysis, one is led to the conclusion that irrigation has played its role successfully in transforming the villages with traditional farmers to the villages with progressive and relatively prosperous cultivators.

Therefore, it can be said that there is a wide scope for the development of minor irrigation in the Block. The Govt. and the Financial Institutions have to take more interest in providing incentives in the form of loan and subsidies for investing in minor irrigation to the progressive and particularly, the young farmers of the Block.

The increase of productivity, change in cropping pattern, agricultural landuse, cropping intensity through the introduction of irrigation facility will not bring much economic benefits to the farmers unless their produces are stored scientifically and sell at a competitive price. At present, there is no provision of cold storage facilities for the perishable products and hence, the farmer have to sell their products at through way prices at the time of harvesting. Further lack of adequate accessibility to the urban market helps the middle man to operate on large scale, at the site of the field itself. Therefore, it may be suggested to have better storage and cooperative marketing facilities, in order to remove the intermediaries from the scene.

During the field study, it was observed that the farmers have to travel relatively long distances to the Block headquarters at Hajo town and to Guwahati, to buy various kinds of inputs. This will bring loss of time and money. As a result, many of the farmers either become reluctant or they cannot afford to spend money to acquire some of the important inputs. Keeping this point in view, it may be suggested that, some of the inputs, be supplied through cooperative centres and fair price shops operated by unemployed youths of the villages.

It was also observed that many of the tube wells pumpsets were lying idle due to mechanical defects. In

generally this type of situation become more frequent, at the time of sowing, when most of the farmers are in need of irrigation. In view of this, it may be suggested that, some local educated unemployed youths may be given adequate training who can look after the repair and maintenance of the equipments.

It was observed that almost all the farmers of the Block are either illiterate or marginally literate. These farmers are generally found to be reluctant to accept a new innovation which is clearly exhibited in the percentage of cultivated area under HYV crops and other inputs. In many occasions, it was also observed that farmers are resistant to change. In such a situation, a few demonstration village may be set-up, providing irrigation facility, introducing modern technology and by motivating mainly the younger generation, who are educated and unemployed. To start with, some motivational programme may be conducted and a few potential young farmer may be selected, who may be given all kinds of assistance from the different Govt. departments. In course of time, these selected young farmers may be allowed to work as catalysts for the spread of new agricultural technology in the area.

4.4 Limitation of the study and suggestions for future research

In order to assess the actual impact of irrigation

schemes in the Block, detailed landuse study and planning is almost essential. In the present study, detail study of landuse could not taken into account mainly due to the scope of the study.

There are large number of variables, such as physical, socio-economic, political and environmental variables are responsible for the selection of certain crops in some particular region. To pinpoint the different physical and socio-economic factors, influencing agricultural pattern in a given area, detailed households study is essential which could not be incorporated in the present study.

Use of field data for one agricultural year in the present micro level study, makes it unwise for generalisation. Its micro-nature further imposes limitations. Therefore, researchers, who are interested to persue such studies in future, may consider the records of some agricultural years.

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APPENDIX A
Impact of Minor Irrigation on Agricultural Landuse
HAJO BLOCK

Section - A : General Description

1. State :
2. District :
3. Block :
4. Village :
5. Date of Survey :
6. Whether SC : Yes/No
7. Whether ST : Yes/No
8. Name of the Cultivator :
9. Family structure -

Sl No	Age	Sex	Education	Occupation	If service holder monthly income Rs.	Remark

Section - B : Land Use

10. Total owned land Area in bigha
11. Basti land
12. Cultivable land
13. Cultivated land
14. Area sown more than once

15. Cropping pattern and Productivity -

Sl No	Crops	Area in hect/bigha	Per hect/bigha production in md/kg	Local seeds or HYV	Irrigated non-irrigated

16. Irrigation facilities :

Sl No	Mode of irrigation	Area irrigated	Time of irrigation		Crop irrigated
			Kharif	Rabi	

