Short Note

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Rice (*Oryza Sativa*) - Based Diversification System in Recent Flood Plain (Jiabhareli Catchment) Situation of NBPZ of Assam

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ABSTRACT

An action research programme was carried out during 2006-07 and 2007-08 to find out the suitable cropping sequences at farmers field of recent flood plain (Jiabhareli catchment) of NBPZ of Assam. The soil was sandy loam in texture having 40.47% WHC, low in available nitrogen, medium in organic carbon, available P_2O_5 and K_2O respectively. Among the 9 cropping sequences (T_1) rice – french bean - maize (grain) recorded highest rainy season rice yield, net return and benefit cost ratio respectively followed by (T_2) rice – pea – okra and (T_8) rice – garlic - sesamum sequence. Similarly highest rice equivalent yield and land use efficiency also recorded in (T_1) rice - french bean – maize (grain) sequences followed by (T_2) rice –pea-okra and (T_8) rice – garlic – sesamum sequence. But highest production efficiency recorded in (T_6) rice - tomato- ridge gourd followed by (T_5) rice – cabbage - cucumber and (T_7) rice – brinjal – summer black gram sequences.

Key words: Diversification, cropping sequence, Rice equivalently yield, land use efficiency, Production efficiency

Rice is main rainy season crop (Singh and Singh, 2007) grown under flood prone and recent flood prone situation of Assam. In Assam around 3-5 lakh hectare areas is under chronically flood-affected (Singh *et al.*, 1997). In these area the domination of rice production and as a result, the area under non cereal crops has continued to diminish. With over dependence of rice production in such area throughout the year, is detrimental to soil fertility. It also makes the crops easily susceptible to the pest attack (Singh *et al.*, 2012), so, the government has now recognized the urgent need for agriculture diversification in such flood prone situation. Diversification of cropping system is essentials to get the higher yield and return, maintain a better soil structure for long - term sustainability (Singh *et al.*, 2009 and Singh *et al.*, 2014b). Crop diversification also minimizes the risk of outbreak of disease and insect pests (Singh *et al.*, 2014a). Thus, not only the numbers of crops but also the types of crops included in the cropping sequences are also important (Singh *et al.*, 2014b). Under cropping system selection of suitable varieties under cropping system mode is utmost important for successful system productivity without impacting preceding or succeeding crops in the cropping system (Singh *et al.*, 2004 and Singh *et al.*, 2008). In such area heavy dependence on rice crops need to be shifted to other vegetable, oilseed, pulse and fiber crops. Introduction of potato and groundnuts in rice base cropping sequence in new alluvial zone of West Bengal has recorded highest yield rice equivalent yield, land use efficiency and net return (Samui *et al.*, 2004). Similarly inclusion of potato in rice base cropping sequences in West Bengal has become attractive because of high yield and remunerative price of potato (Singh *et al.*, 2015). Therefore it was felt necessary to work out location specific crop diversification for recent flood prone are (Jiabhareli catchments) of North Bank Plain Zone (NBPZ) of Assam. This can be utilizes the proper time considering the flood occurrence, natural and applied resources judiciously to maximize profit and sustained environment for future generation.

An action research programme was conducted with 9 types of crop sequences for two consecutive years in randomized complete block design, with 3 replications in fixed plot of 5m X 10m area. The experiment layout at farmer's field, village- Khaloibeel, block - Gabhoru, district – Sonitpur, Assam, Which was recent flood

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prone area under Jiabhereli catchment. It's a tributary of the mighty Brahmaputra, which causes 3-4 times flooding during the month of June to August and water inundation period remain maximum up to seven days. This village falls under North Bank Plain agro climatic zone of Assam. The soil was sandy loam (sand -70.24%, silt – 23.36% and clay -6.40%), water holding capacity 40.47%, soil was slightly acidic in nature ($_{P}^{H}$ – 6.3), medium in organic carbon (0.54%), medium in available P_2O_5 and K_2O (35.58 and 141.66 kg/ha respectively), low in available nitrogen (130.66kg/ha). The experiment was done with recommended package and practices. Different crops and their varieties with respect to fertilizer doses were: Rice (Jalashree) - 40:20:20, French bean (Laxmi) - 65:250:33, Pea (Arkel)- 45:285:10, Mustrad (TS-36) - 87:220:25, Potato (Khasi) - 133:312:83, Tomato (Suraksha) - 162:375:100, Brinjal (Bholabengana) – 50:50:50, Cabbage (Rare ball) – 260:375:100, Garlic (Local) – 100:80:60, Onion (Pusa red) – 60:40:40, Okra (Arka anamika) – 50:50:50, Cowpea (Pusa barsati) – 15:35:10, Colacasia (Knolkochu) – 80:60:120, Cucumber (Harsini) – 50:45:80, Ridge gourd (NS-3) - 20:30:30, Summer black gram (T-9) - 15:35:10, Sesamum (Punjab Til No 1) -30:20:20 and Pumpkin (Local)- 75:80:80.

