Original Research Article

A Comprehensive Appraisal of the Farming Scenario in Riverine Areas of Lower Assam, India

ABSTRACT

The present investigation was undertaken to study the comprehensive appraisal of the farming scenario of Riverine (*Char*) areas of lower Assam based on prevailing climatic parameters, soil-site characteristics, existing cropping pattern and socio-economic conditions of the farmers. Three *Chars* of the district, *viz.*, Faujdar *Char*, Simlabari and Bamunpara Part IV was selected for the study. A multistage purposive cum random sampling design was adopted for the study. The average monthly temperature in the chars ranges from 18.9 to 28.6^{o}C, which are usually suitable for most of the crops like *sali* paddy, maize, chilli etc. The analysis ofphysico-chemical parameters of the soilreveals predominance of sand and sandyloam texture. The available N, P and K contents ranged from 84.2 to 108.5, 38.6 to 42.3 and 127.9 to 152.6 kg/ ha, respectively. The average yield efficiency percentage were observed highest (320.21%) in potato. The per cent pest infestation was recorded as15-25% for almost all the crops studied.

Key words:*Char*, cropping pattern, insect, questionnaire

INTRODUCTION

The riverbed of the Brahmaputra is dotted with a number of riverine areas (*Chars*) all along its length in the plains of Assam. These *Chars* are formed by the suspended materials brought from the catchment areas of the rivers on account of any obstruction in the course of the rivers.Out of 3.61 lakh ha of *Char* area, an arable area of 2.42 lakh ha is supporting a large population of the farming community (GoA, 2018).The chars account for about 5 percent of the total area of the state spreading across 14districts, 55 blocks and around 2,300 villages (GoA, 2016). Economic backwardness limits *Char* dwellers' livelihood options. The income opportunities of farmers are severely restricted by recurring floods and erosion (Chakraborty, 2012). As per a report (GoA, 2018), Dhubri district encompasses 480 numbers of villages in the *Char* areas covering an area of 64,767 hectare. The socio-economic backwardness is a matter of serious concern in the *Char* areas. For majority of the *Char* dwellers, agriculture is the primary source of livelihood (Nath *et al.* 2021). Identification and quantification of socio-economic

factors inhibiting the growth and development of *Char* farmers can pave the way to eradicate the problems of *Char* people.

Most of the *Chars* made up of alluvial deposits, mostly silt and sand. The wide variation in physical and natural features, combined with natural fertility of the alluvial deposits, facilitatescultivation of a wide varieties of *rabi* and summer crops (Talukder*et al*. 2009). The ease of tillage operations in the *Char* land assistfarmers to take up of various crops(Borkakati*et al.* 1999; Vadivelu*et al.* 2005).

To increase agricultural productivity, considering the immediate and future opportunities of these lands, an evaluation was attempted to study the suitability and performance of various crop. An attempt has also been made to prepare an appropriate cropping plan for further enhancement in crop productivity of the study area.

RESEARCH DESIGN AND METHODOLOGY

Selection of the study area:

A preliminary survey cum Participatory Rural Appraisal (PRA) programme was carried out in 2021 in three villages of Dhubri district, *viz*., Faujdar *Char*, Simlabari and Bamunpara Part IV (Fig. 1). A multistage random sampling design was adopted for the study.

Fig. 1: Location of the study areas with GPS coordinates

Period of Study:

Necessary information were collected based on survey using a standard questionnaire

during the first quarter of 2021 through multiple visits to the study area.

Secondary data from various sources *viz.*, District Agricultural Office, Deptt. of Economics and Statistics, Assam Agricultural University, Jorhat are used to corroborate demography, land tenure system, crop activity, land use and cropping pattern, farming system and price of inputs and outputs, maximum and minimum area under certain crops, net benefit and cost benefit analysis. Average yield efficiency percentage (AYEP) was calculatedas:

$$AYEP = \frac{\text{Average crop yield per ha in the given area}}{\text{Mean crop yield per ha in the state}} \times 100$$

Soil samples (0- 15 cm) were collected from the study areas and analysed in the laboratory of Department of Soil Science, SCS College of Agriculture, Assam Agricultural University, Rangamati, Dhubri, Assam. Particle size distribution, soil reaction, organic carbon, and available N, P, K were estimated following standard methods.

