Bangladesh Rice J. 21 (2) : 157-172, 2017

Diversity of Cropping Patterns and Land Use Practices in Faridpur Region

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ABSTRACT

The development of agriculture sector largely depends on the reliable and comprehensive statistics of the existing cropping patterns, cropping intensity and crop diversity of a particular area, which will provide guideline to policy makers, researchers, extensionists and development workers. The study was conducted over all 29 upazilas of Faridpur region during 2015-16 using pre-tested semi-structured questionnaire with a view to document the existing cropping patterns, cropping intensity and crop diversity of this area. From the present study it was observed that about 43.23% net cropped area (NCA) was covered by only jute based cropping patterns on the other hand deep water ecosystem occupied about 36.72% of the regional NCA. The most dominant cropping pattern Boro−Fallow−Fallow occupied about 24.40% of NCA with its distribution over 28 out of 29. The second largest area, 6.94% of NCA, was covered by Boro-B. Aman cropping pattern, which was spread out over 23 upazilas. In total 141 cropping patterns were identified under this investigation. The highest number of cropping patterns was identified 44 in Faridpur sadar and the lowest was 12 in Kashiani of Gopalganj and Pangsa of Rajbari. The lowest crop diversity index (CDI) was reported 0.448 in Kotalipara followed by 0.606 in Tungipara of Gopalganj. The highest value of CDI was observed 0.981 in Faridpur sadar followed by 0.977 in Madhukhali of Faridpur. The range of cropping intensity value was recorded 113-262%. The maximum value was for Saltha of Faridpur and minimum for Kotalipara of Gopalganj. As a whole the CDI of Faridpur region was calculated 0.971 and the average cropping intensity at regional level was 197%.

Key words: Cropping system, jute, diversity index and deep-water ecosystem

INTRODUCTION

The term cropping system refers to the crops, cropping patterns and the management techniques used on a particular field over the period of a year. This term is not a new one, but it has been used more often in recent years in discussions about sustainability of our agricultural production systems. Cropping pattern is the yearly sequence and spatial arrangement of crops or of crops and fallow on a given area (Chandrasekaran *et al*., 2010). The cropping patterns of a region are closely influenced by the geo-climatic, socio-economic, historical and political factors (Hussain, 1996). It also depends on topography, slope, soils and availability of water for irrigation, use of pesticides, fertilizers and mechanization. Weather plays a decisive role in determining the existing cropping pattern. Faridpur region is a low lying area of the country.

Faridpur municipality was established in 1869, which is divided into five districts in modern days. These are Faridpur, Rajbari, Gopalganj, Madaripur and Shariatpur. Collectively all these districts are known as Faridpur region. It is mostly a riverine area of the country belongs to Active Ganges River Floodplain (AEZ-10), Low Ganges River Floodplain (AEZ-12), Gopalganj-Khulna Bils (AEZ-14) and Old Meghna Estuarine Floodplain (AEZ-19) (FAO, 1988). Most of the soils of this region are floodplain and basin type, which are formed from the river deposits. Sedimentation occurs in every year in this region due to the regular flooding. As a result soils of this region

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are very fertile and diversified crops can be grown there during the rainy season as well as in winter. This region is well known for jute and rice cultivation. Several adverse situations e.g. deep flood, flash flood, peat soils, heavy basin clays, noxious perennial weeds, slow drainage affect the cultivation of different crops. As a result the cropping intensity in this region is much lower than the other region like Bogra, Dinajpur, Jessore. Diversified cropping pattern may be an option for the farmers as a coping strategy against risks (Mandal and Bezbaruah, 2013). Typology of different cropping systems is the base for the managers of these systems to intensify production (Shriar, 2000). There is a strong need for judicious and appropriate use limited resources in case of intervention selection that does not lead to increased mal adaption or inequity in the society over long term. Existing trends of available agricultural lands is most essential requirement for any land use planning related to farming and food security in a sustainable manner. Therefore, an increased understanding of arable land use based on the cropping system is essential for the appropriate intervention in sustainable way. In these contexts, existing cropping patterns along with their diversity of such complex agricultural region are very crucial for risk minimization and overall productivity improvement. The present study was designed with the following specific objectives to:

- Understand the existing cropping patterns scenario in Faridpur region
- Visualize the existing land use pattern at upazila and regional level
- Determine the crop diversity and cropping intensity at local and regional level.

METHODOLOGY

Twenty-nine upazilas of Faridpur, Goplaganj, Shariatpur, Madaripur and Rajbari districts under Faridpur agricultural region were the locale of this study. Data were collected using double stage procedure. At initial stage, data were collected through pre-tested semi-structured questionnaire from 29 pre-assigned Sub-Assistant Agriculture Officers (SAAO) of each upazila during July 2015 at upazila level. SAAOs were purposively preselected by Agriculture Extension Officers (AEO), Additional Agriculture Officer (AAO) and upazila Agriculture Officer (UAO) or altogether. Prior to data collection, the pre-tested questionnaire was explained along with proper guidelines to the AEOs or UAOs or both and handed over to them at each Deputy Director's office of Department of Agricultural Extension (DAE) during monthly meeting for the sake of accurate data collection. The filled questionnaires were collected by the scientists of RFS Division, checked, and analyzed to find the inconsistencies of the supplied data before validation workshop. All the inconsistencies among the information were documented. The collected data along with documented inconsistencies were discussed in district level workshop for necessary correction and validation. Second stage of data collection was based on day-long data validation workshop at district level. The workshop dates were 18 August 2015 for Rajbari; 30 May 2016 for Faridpur; 31 May 2016 for Shariatpur; 25 July 2016 for Gopalganj and 26 July 2016 for Madaripur. Four field-workers i.e. one SAPPO and three SAAOs experienced and engaged in crop-based data documentation, all officers from all upazilas viz UAOs, AEOs, AAEOs, DD (DAE), DD (Horticulture), DD of Seed Certification Agency, DTO and ADDs, one representative from Agricultural Training Institute (ATI) and scientists of BRRI regional station, Bhanga and Kushtia participated in the data validation workshop. The number of participants of validation workshop ranged from 40 to 69 in each district. All the participants were divided into three to four groups for data validation. Each group was facilitated by two RFSD scientists to finalize and validate the data and authenticated data were captured. Crop diversity index was calculated by using the following equation described by Kshirsagar *et al*. (1997).

$$CDI_i = 1 - \sum_{j=o}^{n} \left(\frac{a_{ij}}{A_i} \right)^2$$

Where, CDI_i = Crop Diversity Index
a_{ij} =Area planted to the j^{th} crop in the i^{th} location
A_i = Total area planted under all crops

The index is zero for a land area growing only one crop. It approaches unity as the level of diversity increases. Compilation and processing of the collected data were done using Microsoft Excel programme. Descriptive statistics were used to facilitate the presentation of the findings.