17. Fertilizer input :

Name	kg/hect or bigha	Crop fertilised

18. Technification

Farming implements

- (a) Plough
- (b) Tractor
- (c) Weeder - dry/wet
- (d) Sprayer
- (e) Other

19. Modernisation

- (a) Improved seeds :
- (b) Chemical fertiliser : kg :
- (c) Insecicide : kg

APPENDIX B**List of sample villages, Hajo Block**

1. Singimari No.1
2. Singimari No.2
3. Singimari No.3
4. Rowmari
5. Gondhmow
6. Bagta
7. Mokhonia
8. Monah kuchi
9. Ketakibari
10. Pub-Dadara
11. Pacharia
12. Pachim Dadara
13. Bangsor
14. Dadara
15. Bardadhi
16. Garua
17. Abhayapur
18. Soalkuchi pathar
19. Maldahar Pam
20. Hardia
21. Khetri Hardia No.1
22. Khetri Hardia No.2
23. Bamundi
24. Shri Hati No.1
25. Shri Hati, No.2
26. Barlah
27. Kholiahamari
28. Soniadigaon
29. Bornigaon

APPENDIX C
Crop Productivity On Irrigated Lands 1986

PART - A

Sl No Culti- vated land in acre	Area sown more than once		Ahu		Jute		Sali		Potato		Tomato		Brinjal		Wheat		Mustard	
	Area in acre	Yield in acre	Area in acre	Yield kg/acre	Area in acre	Yield kg/acre	Area in acre	Yield kg/acre	Area in acre	Yield kg/acre	Area in acre	Yield Rs/acre	Area in acre	Yield Rs/acre	Area in acre	Yield kg/acre	Area in acre	Yield kg/acre
1	6.6	6.6	5.3	604	1.0	1800	2.6	1200	-	-	2.3	18000	1.7	7000	0.6	960	-	-
2	8.3	5.9	4.6	604	1.3	960	2.6	1200	0.6	1800	1.3	24000	1.9	1200	0.6	1450	-	-
3	9.6	6.6	3.9	484	1.3	1200	3.9	1200	0.2	3000	1.3	18000	1.7	14000	0.6	1450	-	-
4	10.3	9.9	6.6	364	1.7	650	1.7	960	0.3	1900	1.6	17000	1.3	6000	1.0	1450	1.6	360
5	10.3	9.9	6.6	364	1.7	650	0.7	1200	-	-	-	-	0.7	12000	2.0	1400	1.3	600
6	10.3	9.9	8.2	484	3.3	650	2.3	1200	0.3	3000	0.66	10000	0.7	9000	0.9	1400	1.6	460
7	13.1	12.9	3.9	485	1.3	650	1.7	1200	2.6	1800	0.99	9000	0.9	7000	0.9	1400	0.6	480
8	9.1	4.9	3.3	845	-	-	3.9	1200	-	-	-	-	-	-	-	-	-	-
9	13.9	4.9	0.7	960	0.3	850	1.7	960	-	-	-	-	0.3	6000	-	-	0.3	280
10	2.6	1.0	1.7	844	0.7	1200	3.3	1200	-	-	-	-	-	-	-	-	-	-
11	7.2	3.9	1.7	605	0.3	1200	3.9	725	-	-	-	-	-	-	-	-	-	-
12	7.8	3.3	3.9	605	-	-	3.9	1200	-	-	-	-	-	-	-	-	3.3	300
13	4.9	3.3	0.7	604	-	-	0.6	1200	-	-	-	-	0.2	6000	0.7	960	0.9	240
14	2.6	1.3	0.7	964	-	-	1.3	1200	-	-	-	-	0.3	6000	0.3	1200	0.3	360
15	4.6	3.9	1.5	725	-	-	1.3	1200	-	-	-	-	0.3	1200	0.6	1200	0.6	360
16	6.6	4.6	1.5	605	-	-	2.6	1200	-	-	-	-	-	-	0.9	1200	0.6	360
Total	127.8	92.8	54.8	10,749	12.9	9,810	38.0	18,245	4.0	11,500	8.15	96000	9.7	85000	8.8	14070	11.1	3811
Average	7.9	5.8	3.43	-	1.29	-	2.37	-	0.8	-	1.35	-	0.97	-	0.8	-	1.1	-
Average	Yield	671.8	-	981.0	-	1140.3	-	2300	-	16000	-	8500	-	1279	-	381.1	-	381.1

Sources: From Field survey

Appendix - C contd..