Chart 1 : Survey Area:

Sl. No.	Village	GPS Coordinates
1.	Faujdar *Char*	26.2167430 N, 90.3712150 E, Alt.: 31 m
2.	Bamunpara part IV	26.237328^{0}N, 90.258555°E, Alt.: 33 m
3.	Simlabari	26.245153^{0}N, 90.409363°E, Alt.: 36 m

RESULTS AND DISCUSSION

Climate:

The *Char* areas visited receive an average annual rainfall of 1,856 mm. About 63.19, 26.38, 6.95 and 3.48per cent of the annual rainfall occur in the monsoon, pre-monsoon, post-monsoon and winter seasons, respectively. The rainfall during the period from November to February is sporadic and unreliable (Fig. 2). The occasional rainfall that occurs during this period helps to replenish the moisture deficiency of soils. However, such rainfall depending on its timing and intensity may also cause damage to the standing rabi crops. The average monthly temperatures in the chars vary between 18.9 and 28.6^{o}C, which are usually suitable for most crops.

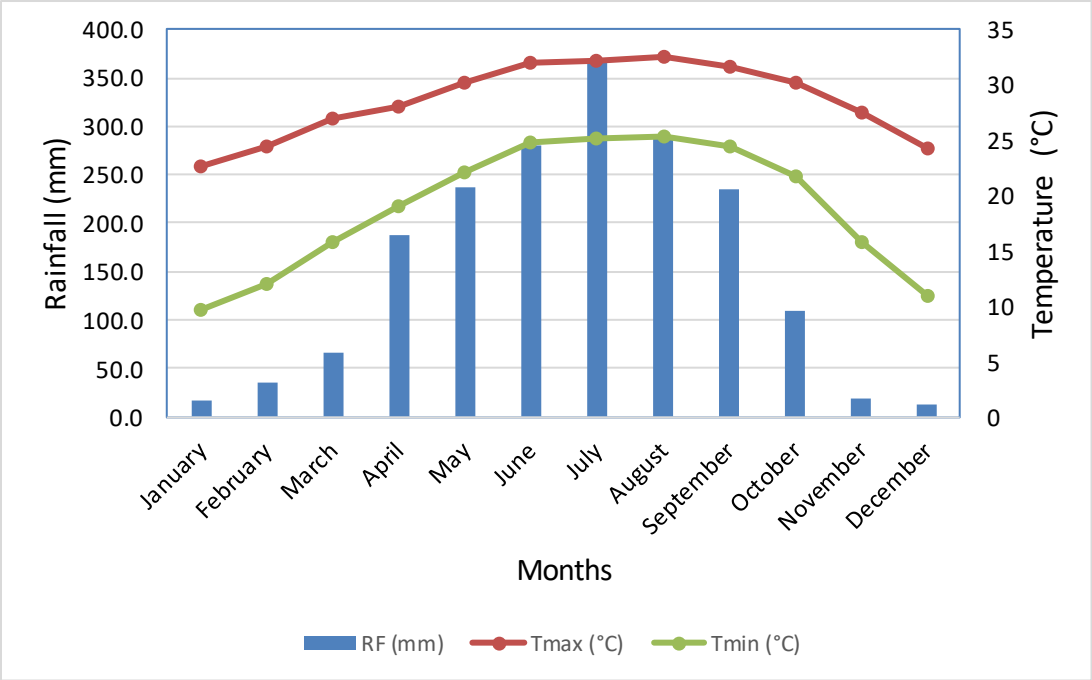

Fig. 2. Weather parameters prevalent in *Char* areas [average of ten years (2012 – 21)]