RESULTS AND DISCUSSION

Land use

Table 1 presents the status of agricultural land utilization. The net cropped area of the Faridpur region is 490,490 hectares. Crops occupied the particular land for round the year were considered under annual crops. The major annual crops reported in the region were pineapple, sugarcane, banana papaya, betel leaf, ginger and turmeric. The annual crops area in different upazilas ranged from 10 to 2,000 ha. The annual crops area accounted only 2.45% of the net cropped area (NCA) in the region. At a glance the region possesses 25% single cropped area (SCA), 47% double cropped area (DCA), 24.6% triple cropped area (TCA). The quadruple cropped area is absent in this region. The SCA had the major share of NCA in Kotalipara, and Tungipara upazilas of Gopalganj district; Kalkini upazila of Madaripur district; Damudya and Naria upazilas of Shariatpur district followed by corresponding double cropped area (DCA). Most of the upazilas were dominated by DCA. The exceptions are Madhukhali and Saltha of Faridpur district and Baliakandi, Kalukhali, Pangsa and Rajbari sadar of Rajbari district where triple cropped area is the dominating one (Table 1). The area which could not be defined under SCA, DCA, TCA or QCA, was considered as others whose coverage is less than 1% of the NCA.

Cropping patterns of Faridpur

In total 141 cropping patterns were observed in Faridpur region of which six cropping patterns with exclusive rice crop covers over 35% of the NCA. There were 46 cropping patterns with exclusive non-rice crop covering over 28% of the NCA. Rest of the NCA i.e. about 37% area is covered by 89 rice-non rice cropping patterns (Appendix 1).

Rice and non-rice crops at a glance

Table 2 presents six cropping patterns where rice is the only crop round the year. It comprises about 35.23% of the NCA in the region. Among them single rice, double rice and triple rice areas represent around 24.44%, 10.69% and 0.03% respectively. It reflects the unparallel dominance of rice in the cropping systems in Faridpur region. In case of individual pattern Boro−Fallow−Fallow has the highest coverage (24.41%) and was recorded in 28 upazilas out of 29. The second dominant cropping pattern Boro- B. Aman occupied 6.94% of NCA which was reported in 23 upazilas. Boro-Fallow- T. Aman covered 3.6% area with its existence in 22 upazilas.

In the current investigation, 46 cropping patterns were identified that was free from rice. Among the 46 patterns, first 32 have been arranged in descending order (Table 3). The rest 14 patterns with negligible area coverage (Table 8) were arranged with other patterns of different categories. Aggregate of the 46 patterns have had 28.45% of NCA. In critical comparison it is clear that exclusive rice area is more or less same as exclusive non-rice area. In Faridpur region crop diversity is much wider than that of other regions like Sylhet and Chittagong where exclusive rice area covers 37 folds and 23 folds respectively, of exclusive non-rice area (Muttaleb *et al*., 2017; Shahidullah *et al*., 2017). Appropriate cropping patterns may facilitate maximum possible land use as well as efficient use of other scarce resources in a sustainable manner. Diversified cropping pattern may be an option for the farmers as a coping strategy against risks (Mandal and Bezbaruah, 2013). Typology of different cropping systems is

Table 1. Land use of different upazilas in Faridpur region (area in hectare), 2014-15.

	Upazila	Area of upazila	Annual crop	SCA	DCA	TCA	QCA	Other	NCA	C.I. (%)
01	Alfadanga	12803	90	700	7310	1300	0	140	9540	205
02	Bhanga	21640	200	850	8760	4480	0	110	14400	224
03	Boalmari	27203	900	0	12360	8100	0	140	21500	234
04	Charbhadrasan	17377	200	1460	6250	260	0	130	8300	183
05	Faridpur sadar	39623	900	2620	13300	7330	0	150	24300	216
06	Madhukhali	23018	2000	845	4265	8890	0	100	16100	237
07	Nagarkanda	19314	390	1700	7600	3970	0	130	13790	214
08	Sadarpur	28579	890	100	11920	6390	0	140	19440	228
09	Saltha	18512	20	255	4225	8030	0	90	12620	262
10	Gopalganj sadar	41375	1300	17650	7460	3960	0	130	30500	151
11	Kasiani	28600	300	11000	8010	1500	0	190	21000	153
12	Kotalipara	36793	50	24050	3330	120	0	150	27700	113
13	Muksudpur	30850	100	7000	12640	3390	0	120	23250	184
14	Tungipara	12724	40	8500	1335	695	0	120	10690	126
15	Kalkini	28011	490	8100	7330	4400	0	170	20490	179
16	Madaripur sadar	31382	410	0	15670	5550	0	130	21760	224
17	Rajoir	23108	130	2800	11590	3070	0	140	17730	201
18	Shibchar	33288	10	5200	10300	7750	0	150	23410	211
19	Baliakandi	22900	450	720	5780	8420	0	180	15550	247
20	Goalanda	14987	10	550	7410	1000	0	140	9110	205
21	Kalukhali	17066	300	1500	4870	5570	0	160	12400	231
22	Pangsa	24902	1050	700	6190	9400	0	110	17450	244
23	Rajbari sadar	31300	550	3200	7550	10000	0	150	21450	229
24	Bhedarganj	26728	70	3290	12790	1770	0	150	18070	191
25	Damudya	9176	160	3800	1450	1430	0	120	6960	163
26	Goshairhat	16867	670	4600	5190	2110	0	150	12720	175
27	Naria	23206	120	6650	4910	1130	0	110	12920	156
28	Shariatpur sadar	17508	160	4200	8345	235	0	120	13060	168
29	Janjira	25274	80	645	12855	575	0	125	14280	199
	Faridpur region		12040	122685	230995	120825	0	3945	490490	197

the base for the managers of these systems to intensify production (Shriar, 2000). Light textured soil with low-water holding capacity are discouraging factors for modern rice cultivation specially in dry season. Moreover, supply of modern varieties of various crops, knowledge of modern crop management practices, good communication facilities, skilled technology transfer channel help crop diversification in a given area (FAO, 1988).