Sl No	Pea		Pulses		Coriander		Onion		Garlic		Vegetables		Pumpkin cucumber	
	Area in acre	Yield Rs/p acre	Area in acre	Yield Kg/p acre	Area in acre	Yield Rs/p acre	Area in acre	Yield Rs/p acre	Area in acre	Yield Kg/acre	Area in acre	Yield Rs/acre	Area in acre	Yield Rs/acre
1	0.3	2000	0.2	380	-	-	-	-	-	-	0.3	3000	0.9	6000
2	0.2	1000	1.9	380	0.3	9000	-	-	-	-	0.3	3000	0.6	1000
3	-	-	-	-	-	-	-	-	-	-	0.3	1500	0.6	3000
4	0.6	4000	-	-	1.6	3000	1.3	3500	0.6	960	0.3	3000	-	-
5	1.3	4500	-	-	1.3	3600	0.6	1200	0.6	720	0.6	6000	-	-
6	0.9	6000	-	-	3.3	3000	1.3	1500	0.9	960	0.2	1000	-	-
7	0.6	6000	-	-	1.9	4500	-	-	1.3	850	0.2	1200	-	-
8	-	-	0.9	360	1.3	4500	-	-	0.9	1000	0.3	1000	-	-
9	-	-	-	-	-	-	-	-	0.6	960	0.2	1000	-	-
10	-	-	0.6	360	-	-	-	-	-	-	-	-	-	-
11	-	-	0.6	380	-	-	-	-	-	-	-	-	-	-
12	-	-	0.6480	-	-	-	-	-	-	-	-	-	-	-
13	0.3	3000	-	-	-	-	-	-	-	-	-	-	-	-
14	1.3	3000	0.9	240	-	-	-	-	-	-	-	-	-	-
15	1.3	3500	0.6	360	-	-	-	-	-	-	-	-	-	-
16	0.9	3000	-	-	-	-	-	-	-	-	-	-	-	-
Total	7.7	36000	6.3	2940	9.7	27,000	3.2	6200	4.9	5400	2.4	20700	2.1	10000
Average acreage	0.77	-	0.78	-	1.6	-	1.07	-	0.8	-	0.26	-	0.7	-
Average Yield	3600	-	367.5	-	4600	-	2066	-	908.3	-	2300	-	3333.3	-

Crop Productivity on Unirrigated Land : 1986

Sl No	Area in Acre	Area sown more than once	Ahu		Jute		Sali		Bao		Potato		Brinjal		Tomato	
			Area in acre	Yield kg/acre	Area in acre	Yield kg/acre	Area in acre	Yield kg/acre	Area in acre	Yield kg/acre	Area in acre	Yield kg/acre	Area in acre	Yield in Rs. acre	Area in acre	Yield kg/acre
1	2.6	2.0	1.9	480	0.6	1200	1.6	720	-	-	0.6	3000	2.0	3000	2.0	3000
2	3.6	2.0	5.9	600	0.3	1200	3.2	720	-	-	0.17	1240	0.9	3000	1.6	4000
3	6.3	5.9	2.9	360	2.9	350	2.9	800	-	-	0.3	1440	0.6	5000	-	-
4	5.9	5.0	3.3	360	1.3	350	1.6	720	-	-	0.17	1200	0.6	6000	-	-
5	2.3	2.0	1.6	600	0.3	960	2.0	800	-	-	0.33	1700	-	-	0.3	7000
6	4.6	3.9	0.6	800	0.3	600	2.6	850	-	-	-	-	-	-	-	-
7	5.3	3.3	1.6	720	0.3	960	1.9	480	-	-	-	-	-	-	-	-
8	4.6	1.6	1.6	480	-	-	3.3	720	0.3	1200	-	-	-	-	-	-
9	2.6	1.6	1.6	600	-	-	1.6	720	-	-	-	-	-	-	-	-
10	4.6	3.9	2.6	800	0.6	600	3.9	600	-	-	-	-	-	-	-	-
11	3.9	3.6	2.6	600	0.5	1000	3.6	480	-	p	-	-	-	-	-	-
12	5.9	3.0	3.3	250	-	-	3.6	480	-	-	-	-	-	-	-	-
13	4.3	4.0	0.6	800	-	-	1.3	850	1.9	840	-	-	-	-	-	-
Total	56.5	47.7	30.1	7250	7.1	7220	33.1	8940	2.2	2040	0.97	5580	2.7	17000	3.9	14000
Average	4.35	3.67	2.30	-	0.78	-	2.55	-	1.1	-	0.24	-	0.68	-	1.3	-
Average Yield	-	-	557.7	-	802.2	-	687.6	-	1020	-	1395	-	4250	-	4666	-

Source: Field Survey, 1986.