Rice is a thermal sensitive cropwithtemperature suitable for growth varying by growth phase of the crop (Wassman*et al*. 2009). The day temperature upto 35^{o}C and night temperature of upto 25^{o}C are suitable for rice growth during *sali* paddy growing period. At tillering the crop requires higher temperature than other stages of its growth. The crop requires 26.50-29.50^{o}C for flowering. At ripening rice requires 20-25^{o}C. Rice grows well in areas receiving average annual rainfall of 1000-1500 mm or more.The prevailing weather conditions at the visited chars were well within the suitable ranges for *sali* paddy.

Chilli grows well in areas with temperatures of 18-27^{o}C during the day and 15-18^{o}Cduring the night (Doorenbos and Kassam, 1979). A warmer night temperature above this range induces earlier flowering. The weather condition during chilli growing winter months are congenial in the *Char* areas of Dhubri. Well aerated and well drained soil condition of the visited *Char* areas also support proper growth, flowering and fruiting of chillis.

A temperature range of 18-20^{o}C is the optimum for germination of maize seeds (Doorenbos and Kassam, 1979). The crop can tolerate hot and dry atmospheric condition so long as sufficient water is available to the plant. It is also relatively tolerant to water deficits during the vegetative and ripening stages. Maize grows well in most soils except very sandy soil. The suitable agro-ecological conditions of *Char* areas support excellent crop growth of maize.

Jute is a tropical crop growing under wide variation of climatic conditions. The optimum range of temperature required is 18-33^{o}C. The crop is basically self-pollinated and needs long daylight for its growth. It grows well with an annual rainfall of 1,500 mm or more, with the occurrence of at least 250 mm of rainfall during each of the months of March, April and May (Banglapaedia, 2006).

Soil characteristics:

The soils in the study areas have an irregular relief of stratified sandy and silty deposits. The soils form under a diverse set of environmental conditions including vegetation, relief, drainage and age of sedimentation, which together lead to different patterns of soil fertility, crop suitability, land use and agronomic practices. The soil samples collected during our field visits from the Fauzdar, Bamumparapart IV and Simlabari *char*s.The physio-chemical parameters of the soils the three *Chars* under study (Table 1) indicated that soils contain sand in a large proportion and the texture varied from sand to loamy sand. Meager quantities of the organic matter (0.38 to 0.51%) in the areas can be attributed to the recent deposit of sand in the top layer. The overall nutrient status of the soils was found to be medium to high (Table 2). The available N, P and K contentsranged from 84.2 to 108.5, 38.6 to 42.3 and 127.9 to 152.6 kg/ ha, respectively. Such soils are usually suitable for many crops. *Char* soil is usually productive as it benefits greatly from seasonal flooding through nitrogen fixation by blue-green algae and bacteria. The flooding also benefits through the addition of organic matter and nutrients from the decomposed flora and fauna. The seasonal fluctuation between aerobic and anaerobic soil conditions also makes phosphorus and possibly potash more readily available to plants (Brammer, 2000).

Table 1: Physical and chemical characteristics of soil.

Location	Colour	Sand	Silt	Clay	Texture	pH	OC (%)
Faujdar *Char*	10YR7/1	85.8	10.7	3.5	Loamy sand	6.7	0.48
Bamunpara part IV	10YR7/1	78.6	12.5	8.9	Loamy sand	6.8	0.51
Simlabari	10YR6/1	92.4	3.5	4.1	Sand	6.5	0.38

Table 2: Nutrient status of soil.