Pulse crops

Thirty-eight cropping patterns are holding different pulse crops (Table 4). Among them lentil is covering the largest area whereas mungbean is cultivated in the smallest area. The cropping patterns of only lentil altogether cover more than one-half of pulse growing area in the region. Grasspea holds the second position in pulse crop cultivation in Faridpur region. There are 11 cropping patterns for grasspea, which occupy over 2% of NCA. In the documentation of pulse cropping, Lentil−Jute−Fallow reported its widest spreading over 22 upazilas in the region. The aggregate area of the pulse cropping systems stands for 14.68% of the NCA in Faridpur region.

Spices crops

Spices crops play an important role in the economy of Faridpur region. Twenty-seven cropping patterns are holding different spices

Table 2. Cropping patterns with exclusive rice in Faridpur region, 2014-15.

	Cropping pattern	Area (ha)	% of NCA	Frequency (no. of upazila)
01	Boro–Fallow–Fallow	119750	24.41	28
02	Boro–B. Aman	34060	6.94	23
03	Boro–Fallow–T. Aman	17685	3.61	22
04	Boro–Aus–Fallow	685	0.14	6
05	Fallow–B. Aman	500	0.10	1
06	Boro–Aus–T. Aman	150	0.03	2
	Total	172830	35.23	

Table 3. Cropping patterns with exclusive non-rice in Faridpur region, 2014-15.

	Cropping pattern	Area (ha)	% of NCA	Frequency (no. of upazila)
01	Onion–Jute–Fallow	25960	5.29	23
02	Wheat–Jute–Fallow	23210	4.73	25
03	Lentil–Jute–Fallow	15330	3.12	22
04	Mustard–Jute–Fallow	13880	2.83	18
05	Grasspea–Jute–Fallow	12680	2.58	18
06	Vegetab–Vegetab–Vegetab	8420	1.72	16
07	Coriander–Jute–Fallow	6510	1.33	12
08	Garlic–Jute–Fallow	6020	1.23	16
09	Vegetab–Vegetab–Fallow	4255	0.87	13
10	Vegetab–Jute–Fallow	3820	0.78	6
11	Chilli–Jute–Fallow	2045	0.42	9
12	Lentil–Vegetab–Vegetab	1910	0.39	2
13	Blackcumin–Jute–Fallow	1780	0.36	10
14	Potato–Jute–Fallow	1735	0.35	10
15	Groundnut–Fallow–Fallow	1480	0.30	4
16	Chilli–Fallow–Fallow	1360	0.28	5
17	Lentil–Sesame–Fallow	1125	0.23	5
18	Pea–Jute–Fallow	910	0.19	8
19	Chilli–Vegetab–Fallow	810	0.17	6
20	Blackgram–Jute–Fallow	735	0.15	6
21	Sesame–Fallow–Blackgram	680	0.14	4
22	W.Melon–Fallow–Fallow	510	0.10	2
23	Groundnut–Fallow–Blackgram	500	0.10	1
24	Onion–Sesame–Fallow	500	0.10	3
25	S.Potato–Fallow–Fallow	495	0.10	5
26	Vegetab–Fallow–Fallow	450	0.09	3
27	Onion–Vegtab–Vegetab	400	0.08	1
28	Fallow–Fallow–Blackgram	370	0.08	4
29	Wheat–Ginger/Turmeric	350	0.07	1
30	S.Potato–Jute–Fallow	230	0.05	4
31	Wheat–Sesame–Fallow	230	0.05	2
32	Grasspea–Sesame–Fallow	210	0.04	2
33-46	Other 14 patterns (in Table 8)	740	0.15	
	Total	139640	28.45	

Table 4. Area covered by pulse crops under cropping system in Faridpur region, 2014-15.

	Cropping pattern	Area (ha)	% of NCA	Frequency (no. of upazila)
01	Lentil–Jute–Fallow	15330	3.13	22
02	Lentil–Jute–T. Aman	13230	2.70	21
03	Grasspea–Jute–Fallow	12680	2.59	18
04	Grasspea–B. Aman	4140	0.84	9
05	Lentil–Sesame–T. Aman	3280	0.67	5
06	Grasspea–Jute–T. Aman	2460	0.50	11
07	Lentil–B. Aman	2130	0.43	7
08	Lentil–Vegetab–Vegetab	1910	0.39	2
09	Pea–B. Aman	1730	0.35	4
10	Grasspea–Fallow–T. Aman	1510	0.31	2
11	Grasspea–Boro–Fallow	1430	0.29	2
12	Blackgram–B. Aman	1300	0.27	4
13	Boro–Fallow–Blackgram	1250	0.25	4
14	Lentil–Sesame–Fallow	1125	0.23	5
15	Pea–Jute–Fallow	910	0.19	8
16	Lentil–Fallow–T. Aman	830	0.17	2
17	Grasspea–B.Aus+B. Aman	770	0.16	3
18	Blackgram–Jute–Fallow	735	0.15	6
19	Grasspea–Sesame–T. Aman	700	0.14	1
20	Sesame–Fallow–Blackgram	680	0.14	4
21	Lentil–Aus–Fallow	670	0.14	4
22	Wheat–Aus–Blackgram	550	0.11	1
23	Groundnut–Fallow–Blackgram	500	0.10	1
24	Fallow–Fallow–Blackgram	370	0.08	4
25	Lentil–Aus–T. Aman	350	0.07	2
26	Grasspea–Aus–T. Aman	330	0.07	1
27	Pea–Fallow–T. Aman	290	0.06	3
28	Grasspea–Sesame–Fallow	210	0.04	2
29-38	Other 10 patterns (in Table 8)	585	0.12	
	Total pulse crops	71985	14.68	

crops (Table 5). Among them onion alone is leading nine cropping patterns covering the largest area of 56,450 hectares which is equivalent to 11.50% of NCA in the region. Garlic holds the second position in spices crops leading five cropping patterns covering 13,210 hectares (2.69% of NCA). Blackcumin is a special crop with multidimensional uses. For its medicinal use it is a high value commodity in the market. Faridpur agricultural region is specially famous for the production of blackcumin. This crop is leading two patterns covering 3,000 hectares. Light textured soil and siltation by flood water are encouraging factors for spices. Moreover, extensive jute cultivation enriches soil organic matter, makes the soil friable and free from weed. All the aforesaid determinants along with marketing facilities are helping spices crop production. Favourable climate, supply of modern varieties, knowledge of modern crop management practices, good communication facilities, skilled technology transfer channel help extensive production of demanded crop (FAO, 1988).