Appendix 'C' PART B contd..

Sl No	Mustered		Pulses		Dhania		Garlic		Onion		Wheat	
	Area in acre	Yield kg/acre	Area in acre	Yield kg/acre	Area in acre	Yield Rs/acre	Area in acre	Yield kg/acre	Area in acre	Yield Rs./acre	Area in acre	Yield kg/acre
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	1.9	4000	0.6	960	0.3	900	-	-
4	-	-	-	-	1.3	4500	0.6	720	0.3	900	-	-
5	-	-	-	-	0.16	3000	0.6	600	0.3	720	0.9	650
6	0.6	360	0.3	360	-	-	-	-	-	-	0.4	650
7	-	-	1.6	480	-	-	-	-	-	-	0.3	650
8	0.3	240	0.6	360	-	-	-	-	-	-	0.3	500
9	-	-	1.3	240	-	-	-	-	-	-	0.3	550
10	0.6	240	0.9	360	-	-	-	-	-	-	0.6	650
11	0.9	360	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-
13	0.6	240	0.3	480	-	-	-	-	-	-	0.7	750
Total	3.0	1440	5.0	2280	3.3	11500	1.8	2280	0.9	2520	3.5	4380
Average	0.6	-	0.83	-	1.1	-	0.6	-	0.3	-	0.5	-
Average yield	-	228.0	-	380	-	3833	-	760	-	840	-	625.7

APPENDIX D

Village wise intensity of cropping: Hajo Block, 1986

Sl No	Village	Net sown area(acre)	Gross cropped area(in acre)	Cropping Intensity (%)
1.	Charmajuli gaon	165.2	288.0	174.3+
2.	Charmajuli pam	60.6	90.4	149.0***
3.	Dalibari No.1	438.7	639.0	145.6***
4.	Dalibari No.2	161.9	291.0	179.7+
5.	Pub-Dadara	503.3	535.1	106.3*
6.	Pachim-Dadara	331.8	457.6	137.9**
7.	Singimari No.1	417.2	506.6	121.4**
8.	Singimari No.2	250.0	296.3	118.5*
9.	Singimari No.3	140.1	-	100.0*
10.	Niz Gondhmow	166.2	239.0	143.8***
11.	Gondhmow No.1	264.2	408.9	154.7***
12.	Gondhmow No.2	374.2	558.0	149.1***
13.	Soalkuchi pathar	220.5	227.1	102.9*
14.	Bathanor Pam	65.2	75.1	115.1*
15.	Sri Hati No.1	175.2	259.3	148.0***
16.	Sri Hati No.2	415.9	512.6	123.2**
17.	Sri Hati No.3	192.0	243.3	126.7**
18.	Sarulah	265.2	314.9	118.7*
19.	Bathan gaon	230.5	298.4	129.4**
20.	Sampara gaon	315.2	464.2	147.2***
21.	Ambari	295.7	451.3	152.6***
22.	Bargaon	313.6	472.9	150.7***
23.	Rowmari	416.9	648.7	155.6***
24.	Bongsor No.1	325.5	477.8	146.7***
25.	Bongsor No.2	264.6	369.2	139.5**
26.	Niz Bongsor	647.0	978.1	151.1***
27.	Halogaon No.1	278.5	477.2	171.3+
28.	Halogaon No.2	313.9	519.2	165.4+

Cont...