Location	Available N (kg/ha)	Available P (kg/ha)	Available K (kg/ha)
Faujdar *Char*	108.5	38.6	134.4
Bamunpara part IV	122.7	42.3	152.6
Simlabari	84.2	40.5	127.9

Production status of various crops:

The yield performance of summer rice (6600 kg/ha) is superior in the study area compared to *sali* rice (5400 kg/ha) owing to favourable prevalent weather conditions during the summer season. It is observed that the average yield efficiency of summer and *sali* rice are 254.53 and 250.00 per cent, respectively compared to the state average (Table 3). Among various pulses grown in *Char* areas, blackgram exhibits great promise with 175.59 AYEP. In case of oilseed crops, the AYEP of rapeseed, lentil, nigerand sesamum are 194.49, 117.80, 161.29 and 84.51, respectively. Jute is a popular crop among the farmers and perform reasonably wellin the *Char* areas with AYEP of 162.31. The performance of potato (AYEP: 320.21) is very encouraging and suitable soil and climatic conditions might be attributed for such higher yield in the study area. Chilli, though cultivated extensively by the *Char* dwellers and resulted better yield compared to state average (AYEP: 146.99), incidence of pests and diseases are of major concern for realizing the potential yield.

Table 3: Average yield efficiency percentage of major crops.

Crops	Av. yield in study area(kg/ha)	Av yield in State (kg/ha)	Av yield efficiency percentage (AYEP)
Sali rice	5400	2160	250.00
Summer rice	6600	2593	254.53
Rapeseed	1200	617	194.49
Back gram	1050	598	175.59
Green gram	900	753	119.52
Lentil	900	764	117.80
Niger	900	558	161.29
Sesamum	600	710	84.51
Jute	3600	2218	162.31
Potato	24000	7495	320.21

Chilli (green)	1439	979	146.99

Recommended land use pattern:

The factors like soil and climate along with food security, market price and local cultivation practice are the major determinants of crops and cropping system in the *Char* areas.The *Char*-areas under study have three overlapping cropping seasons, *viz*.,*rabi*, summer and *kharif*. The*rabi* season is usually during a flood-free period, but the later part ofthe summer and the early part of the kharif seasons coincide with the flood period.Chilli, maize, jute, rice, peanut, wheat, millets, oilseeds, onion, garlic, sugarcane, peas andpulses are the crops grown in the *Char* areas. The crops are more diversified duringthe *rabi* season because of favourable climate during this period.

Rice is a commoncrop in every *Char*.*Sali* rice is cultivated by the farmers in mediumland in spite of great risk of flood damage, as the monsoon ensures water requirement of the crop without irrigation.*Boro*rice (Summer paddy) is also common inall the *chars* under thestudy. *Ahu* rice (pre-monsoon season) is also found in mostof the *chars*. Hybrid maize is also popularly grownin the study area.Jute is thesingle most dominant crop in the summer season in most of the *chars* of Dhubri district. Sesame is grownin pre-monsoon (April-June) season in the*char*areas under the study. Different kinds of vegetables are grown, though pumpkin is more popular. Onion, chili, and mustard are traditionally cultivated in chars during*rabi* season (dry period). The spices like chili, black cumin and coriander are found to grow extensively.Lathyrus, cowpea, soybean and watermelon are also cultivated in the study area to a limited extent.

The dominant cropping pattern, however, varies from *Char* to *Char*. Several cropping patterns are followed in every *Char*.However, most of the patterns have at least one fallow season, though in a few patterns, two or three crops are also grown, especially in themedium high land. Number ofcrops in *rabi* season (dry period; November - March) is much higher than that in summer (April-June) or *kharif* season. The cropping patterns suggested for the *Char* areas are as follows:

1. Direct seeded early summer rice (February to May) - transplanted late winter rice (August to November)

2. Summer vegetables (February to May) - transplanted late winter rice (August to November) - potato/pea (December to February)

3. Summer vegetables (February to May) - transplanted late winter rice (August to November) - groundnut/pea (December to February)