Fibre crops

Socially and economically jute is an important crop in the Faridpur region. Thirty-six cropping patterns were identified based on jute (Table 6). It is observed that the jute based cropping patterns covered 43.49% of NCA of the Faridpur region. Among them Wheat-Jute-T. Aman cropping pattern alone occupied

Table 5. Cropping patterns with spices crops in Faridpur region, 2014-15.

	Cropping pattern	Area (ha)	% of NCA	Frequency (no. of upazila)
01	Onion–Jute–Fallow	25960	5.29	23
02	Onion–Jute–T. Aman	24510	4.99	14
03	Coriander–Jute–Fallow	6510	1.33	12
04	Garlic–Jute–Fallow	6020	1.23	16
05	Chilli–B. Aman	4370	0.89	6
06	Garlic–Jute–T. Aman	3570	0.73	8
07	Coriander–Jute–T. Aman	3380	0.69	11
08	Onion–Aus–Fallow	2860	0.58	5
09	Chilli–Jute–Fallow	2045	0.42	9
10	Blackcumin–Jute–Fallow	1780	0.36	10
11	Onion–B. Aman	1620	0.33	5
12	Chilli–Aus–Fallow	1570	0.32	3
13	Chilli–Fallow–Fallow	1360	0.28	5
14	Blackcumin–Jute–T. Aman	1220	0.25	9
15	Chilli–Vegetab–Fallow	810	0.17	6
16	Coriander–Sesame–T. Aman	700	0.14	1
17	Chilli–Fallow–T. Aman	620	0.13	3
18	Onion–Sesame–Fallow	500	0.10	3
19	Garlic–B. Aman	480	0.10	3
20	Onion–Vegtab–Vegetab	400	0.08	1
21	Onion–Sesame+B. Aman	300	0.06	1
22	Garlic–Aus–Fallow	280	0.06	3
23-27	Other five patterns (in Table 8)	490	0.10	-
	Total spices crops	58305	11.89	

6.74% of the NCA which is distributed over 26 upazilas out of 29 covering 33,045 hectares of land area. The second prevailing Onion-Jute-Fallow covers about 25,960 hectare area which is 5.29% of the NCA. Wheat-Jute-Fallow stands in fourth position in terms of area coverage but it is widely distributed over 25 upazilas out of 29 which is the second highest position in respect to distribution of the pattern in the region. Well-drained light-textured soil makes the friendly situation for early growth stages of jute. High temperature, high humidity and satisfactory rainfall are the pre-requisites for cultivation of the crop. Plenty of flood water is on time available in the region for jute retting. Clear sun-shine during the harvesting period is an extra facility for post-harvest management of fibre and stick. Now-a-days jute-stick also has a good market value with export potential. All these make a favourable package, which encourages the farmers for extensive jute cultivation in the region (FAO, 1988).

Deep-water rice ecosystem

Deep water is a special type of ecosystem in the country. In context of Faridpur region this ecosystem is very important. Table 7 presents the cropping patterns under deep water ecosystem. Among the listed 25 patterns Boro–B. Aman cropping pattern covers the highest area of 34,060 hectares which represents 6.94% of the region's NCA. This pattern is distributed over 23 upazilas out of 29. The second highest Chilli–B. Aman cropping pattern covers 4,370 hectares and distributed over six upazilas. In total the area allocated for deep water rice cultivation is 61,725 hectares, which is equivalent to 12.58% of NCA in Faridpur region. The water level of this ecosystem ranges between 150 and 400 cm, and water usually remains 3-4 months. Special rice varieties known as 'floating rice' are planted in these areas. In the past Bangladesh had a land coverage of three million hectares for deepwater rice (Jackson *et al.*, 1972). In course of time the continuous effort on modern agriculture shifted DWR area mainly to modern

Table 6. Cropping patterns with jute crops in Faridpur region, 2014-15.

	Cropping pattern	Area (ha)	% of NCA	Frequency (no. of upazila)
01	Wheat–Jute–T. Aman	33045	6.74	26
02	Onion–Jute–Fallow	25960	5.29	23
03	Onion–Jute–T. Aman	24510	5.00	14
04	Wheat–Jute–Fallow	23210	4.73	25
05	Lentil–Jute–Fallow	15330	3.13	22
06	Mustard–Jute–Fallow	13880	2.83	18
07	Lentil–Jute–T. Aman	13230	2.70	21
08	Grasspea–Jute–Fallow	12680	2.59	18
09	Mustard–Jute–T. Aman	10580	2.16	17
10	Coriander–Jute–Fallow	6510	1.33	12
11	Garlic–Jute–Fallow	6020	1.23	16
12	Vegetab–Jute–Fallow	3820	0.78	6
13	Garlic–Jute–T. Aman	3570	0.73	8
14	Coriander–Jute–T. Aman	3380	0.69	11
15	Grasspea–Jute–T. Aman	2460	0.50	11
16	Vegetab–Jute–T. Aman	2290	0.47	6
17	Chilli–Jute–Fallow	2045	0.42	9
18	Blackcumin–Jute–Fallow	1780	0.36	10
19	Potato–Jute–Fallow	1735	0.35	10
20	Blackcumin–Jute–T. Aman	1220	0.25	9
21	Fallow–Jute–T. Aman	1200	0.24	1
22	Boro–Jute–Fallow	1150	0.23	3
23	Pea–Jute–Fallow	910	0.19	8
24	Blackgram–Jute–Fallow	735	0.15	6
25	Potato–Jute–T. Aman	485	0.10	7
26	Boro–Jute–T. Aman	400	0.08	1
27	Sesame–Jute–T. Aman	260	0.05	1
28	S.Potato–Jute–Fallow	230	0.05	4
29-36	Other eight patterns (in Table 8)	710	0.14	
	Total area for jute	213335	43.49	

Table 7. Cropping patterns under deep water rice ecosystem in Faridpur region, 2014-15.