Sl No	Village	Net sown area(acre)	Gross cropped area(in acre)	Cropping Intensity (%)
29.	Barlah	320.9	520.6	162.2+
30.	Hatimura NC	300.0	369.5	123.1**
31.	Bamundi	118.5	204.6	172.6+
32.	Dakonia No.1	40.1	64.9	161.8+
33.	Dakonia No.2	37.1	54.3	146.3***
34.	Khetri Hardia No.1	313.0	326.6	104.3*
35.	Khetri Hardia No.2	232.9	253.1	108.6*
36.	Saban Sah No.1	247.7	376.8	152.1***
37.	Sabansah No.2	432.4	529.7	122.5**
38.	Saban Sah No.3	400.0	607.0	151.7***
39.	Khetri Hardia No.3	214.2	338.0	157.7***
40.	Saban Sah No.4	292.4	491.1	167.9+
41.	Niz Hardia	139.7	244.7	175.1+
42.	Hardia Pam	668.9	1071.7	160.2+
43.	Maldah Pam	611.3	852.7	139.4**
44.	Ujan Takardia	273.8	515.5	188.2++
45.	Takardia	466.6	752.0	161.1+
46.	Sanpara gaon	409.9	608.6	148.4***
47.	Abhayapur	366.6	536.1	146.2***
48.	Kulhati No.1	1311.2	1422.1	108.4*
49.	Kulhati No.2	1163.2	1428.2	122.7**
50.	Uttar Pakorkona	250.0	299.7	119.8*
51.	Dakhain Pakorkona	338.7	471.1	139.0**
52.	Khudra Kulhati	442.7	709.9	160.3+
53.	Goria para pacharia	435.1	729.8	167.7+
54.	Pacharia	354.3	652.3	184.1++
55.	Pacharia dalarpahar	511.9	698.6	136.4**
56.	Pacharia	765.2	1264.9	165.3+
57.	Borijani	252.0	340.7	135.1**
58.	Ketakibari	569.9	814.9	142.9***
59.	Tetelia	377.5	568.9	150.7***
60.	Bahana	353.6	628.4	177.7+

Contd...

Appendix D contd..

Sl No	Village	Net sown area(acre)	Gross cropped area(in acre)	Cropping Intensity (%)
61.	Bardadhi	449.3	534.7	119.0*
62.	Abhapur	550.7	653.7	118.7*
63.	Garya	40.7	76.3	187.4++
64.	Nadia	593.8	853.1	143.6***
65.	Ujan Kuri	24.8	35.1	141.5***
66.	Major Kuri	229.8	309.3	134.5**
67.	Bongaltola	126.5	164.6	130.1**
68.	Barbakara	281.4	368.4	130.9**
69.	Sarubakara	188.4	240.4	127.6**
70.	Tarabari	74.2	135.1	182.0++
7D.	Bongalpara	195.4	295.7	151.3***
72.	Bhalkor No.1	341.4	450.7	132.0**
73.	Bhalkor No.2	181.4	273.1	150.5***
74.	Solmari No.1	386.1	386.1	100.0*
75.	Solmari No.2	62.6	92.4	147.6***
76.	Kholiahamari No.1	90.4	107.9	119.3*
77.	Kholihamari No.2	33.8	50.3	148.8***
78.	Andhupara	252.3	338.4	134.1**
79.	Bihdia	418.9	475.2	113.4*
80.	Barni	629.1	981.	155.9***
81.	Kuria gaon	550.7	752.7	136.6**
82.	Dehor kuria gaon	337.1	628.8	186.5++
83.	Soniadi	1220.5	1438.7	117.8*
84.	Raja Bazar	189.7	331.7	174.8+
85.	Kalita kuchi	746.7	1131.5	151.5***
86.	Khopani kuchi	327.1	1132.1	136.8**
87.	Ukhru	158.9	255.9	161.0+
88.	Bagta No.1	1034.4	1169.9	113.0*
89.	Bagta No.2	702.3	821.8	117.0*

Contd....

Appendix D contd..

Sl No	Village	Net sown area(acre)	Gross cropped area(in acre)	Cropping Intensity (%)
90.	Monahkuchi	1092.0	1599.6	146.4***
91.	Mokhonia	325.8	535.4	164.3+
92.	Japia	569.9	942.4	165.3+
93.	Dihina	522.2	633.1	121.2**
94.	Akadi	546.7	639.4	116.9*
95.	Dakhin Singra	438.1	619.9	141.4***
96.	Kumar pur	635.1	887.1	139.6**
97.	Chorabari	1174.8	1926.4	163.9+
98.	Hoblakha	477.1	924.1	193.6++

Source: S.D.C. office, Hajo, 1986.