4. Summer rice/summer pulse (February to May) - fallow – potato/vegetables/toria/wheat/pea (December to February)

5. Groundnut/melons (February to May) – fallow – early pulse/vegetables (December to February)

6. Summer rice (February to June) – fallow – sweet potato (September to February)

Different cropping pattern may be suggested for the *Char* areas under study on the basis of soil suited to crops, socio economic conditions, length of growing period of crops, prevailing pattern of flooding, BC ratio, etc. Crop diversification relying on introduction of new cultivars and adoption of locally adoptable agro-technologies may be suggested to address these issues. It is worth mentioning that, wheat is excluded as one of the major crops of the study areas due to problems associated with threshing, storage, pre-harvest sprouting, etc. Concurrently, late transplanted winter rice may be a viable alternative for such locations. To evade the flood, two crops before and after its occurrence could be suggested. Moreover, choice of the crop is mainly driven by the market demand, soil types, and available resources at the disposal of the farmers. It is expected that implementations of thesuggested cropping pattern would enhance the productivity of crops in the areas under study.

Major insect pests:

Farmers, input dealers, extension officials and NGO staffs identified pests and diseases as hazards to crop production and storage across all the chars. The occurrence of pests and diseases in the fields is linked with weather. In the events of cold, fog, cloud, drizzle, hot, and seasonal weather change, the incidences of pests and diseases increase. The quality of seed, it's processing/treatment before sowing, the occurrence of flood in the previous monsoon and the soil condition also factor in pest and disease incidences. Chilli is more affected than maize and jute. Plant, stem and root rotting, plant and root turning into yellow color, leaf curl, leaf turning into white color, formation of root nodule, and cutting of roots and plant bases are the pest- and disease-related hazards for chilli. Cutworm, aphid, thrips, mite, leaf curl virus and anthracnose are among the major pests and diseases for chilli. Maize is affected by different pests and diseases including cutworm, stem borer, aphid and leaf blight at its early growth stage and jute

by hairy caterpillar, semi-looper and stem rotting at the mid-stage. Insects and rodents also destroy the stored chilli and jute.

The major insect pests along with percent infestation in all the surveyed *Char* villages of the district are depicted in Table 4. From the investigation it was recorded that in all the crops pest infestation was recorded as15-25%. The data were collected using simple random sampling in all the crop fields. Majority of the farmers use pesticides for controlling the pests.

Table 4: Major insect pests with per cent infestation.

Crop	**Major insect pests**	**% infestation**
Sali rice	Yellow stem borer	20-25
	Leaf folder	20-23
	Case worm	15-18
	Gundhi bug	30-35
	Whorl maggot	15-20
Summer rice	Yellow stem borer	15-20
	Leaf folder	15-22
	Case worm	12-15
	Gundhi bug	25-30
Rapeseed	Aphids	30-35
	Saw fly	15-20
Back gram	Aphids	20-25
	Pod borer	15-20
Green gram	Aphids	20-25
	Pod borer	18-20
Potato	Cut worm	15-20
	Red ant	20-25

	Mole cricket	20-25
Jute	Bihar hairy caterpillar	15-20
Tomato	Fruit borer	25-30
	Aphids	15-20
	White fly	15-20
Okra	Jassids	20-25
	White fly	15-20
	Fruit borer	15-25
Brinjal	Shoot and fruit borer	20-25
Chilli	White fly	15-20
	Fruit borer	20-25
Cole crops	Cut worm	15-20
	Diamond back moth	10-15
	Aphids	15-20
Maize	Cut worm	15-20
	Maize borer	20-25

(Data represents the average of three *Char* villages)

CONCLUSION

In view of the findings of the present study, some tangible measures may be adopted focusing in the areas of soil testing, IPM, capacity building, infrastructure facilities, etc in the *Char* areas of the district. Multiple cropping and intercropping should be actively encouraged. Mobilization of institutional support for creation of permanent assets, assured and timely availability of critical inputs, market linkage, credit facilities, etc is the need of the hour. It is expected that the socioeconomic standard of the farmers in the study area can be uplifted with the introduction of modern technologies and other amenities in conjunction with the recommendations provided. However, further investigations encompassing a larger study area

with higher numbers of parameters concerning socioeconomic status of the community may be advocated.

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