	Cropping pattern	Area (ha)	% of NCA	Frequency (no. of upazila)
01	Boro–B. Aman	34060	6.94	23
02	Chilli–B. Aman	4370	0.89	6
03	Grasspea–B. Aman	4140	0.84	9
04	Mustard–Boro–B. Aman	2620	0.53	2
05	Groundnut–B. Aman	2400	0.49	3
06	Lentil–B. Aman	2130	0.43	7
07	Pea–B. Aman	1730	0.35	4
08	Onion–B. Aman	1620	0.33	5
09	Wheat–B. Aman	1500	0.31	5
10	Blackgram–B. Aman	1300	0.27	4
11	Mustard–B. Aman	990	0.20	3
12	Mustard–B.Aus+B. Aman	980	0.20	3
13	Grasspea–B.Aus+B. Aman	770	0.16	3
14	W.Melon–B. Aman	505	0.10	2
15	Fallow–B. Aman	500	0.10	1
16	Garlic–B. Aman	480	0.10	3
17	Vegetab–B. Aman	430	0.09	2
18	Mustard–Sesame+B. Aman	350	0.07	1
19	Onion–Sesame+B. Aman	300	0.06	1
20-25	Other six patterns (in Table 8)	550	0.11	
	Total deep-water rice area	61725	12.58	

Boro. Now the area under deep water rice in Bangladesh is reduced to 0.4 million hectares (Nasim *et al.*, 2017). Though this cropping system is less productive than other modern cropping systems, however, the specific fragile ecosystem still struggling because of no other alternatives.

Sporadic and distinct cropping patterns

There are some cropping patterns which are extremely location-specific, however, with large area coverage. These are Fallow−Jute−T. Aman (Table 6), Lentil−Vegetables−Vegetables (Table 4) and Mustard−Boro−B. Aman (Table 7). The Fallow−Jute−T. Aman is grown only in Goplaganj sadar upazila (1,200 ha). Lentil−Vegetables−Vegetables is cultivated only in Madhukhali upazila on 1,900 ha of land. Mustard−Boro−B. Aman is limited to two upazilas viz Kalkini (720 ha) and sadar upazila (1,900) in Madaripur district.

Rare cropping patterns

In the present investigation, 42 cropping patterns have been identified as rare cropping patterns with negligible area coverage and seldom existence (Table 8). These are location specific system and are limited in one or two or in some cases three upazilas of the region. Total area coverage of the 42 patterns is far less than 1% of NCA. Among these, the highest area was allotted for Fallow−Sesame+B. Aman and Onion−Sesame−T. Aman (200 ha for each). These are recorded in Madhukhali upazila of Faridpur and Kalukhali upazila of Rajbari district. The smallest area was recorded for two cropping patterns whose coverage was five hectares for each (Table 8).

Most dominant cropping pattern

Boro−Fallow−Fallow was the most dominant cropping pattern in Faridpur region. It covers 24.41% of NCA in the region and is available in 28 upazilas out of 29 (Table 9). The highest area under this cropping pattern was recorded 23,000 hectares in Kotalipara upazila which represents 19.21% of the total single Boro area of the region. In respect to individual upazila the highest area is also covered by the Kotalipara upazila and it is 83% of its NCA for this pattern alone. Saltha, Janjira and Sadarpur upazila had negligible area coverage for this pattern. This pattern is frequent and concurrently experienced by early flash flood in April and cold injury at reproductive stage. Diversified cropping pattern may be resort for the farmer as a coping strategy with flood related risk (Mandal and Bezbaruah, 2013) but scope of diversification is limited due to environmental and climatic condition (FAO, 1988). In the country-wide data compilation it was observed that the single Boro was the 2nd dominant cropping pattern in Bangladesh covering 1.14 million ha (13% of NCA in the country) with its distribution in 342 upazilas of 59 districts (Nasim *et al.*, 2017).

Second dominant cropping pattern

The second dominant cropping pattern in Faridpur region is Boro-B. Aman. It belongs to 6.94% of NCA of the region and spread out over 23 upazilas (Table 10). Muksudpur upazila of Gopalganj district holds the highest area (6,300 ha) under this cropping pattern. It contributes 18.5% share of the Boro-B. Aman cropping area in the region. Rajoir stands in the second position, however, this upazila of Madaripur district has allocated biggest share 34.09% surface of its NCA. In the country-wide compilation of data it was observed that Boro−B. Aman was the 7th dominant cropping pattern in Bangladesh covering 1.83 lac ha (2.14% of NCA in the country) with its distribution in 113 upazilas of 32 districts (Nasim*et al.*, 2017).

Third dominant cropping pattern

Wheat-Jute-T. Aman cropping pattern holds the third largest area coverage 33,045 hectares in Faridpur region. This area is an equivalent to 6.73% of NCA in the region. This pattern Wheat-Jute-T. Aman is distributed over 26 upazilas. Pangsa upazila has an area of 5,200 ha for Wheat-Jute-T. Aman which stands for 15.74% of the total area under this pattern in the region (Table 11). It also covers the biggest share of upazila NCA (31.71%) allotted over different upazilas. In the country-wide compilation of data it was observed that Wheat−Jute−T.

Table 8. Rare cropping patterns covering non-significant area in Faridpur region, 2014-15.

	Cropping pattern	Area (ha)	% of NCA	Frequency	Upazila
01	Fallow−Sesame+B. Aman	200	0.04	1	Madhukhali
02	Onion−Sesame−T. Aman	200	0.04	1	Kalukhali
03	Vegetab−Vegetab−T. Aman	160	0.03	2	Madhukhali+Gosahirhat
04	Boro−Aus−T. Aman	150	0.03	2	Goalanda+Bhedarganj
05	Chickpea−Jute−T. Aman	150	0.03	3	Kalkini+Rajoir+Madaripur
06	Potato−B. Aman	150	0.03	1	Boalmari
07	Boro−Sesbania−T. Aman	120	0.03	2	Boalmari+Charbhadrasan
08	Vegetab−Jute−Vegetab	120	0.03	1	Rajoir
09	Sunflower−Jute−Fallow	105	0.02	2	Tungipara+Shariatpur
10	Mungbean−Jute−Fallow	100	0.02	3	Faridpur+Gopalganj+Kalkini
11	Vegetab−Onion−Aus	100	0.02	1	Madaripur
12	Wheat−Aus−T. Aman	100	0.02	1	Boalmari
13	Wheat−Vegetab−Vegetab	100	0.02	1	Baliakandi
14	Chilli−Jute−T. Aman	90	0.02	3	Bhanga+Saltha+Tungipara
15	S.Potato−B. Aman	90	0.02	1	Kalkini
16	Boro−Aus−Blackgram	80	0.02	1	Janjira
17	Mungbean−Jute−T. Aman	80	0.02	3	Gopalganj+Tungipara+Kalkini
18	Vegetab−Aus−Fallow	80	0.02	1	Janjira
19	Mustard−Sesame−T. Aman	70	0.01	2	Faridpur+Rajoir
20	Potato−Vegetab−T. Aman	70	0.01	1	Baliakandi
21	Mungbean−B.Aus+B. Aman	60	0.01	2	Faridpur+Tungipara
22	Maize−Jute−Fallow	55	0.01	2	Faridpur +Shariatpur
23	Coriander−Fallow−Fallow	50	0.01	2	Charbhadrasan+Janjira
24	Coriander−Vegetab−Fallow	50	0.01	1	Goalanda
25	Grasspea−Fallow−Fallow	50	0.01	1	Saltha
26	Maize−Fallow−Fallow	45	0.01	2	Charbhadrasan+Janjira
27	Muskmelon−B. Aman	40	0.01	1	Rajoir
28	Boro−Sesbania−Fallow	30	0.01	1	Charbhadrasan
29	Grasspea−Sesbania−Fallow	30	0.01	1	Bhedarganj
30	Lentil−Mungbean−T. Aman	20	0.00	1	Rajoir
31	Potato−Aus−Fallow	20	0.00	1	Charbhadrasan
32	Potato−Aus−T. Aman	20	0.00	1	Gosahirhat
33	Sesame−Fallow−T. Aman	20	0.00	1	Kotalipara
34	Maize−B. Aman	10	0.00	1	Charbhadrasan
35	Muskmelon−Fallow−Fallow	10	0.00	1	Baliakandi
36	Muskmelon−Fallow−T.Amn	10	0.00	1	Madhukhali
37	S.Potato−Fallow−T. Aman	10	0.00	1	Tungipara
38	Soybean−Fallow−Fallow	10	0.00	1	Bhedarganj
39	Soybean−Jute−Fallow	10	0.00	1	Bhedarganj
40	Wheat−Mungbean−T. Aman	10	0.00	1	Tungipara
41	Mustard−Mungbean−T.Amn	5	0.00	1	Madhukhali
42	Tobacco−Fallow−Fallow	5	0.00	1	Saltha
	Total	2885	0.59	-	