- * high
- ++ Very high
- * Very low
- ** low
- *** Moderate

PART A
Irrigated Land

APPENDIX E
Cropping Pattern 1986 : Hajo Block

	Ahu paddy		Jute		Sali Paddy		Potato		Brinjal		Tomato	
	Seed HYV/L	Irr. Un-Irr.	Seed HYV/L	Irr. Un-Irr.	Seed HYV/L	Irr. Un-Irr.	Seed HYV/L	Irr. Un-Irr.	Seed HYV/L	Irr. Un-Irr.	Seed HYV/L	Irr. Un-Irr.
1	Pusa	Yes	Yes	Yes	Yes	Yes	-	-	-	-	-	-
2	Pusa/L	"	"	"	"	"	HYV	Yes	-	"	"	"
3	"	"	"	"	"	"	"	Yes	"	"	"	"
4	"	"	"	"	"	"	Local	No	No	"	"	"
5	"	"	"	"	"	No	"	"	"	"	"	"
6	"	"	"	"	"	No	-	-	-	"	"	"
7	"	"	"	"	"	No	-	-	-	"	"	"
8	HYV	Irr	"	-	"	No	-	-	-	-	-	-
9	HYV/L	Irr	Used	"	"	No	?	?	?	-	-	"
10	"	"	"	"	"	"	-	-	-	-	-	-
11	"	"	"	"	"	"	-	-	-	-	-	-
12	"	"	"	-	"	"	-	-	-	L	Yes	-
13	"	"	"	-	"	"	-	-	-	-	-	-
14	"	"	"	-	L	No	-	-	-	L	Yes	-
15	"	"	"	-	L	"	"	-	-	L	"	-
16	"	"	"	-	"	"	-	-	-	-	-	-

Sources Field Survey 1986.

Contd...

PART A
Irrigated land

	Wheat			Mustard			Pea			Pulses			Coriander			Garlic & Onion		
	Seed HYV/L	Irr. Un-Irr.	Fert Irr.	Seed HYV/L	Irr. Un-Irr.	Fert Irr.	Seed HYV/L	Irr. Un-Irr.	Fert Irr.	Seed HYV/L	Irr. Un-Irr.	Fert Irr.	Seed HYV/L	Irr. Un-Irr.	Fert Irr.	Seed HYV/L	Irr. Un-Irr.	Fert Irr.
1	-	-	-	-	-	-	Local	Yes	Yes	Local	No	No	Local	Yes	Yes	-	-	-
2	-	-	-	-	-	-	"	"	"	"	"	"	"	"	"	"	"	"
3	-	-	-	-	-	-	"	"	"	-	-	-	"	"	"	"	"	"
4	HYV	No	Yes	Local	Yes	Yes	"	"	"	-	-	-	"	"	"	Local	Yes	Yes
5	"	Yes	"	"	"	"	"	"	"	-	-	-	"	"	"	"	"	"
6	"	"	"	"	"	"	"	"	"	-	-	-	"	"	"	"	"	"
7	"	"	"	"	"	"	"	"	"	-	-	-	"	"	"	"	"	"
8	"	"	"	-	-	-	Local	Yes	Yes	Local	Nb	Nb	?	?	-	-	-	-
9	-	-	-	Local	"	No	-	-	-	"	"	"	-	-	-	-	-	-
10	HYV	Yes	Yes	-	-	-	-	-	-	"	Yes	"	-	-	-	-	-	-
11	"	"	-	-	-	-	-	-	"	"	"	"	-	-	-	-	-	-
12	-	-	-	Local	No	No	-	-	-	"	"	"	-	-	-	-	-	-
13	"	"	"	Local	Yes	No	-	-	"	"	"	"	-	-	-	-	-	-
14	"	"	"	"	Yes	No	Local	Yes	Yes	-	-	-	-	-	-	-	-	-
15	"	No	No	"	Yes	No	"	"	"	-	-	-	-	-	-	-	-	-
16	"	"	"	"	Yes	Yes	"	"	"	Local	Yes	No	-	-	-	-	-	-

Contd..

Cropping Pattern of Hajo Blocka 1986

Part B
Unirrigated Land

	Ahu paddy			Jute			Sali paddy		
	Seed	Irrl	Fert	Seed	Irrl	Fert	Seed	Irrl	Fert.
1	Local	No	No	HYV	No	No	Aijong	No	No
2	"	"	"	"	Yes	"	"	"	"
3	"	"	"	"	No	"	L+HYV	"	"
4	"	"	"	Local	"	"	L+HYV	"	"
5	"	"	"	"	"	"	L	"	"
6	Pusa	"	"	692	Yes	No	L+HYV	Yes	"
7	HYV	"	"	-	-	-	L+H	No	"
8	Local	"	"	Tosa	Yes	"	L+H	No	"
9	"	"	"	-	-	-	L	"	"
10	"	"	"	Local	No	No	L+H	"	"
11	"	"	"	632	2	2	L+H	"	"
12	"	"	"	-	-	-	L+H	"	"
13	"	"	"	-	-	-	L	"	"

Source: Field Survey 1986

Contd..