Table 9. Distribution of the most dominant Boro−F−F cropping pattern in Faridpur region, 2014-15.

	Upazila	Area (ha)	% of upazila NCA	% of the pattern in region
01	Kotalipara	23000	83.18	19.21
02	Gopalganj	17000	58.22	14.2
03	Kasiani	11000	53.14	9.19
04	Tungipara	8300	77.93	6.93
05	Kalkini	8100	40.50	6.76
06	Muksudpur	7000	30.24	5.85
07	Naria	5700	44.53	4.76
08	Shibchar	5200	22.22	4.34
09	Goshairhat	4600	38.17	3.84
10	Shariatpur	4200	32.56	3.51
11	Damudya	3800	55.88	3.17
12	Rajbari	3200	15.31	2.67
13	Bhedarganj	3000	16.67	2.51
14	Rajoir	2800	15.91	2.34
15	Madaripur	2600	12.18	2.17
16	Nagarkanda	1700	12.69	1.42
17	Faridpur	1500	6.41	1.25
18	Kalukhali	1500	12.40	1.25
19	Charbhadrasan	1200	14.81	1.00
20	Bhanga	850	5.99	0.71
21	Baliakandi	700	4.64	0.58
22	Pangsa	700	4.27	0.58
23	Madhukhali	600	4.26	0.50
24	Alfadanga	550	5.82	0.46
25	Goalanda	450	4.95	0.38
26	Saltha	200	1.59	0.17
27	Janjira	200	1.41	0.17
28	Sadarpur	100	0.54	0.08
	Faridpur region	119750	24.40	100.00

Aman was the 9th dominant cropping pattern in Bangladesh covering 1.47 lac ha (1.72% of NCA in the country) with its distribution in 216 upazilas of 43 districts (Nasim *et al*., 2017).

Fourth dominant cropping pattern

Fourth dominant cropping pattern Onion-Jute-Fallow has occupied 25,960 ha representing 5.29% share of NCA in Faridpur region (Table 12). This pattern is distributed over 23 upazilas where Nagarkanda ranked in top position. This upazila has 5,800 ha area Onion-Jute-Fallow, which is over 43% of upazila NCA. Boalmari upazila ranks in second position with 5,350 ha area for this pattern; which is also stands in second position in terms of percentage of upazila NCA as well as distribution of the patterns in the region.

Fifth dominant cropping pattern

The fifth dominant cropping pattern of the region is Onion-Jute-T. Aman. It had been covering 24,510 hectares representing 4.99% share of NCA in Faridpur region (Table 13). This pattern is distributed over 14 upazilas where Saltha ranked in top position. This upazila had 7,000 ha area for Onion-Jute-T. Aman pattern which is 55.56% of its upazila NCA. This is also the highest area coverage (28.56%) in respect of this pattern in the region.

Crop diversity and cropping intensity

The level of crop diversification largely depends on the geo-climatic or socio-economic conditions and technological development in a region (Bhatia, 1965). Higher number of available crops under cultivation in an

Table 10. Distribution of the 2nd dominant Boro−B. Aman cropping pattern in Faridpur region, 2014-15.

	Upazila	Area (ha)	% of upazila NCA	% of the pattern in region
01	Muksudpur	6300	27.21	18.50
02	Rajoir	6000	34.09	17.62
03	Madaripur	5000	23.42	14.68
04	Bhanga	2100	14.79	6.17
05	Sadarpur	2000	10.78	5.87
06	Kasiani	1500	7.25	4.40
07	Kotalipara	1300	4.70	3.82
08	Shariatpur	1300	10.08	3.82
09	Faridpur	1000	4.27	2.94
10	Rajbari	1000	4.78	2.94
11	Bhedarganj	900	5.00	2.64
12	Naria	900	7.03	2.64
13	Kalkini	850	4.25	2.50
14	Nagarkanda	800	5.97	2.35
15	Gopalganj	800	2.74	2.35
16	Alfadanga	700	7.41	2.06
17	Damudya	400	5.88	1.17
18	Goshairhat	400	3.32	1.17
19	Madhukhali	280	1.99	0.82
20	Saltha	200	1.59	0.59
21	Kalukhali	200	1.65	0.59
22	Tungipara	80	0.75	0.23
23	Boalmari	50	0.24	0.15
	Faridpur region	34060	6.94	100.00