	Bao paddy			Potato			Brinjal			Tomato		
	Seed	Irrig	Fert	Seed	Irrig	Fert	Seed	Irrig	Fert	Seed	Irrig	Fert
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	HYV	No	No	L	"	Yes	L	"	Yes
3	-	-	-	"	"	"	L	Yes	Yes	-	-	-
4	-	-	-	"	"	"	L	No	No	-	-	-
5	-	-	-	Local	No	No	L	No	No	L	No	No
6	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-
8	Local	No	No	-	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-
10	Local	No	No	-	-	-	-	-	-	-	-	-
11	Local	No	No	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	L	No	No	-	-	-
13	Local	No	No	-	-	-	-	-	-	-	-	-

Part B contd..

Cropping pattern of Hajo blocks 1986

PART B
Unirrigated Land

	Wheat			Mustard			Pea			Pulses		
	Seed	Irr	Fert	Seed	Irr	Fert	Seed	Irr	Fert	Seed	Irr	Fert
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	L	No	No	-	-	-
4	HYV	No	No	-	-	-	L	No	No	-	-	-
5	"	"	"	-	-	-	L	No	No	-	-	-
6	-	-	-	L	No	No	-	-	-	L	No	No
7	HYV	Yes	Yes	-	-	-	-	-	-	L	No	No
8	"	"	"	L	No	No	-	-	-	L	No	No
9	-	-	-	-	-	-	-	-	-	L	No	No
10	HYV	No	No	L	No	No	-	-	-	L	No	No
11	HYV	"	"	L	No	No	-	-	-	L	No	No
12	"	"	"	L	-	-	L	No	No	L	No	No
13	"	Yes	"	L	-	-	L	No	No	L	No	No

APPENDIX F
Intensity of Agricultural land use, Hajo Block, 1986

Village	Geographical area in acre	Net Sown area in acre	P.C. of net sown area to geog.area
1. Charmajuli gaon	451.3	165.2	36.6
2. Charmajuli Pam	252.0	60.6	24.0
3. Dalibari No.1	484.4	438.7	90.5
4. Dalibari No.2	409.0	161.9	39.4
5. Pub Dadara	834.8	503.3	60.2
6. Pachim Dadara	391.4	331.8	84.7
7. Singimari No.1	735.1	417.2	56.7
8. Singimari No.2	401.6	250.0	62.2
9. Singimari No.3	289.1	140.1	48.4
10. Niz Gondhmow	385.4	166.2	43.1
11. Gondhmow No.1	562.0	264.2	46.9
12. Gondhmow No.2	300.7	271.5	90.2
13. Soalkuchi Pathar	288.7	220.5	76.3
14. Bathnor pam	461.9	65.2	1.4
15. Sri Hati No.1	748.7	175.2	23.4
16. Sri Hati No.2	621.8	415.9	66.8
17. Sri Hati No.3	662.2	192.0	28.9
18. Sarulah	891.4	265.2	29.7
19. athangaon	370.9	230.5	62.1
20. Sanpara gaon	464.6	315.2	67.8
21. Ambari	437.1	295.7	67.6
22. Bargaon	638.1	313.6	49.1
23. Rowmari	526.8	416.9	79.1
24. Bongsor No.1	469.2	325.5	69.3
25. Bongsor No.2	339.1	264.6	78.0
26. Niz Bongsor	821.8	647.0	78.7

Contd...

Appendix F contd..