area dictates its higher diversity. Number of cropping patterns is also a gross indicator of crop diversity. A total of 141 cropping patterns were identified in the whole area of Faridpur region under this investigation. The highest number of cropping patterns was identified 44 in Faridpur sadar upazila and that was 42 in Janjira and 40 in Charbhadrasan (Table 14). The lowest number of cropping patterns was identified 12 in Kasiani and Pangsa. The higher number of cropping patterns is generally related to higher level of diversity indices for cropping pattern. The upazilas having lower number of cropping patterns were due to flooding and/ or water logging. The lowest diversity index for cropping pattern was recorded 0.307 in Kotalipara followed by 0.394 in Tungipara upazila. The highest value of diversity index for cropping pattern was found 0.957 in Faridpur sadar that was followed by 0.949 in Janjira upazila. The lowest CDI was reported 0.448 in Kotalipara followed by 0.606 in Tungipara. The highest value of CDI was observed 0.981 in Faridpur sadar followed by 0.977 in Madhukhali upazila. The range of cropping intensity values was recorded 113-262%. The maximum value was for Saltha upazila of Faridpur district and minimum for Kotalipara upazila of Gopalganj district. As a whole the CDI of Faridpur region was calculated 0.971 and the average cropping intensity at regional level was 197%. In a simultaneous study, the investigators identified 316 cropping patterns for whole Bangladesh; where the CDI value was 0.952 at national level and the national average of cropping intensity was 200% (Nasim *et al.*, 2017). Diversification of crops helps risk reduction as diversification allows a producer to balance low price in one or two crops with reasonable prices in other (Blade and Slinkard, 2002). The farmers of Kerala diversified their cropping pattern to minimize risk from crop failures and price fluctuations (Mahesh, 1999).

Table 11. Distribution of the 3rd dominant Wheat-Jute-T. Aman cropping pattern in Faridpur region, 2014-15.

	Upazila	Area (ha)	% of upazila NCA	% of the pattern in region
01	Pangsa	5200	31.71	15.74
02	Faridpur	4000	17.09	12.1
03	Boalmari	3300	16.02	9.99
04	Sadarpur	3000	16.17	9.08
05	Bhanga	2500	17.61	7.57
06	Nagarkanda	2000	14.93	6.05
07	Rajbari	2000	9.57	6.05
08	Madhukhli	1900	13.48	5.75
09	Baliakandi	1600	10.60	4.84
10	Kalukhali	1400	11.57	4.24
11	Alfadanga	900	9.52	2.72
12	Muksudpur	800	3.46	2.42
13	Shibchar	700	2.99	2.12
14	Goalanda	600	6.59	1.82
15	Madaripur	500	2.34	1.51
16	Saltha	400	3.17	1.21
17	Naria	350	2.73	1.06
18	Gopalganj	300	1.03	0.91
19	Kasiani	300	1.45	0.91
20	Bhedarganj	250	1.39	0.76
21	Tungipara	230	2.16	0.70
22	Damudya	220	3.24	0.67
23	Goshairhat	220	1.83	0.67
24	Kalkini	200	1.00	0.61
25	Shariatpur	100	0.78	0.30
26	Janjira	75	0.53	0.23
	Faridpur region	33045	6.73	100.00

Table 12. Distribution of the 4th dominant Onion-Jute-Fallow cropping pattern in Faridpur region, 2014-15.

	Upazila	Area (ha)	% of upazila NCA	% of the pattern in region
01	Nagarkanda	5800	43.28	22.34
02	Boalmari	5350	25.97	20.61
03	Saltha	2300	18.25	8.86
04	Kalukhali	1800	14.88	6.93
05	Faridpur	1500	6.41	5.78
06	Baliakandi	1500	9.93	5.78
07	Sadarpur	1300	7.01	5.01
08	Janjira	1080	7.61	4.16
09	Goalanda	850	9.34	3.27
10	Bhanga	800	5.63	3.08
11	Shibchar	800	3.42	3.08
12	Rajbari	550	2.63	2.12
13	Kasiani	500	2.42	1.93
14	Alfadanga	470	4.97	1.81
15	Muksudpur	400	1.73	1.54
16	Charbhadrasan	250	3.09	0.96
17	Tungipara	200	1.88	0.77
18	Kalkini	120	0.60	0.46
19	Madaripur	100	0.47	0.39
20	Bhedarganj	100	0.56	0.39
21	Shariatpur	70	0.54	0.27
22	Madhukhali	60	0.43	0.23
23	Rajoir	60	0.34	0.23
24	Faridpur region	25960	**5.29**	100.00

Table 13. Distribution of the 5th dominant Onion-Jute-T. Aman cropping pattern in Faridpur region, 2014-15.

	Upazila	Area (ha)	% of upazila NCA	% of the pattern in region
01	Saltha	7000	55.56	28.56
02	Pangsa	3400	20.73	13.87
03	Baliakandi	2800	18.54	11.42
04	Kalukhali	2800	23.14	11.42
05	Madhukhali	2000	14.18	8.16
06	Shibchar	1800	7.69	7.34
07	Faridpur	1000	4.27	4.08
08	Bhanga	900	6.34	3.67
09	Sadarpur	900	4.85	3.67
10	Rajbari	600	2.87	2.45
11	Nagarkanda	500	3.73	2.04
12	Muksudpur	400	1.73	1.63
13	Naria	360	2.81	1.47
14	Damudya	50	0.74	0.20
	Faridpur region	24510	4.99	100.00

Table 14. Crop diversity and cropping intensity in Faridpur region, 2014-15.

	Upazila	No. of identified pattern	No. of crop	Diversity index for cropping pattern	Crop diversity index (CDI)	C.I. (%)
01	Alfadanga	18	15	0.917	0.957	205
02	Bhanga	16	16	0.887	0.947	224
03	Boalmari	21	19	0.861	0.948	234
04	Charbhadrasan	40	22	0.942	0.970	183
05	Faridpur sadar	44	25	0.957	0.981	216
06	Madhukhali	39	22	0.937	0.977	237
07	Nagarkanda	17	14	0.779	0.901	214
08	Sadarpur	21	22	0.909	0.959	228
09	Saltha	23	16	0.649	0.850	262
10	Gopalganj sadar	25	18	0.675	0.848	151
11	Kasiani	12	10	0.692	0.732	153
12	Kotalipara	16	14	0.307	0.448	113
13	Muksudpur	17	15	0.810	0.912	184
14	Tungipara	28	22	0.394	0.606	126
15	Kalkini	30	19	0.822	0.935	179
16	Madaripur sadar	23	17	0.883	0.952	224
17	Rajoir	29	21	0.837	0.922	201
18	Shibchar	18	14	0.908	0.966	211
19	Baliakandi	24	21	0.924	0.965	247
20	Goalanda	22	17	0.931	0.966	205
21	Kalukhali	16	13	0.885	0.943	231
22	Pangsa	12	12	0.852	0.928	244
23	Rajbari sadar	18	15	0.928	0.971	229
24	Bhedarganj	33	21	0.935	0.970	191
25	Damudya	22	17	0.689	0.871	163
26	Goshairhat	22	13	0.843	0.938	175
27	Naria	22	13	0.783	0.902	156
28	Shariatpur sadar	30	22	0.851	0.930	168
29	Janjira	42	21	0.949	0.974	199
	Faridpur region	141	34	0.918	0.971	197

CONCLUSION

Faridpur region holds a wide range of cropping patterns with diversified crops. The intensity of cropping in the region is more or less similar to the national average but the country demands more to cope with its huge population within its limited resources. The less intensified area of the region is under deep water ecosystem which covers a major share of the regional NCA. Single Boro and Boro-B. Aman cropping patterns are the dominant patterns in this ecosystem. Based on the findings of the study, the following recommendations were made.