Village	Geographical area in acre	Net Sown area in acre	P.C. of net sown area to geog.area
27. Halogaon No.1	594.7	278.5	72.3
28. Halogaon No.2	391.7	313.9	80.1
29. Barlah	489.7	320.9	65.5
30. Hatimura N C	649.0	300.0	46.2
31. Bamundi	209.9	118.5	56.2
32. Dakonia No.1	412.2	40.1	9.7
33. Dakonia No.2	552.6	37.1	6.7
34. Khetri Hardia No.1	339.7	313.0	92.1
35. Khetri Hardia No.2	285.8	232.9	81.4
36. Sabansah No.1	282.8	247.7	87.5
37. Sabansah No.2	474.8	432.4	91.0
38. Sabansah No.3	486.7	400.0	82.1
39. Sabansah No.4	322.5	292.4	90.6
40. Khetri Hardia No.3	257.9	214.2	83.0
41. Niz Hardia	221.8	139.7	62.9
42. Hardia Pam	912.9	668.9	73.2
43. Maldah pam	750.3	611.3	81.4
44. Ujan Takradia	662.2	466.6	70.4
45. Sanpara	1908.6	409.9	21.4
46. Abhayapur	409.6	366.6	89.5
47. Kulhati No.1	2267.5	1311.2	57.8
48. Kulhati No.2	1300.0	1163.2	89.4
49. Uttar Pakorkona	276.1	250.0	90.5
50. Dakhin Pakorkona	376.5	338.7	89.9
51. Khudra Kulhati	472.8	442.7	93.6
52. Gorla para Pacharia	453.6	435.1	95.9
53. Napara Pacharia	444.7	354.3	79.6
54. Pacharia Dalarpahar	887.7	511.9	57.6
55. Pacharia	843.0	765.2	64.2
56. Borijani	393.7	252.0	64.0
57. Ketaki bari	603.6	569.9	94.4

Cont....

Appendix F contd.

Village	Geographical area in acre	Net Sown area in acre	P.C. of net sown area to geog.area
58. Jetelia	478.5	377.5	78.8
59. Bahama	774.2	353.6	45.6
60. Bardadhi	603.6	449.3	74.4
61. Abhapur	944.4	550.7	58.3
62. Garua	541.4	40.7	7.5
63. Nadia	759.6	593.8	78.1
64. Ujan Kuri	181.8	24.8	13.6
65. Major Kuri	532.1	229.8	43.1
66. Bongaltola	325.5	126.5	38.8
67. Barbakra	354.0	281.4	79.4
68. Sarubakra	249.0	188.4	75.6
69. Tarabari	1464.2	265.7	55.1
70. Bongalpara	578.1	195.4	33.8
71. Bhalkor No.1	509.9	341.4	66.9
72. Bhalkor No.2	328.8	181.4	55.1
73. Solmari No.1	386.7	386.1	99.1
74. Solmari No.2	440.4	62.6	14.1
75. Kholihamari No.1	621.8	90.4	14.5
76. Kholihamari No.2	431.4	33.8	7.8
77. Andhupara	453.6	252.3	55.6
78. Bihdia	466.5	418.9	89.7
79. Borni	1378.5	629.1	45.6
80. Kuriagaon	601.3	550.7	91.5
81. Dehor Kuriagaon	634.4	337.1	53.1
82. Soniadi	1693.4	1220.5	72.0
83. Raja Bazar	276.2	189.78	68.6
84. Kalita Kuchi	1132.4	746.7	65.9
85. Khopani kuchi	935.8	827.1	88.3
86. Ukhru	259.3	158.9	61.2
87. Bagta No.1	1675.5	1034.4	61.7

Contd...

Appendix F contd..

Village	Geographical area in acre	Net Sown area in acre	P.C. of net sown area to geog.area
88. Bagta No.2	1006.0	264.2	26.2
89. Bagta No.3	1899.0	843.0	44.0
90. Monahkuchi	1750.3	1092.0	62.4
91. Mokhonia	568.2	325.8	57.3
92. Japia	1269.9	569.9	44.8
93. Dihina	962.2	522.2	54.2
94. Akadi	816.6	546.7	67.1
95. Dakhin Singra	668.5	438.1	65.5
96. Kumarpur	1197.7	635.1	53.0
97. Chorabari	2204.3	1174.8	53.3
98. Hablakha	965.2	477.1	49.6

Source: SDC office, Hajo, 1986.

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- | | | | |
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- (h) Attended the UGC sponsored Refresher Course in Geography, held in the department of Geography, Gauhati University, 1982.
- (i) Attended the UGC sponsored Summer Institute in Geography held in Nowgong College, 1983.



1. Officials of Life Irrigation Scheme, Bagta-Boromboi, Hajo.



2. Pumping Station, Puthimari river, Bagta-Boromboi, Hajo



3. Hume pipe used for supplying water to the field.



4. An uncared canal.



5. Onion cultivation, Govt. sponsored tube well with distribution canal.



6. Private tube well, in the Brinjal field.



7(a) Plucking of Brinjal.



7. Tomatos, Pumpkins etc. being made ready for market.



8. A System of carrying Vegetables to the market.

9,. An apparent view of the Singimari whole-sale vegetable market.



10. Different kinds of vegetables of Singimari market

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