- Necessary steps need to be taken to increase the productivity of exclusive rice based cropping patterns. As rice is the major component of the food security in context of our country, we need to explore some high yielding rice varieties along with the recommended crop management practices for deep water ecosystem.
- The upazilas having unique or exceptional cropping patterns with large area coverage might be studied in-depth to extrapolate to similar environments.
- Scope might be explored for the establishment of agro-industry on the basis of jute crop.
- Research and development activities can be taken in hand to diversify the single and double cropped area with the inclusion of new crops and crop varieties.
- In the single Boro area suitable vegetables might be grown on floating bed system in wet season.

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Appendix 1. List of cropping patterns in Faridpur region, 2014-15.

	Cropping pattern	Area (ha)		Cropping pattern	Area (ha)
01	Boro−Fallow−Fallow	119750	51	Groundnut− Aus−Fallow	1150
02	Boro−B. Aman	34060	52	Lentil−Sesame−Fallow	1125
03	Wheat−Jute−T. Aman	33045	53	Mustard−B. Aman	990
04	Onion−Jute−Fallow	25960	54	Mustard−B.Aus+B. Aman	980
05	Onion−Jute−T. Aman	24510	55	Sesame−Aus−Fallow	950
06	Wheat−Jute−Fallow	23210	56	Pea−Jute−Fallow	910
07	Boro−Fallow−T. Aman	17685	57	Lentil−Fallow−T. Aman	830
08	Lentil−Jute−Fallow	15330	58	Chilli−Vegetab−Fallow	810
09	Mustard−Jute−Fallow	13880	59	Wheat−Fallow−T. Aman	780
10	Lentil−Jute−T. Aman	13230	60	Grasspea−B.Aus+B. Aman	770
11	Grasspea−Jute−Fallow	12680	61	Blackgram−Jute−Fallow	735
12	Mustard−Jute−T. Aman	10580	62	Coriander−Sesame−T. Aman	700
13	Vegetab−Vegetab−Vegetab	8420	63	Grasspea−Sesame−T. Aman	700
14	Coriander−Jute−Fallow	6510	64	Boro−Aus−Fallow	685
15	Mustard−Boro−Fallow	6170	65	Sesame−Fallow−Blackgram	680
16	Garlic−Jute−Fallow	6020	66	Lentil−Aus−Fallow	670
17	Chilli−B. Aman	4370	67	Chilli−Fallow−T. Aman	620
18	Vegetab−Vegetab−Fallow	4255	68	Wheat−Aus−Blackgram	550
19	Grasspea−B. Aman	4140	69	W.Melon−Fallow−Fallow	510
20	Vegetab−Jute−Fallow	3820	70	W.Melon−B. Aman	505
21	Garlic−Jute−T. Aman	3570	71	Fallow−B. Aman	500
22	Coriander−Jute−T. Aman	3380	72	Groundnut−Fallow−Blackgram	500
23	Lentil−Sesame−T. Aman	3280	73	Mustard−Fallow−T. Aman	500
24	Onion−Aus−Fallow	2860	74	Onion−Sesame−Fallow	500
25	Mustard−Boro−B. Aman	2620	75	S.Potato−Fallow−Fallow	495
26	Grasspea−Jute−T. Aman	2460	76	Potato−Jute−T. Aman	485
27	Groundnut−B. Aman	2400	77	Garlic−B. Aman	480
28	Vegetab−Jute−T. Aman	2290	78	Sesame−Aus−T. Aman	460
29	Wheat−Sesame−T. Aman	2170	79	Vegetab−Fallow−Fallow	450
30	Lentil−B. Aman	2130	80	Vegetab−B. Aman	430
31	Mustard−Aus−Fallow	2090	81	Boro−Jute−T. Aman	400
32	Chilli−Jute−Fallow	2045	82	Onion−Vegtab−Vegetab	400
33	Lentil−Vegetab−Vegetab	1910	83	Fallow−Fallow−Blackgram	370
34	Blackcumin−Jute−Fallow	1780	84	Lentil−Aus−T. Aman	350
35	Potato−Jute−Fallow	1735	85	Mustard−Sesame+B. Aman	350
36	Pea−B. Aman	1730	86	Wheat−Ginger/Turmeric	350
37	Onion−B. Aman	1620	87	Grasspea−Aus−T. Aman	330
38	Mustard−Boro−T. Aman	1590	88	Mustard−Aus−T. Aman	320
39	Chilli−Aus−Fallow	1570	89	Groundnut−Fallow−T. Aman	310
40	Grasspea−Fallow−T. Aman	1510	90	Onion−Sesame+B. Aman	300
41	Wheat−B. Aman	1500	91	Pea−Fallow−T. Aman	290
42	Groundnut−Fallow−Fallow	1480	92	Garlic−Aus−Fallow	280
43	Grasspea−Boro−Fallow	1430	93	Vegetab−Fallow−T. Aman	280
44	Chilli−Fallow−Fallow	1360	94	Sesame−Jute−T. Aman	260
45	Blackgram−B. Aman	1300	95	Boro−Vegetab(Float/Norm)	245
46	Boro−Fallow−Blackgram	1250	96	S.Potato−Jute−Fallow	230
47	Blackcumin−Jute−T. Aman	1220	97	Wheat−Sesame−Fallow	230
48	Fallow−Jute−T. Aman	1200	98	Fallow−Sesame−T. Aman	210
49	Wheat−Aus−Fallow	1200	99	Grasspea−Sesame−Fallow	210
50	Boro−Jute−Fallow	1150	100-141	Other 42 patterns (Table 8)	910