In cropping sequence rice – french bean – maize (grain) recorded highest yield of rainy season rice (4.146 tonnes/ha) and lowest yield of rainy season rice recorded in rice – tomato – ridge gourd (4.017 tonnes/ha). There was no significant different in yield of rice among the different cropping sequences (Table 1). In these 9 cropping sequences there was found great significant differences among cost of cultivation, gross return, net return and benefit: cost ratio. From the analysis revealed that the highest cost of cultivation recorded at (T_4) rice – potato – colacasia sequence followed by (T_2) rice – pea-Okra and lowest cost of cultivation recorded at (T_9) rice – onion - pumpkin sequences (Table 1). This might be due to the higher cost involved in potato cultivation followed by pea and okra. The highest gross return recorded at (T_2) rice – pea-okra sequence followed by (T_1) rice – french bean – maize (grain) and (T_8) rice – garlic – sesamum sequence. But highest net return and benefit: cost ratio recorded (T_1) rice – French bean-maize (grain) followed by (T_2) rice – pea - okra and (T_8) rice – garlic – sesamum sequence. Therefore form the gross return, net return and benefit: cost ratio point of view revealed that maximum benefit could be obtained either from the 3 cropping sequences viz.(T_1) rice - french bean – maize (grain), (T_2) rice – pea – okra and (T_8) rice – garlic - sesamum. This might be due to the incorporation of pulses, oilseed and vegetables in the rice base cropping sequences. Rice equivalent yield was the highest in (T_1) rice - french bean – maize(grain) cropping system followed by (T_2) rice – pea – okra and (T_8) rice – garlic – sesamum (Table 2). This might be due to the higher yield of rice along with other pulse, oilseed and vegetable crops. Similarly land use efficiency was recorded at (T_1) rice – french bean – maize (grain) followed by (T_2) rice – pea - okra and (T_8) rice – garlic – sesamum sequence. But production efficiency highest recorded (T_6) rice – tomato – ridge gourd sequences followed by (T_5) rice – cabbage – cucumber and (T_7) rice – brinjal – summer black gram sequence.

Table 1: Evaluation of different crop sequences tested in recent flood plain situation of NBPZ of Assam.

Treatment	Season and crop			System duration (days)	Rainy season rice yield (tones/ha)	Cost of cultivation (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	Benefit : Cost ratio
	Rainy	**Winter**	**Summer**						
T_1	Rice	French bean	Maize (Grain)	305	4.146	51391	190710	139319	2.710
T_2	Rice	Pea	Okra	355	4.127	56786	193340	136554	2.405
T_3	Rice	Mustard	Cowpea	340	4.100	52467	99700	47233	0.900
T_4	Rice	Potato	Colacasia	340	4.126	66409	129450	63041	0.949
T_5	Rice	Cabbage	Cucumber	340	4.120	56006	144340	88334	1.577
T_6	Rice	Tomato	Ridge gourd	335	4.017	55983	148910	92927	1.660
T_7	Rice	Brinjal	Black gram	335	4.084	52779	118840	66061	1.252
T_8	Rice	Garlic	Sesamum	350	4.122	50232	157560	107328	2.137
T_9	Rice	Onion	Pumpkin	355	4.027	45127	133210	88083	1.951
CD (P=0.05)					NS	1565.99	1681361	818.32	0.09

MSP (Rs/tones): Rice -7000, French bean-8000, Maize-15000, Pea-20000, Okra-8000, Mustard -20000, Cowpea – 10000, Potato -6000, Colacasia – 8000, Cabbage – 5000, Cucumber -5000, Tomato – 3000, Ridge gourd – 5000, Brinjal – 3000, Black gram – 30000, Garlic – 15000, Sesamum – 30000, Pumpkin – 2000 and Onion – 6000.

Table 2: Yield data and production efficiency of different crop sequences tested in recent flood plain situation of NBPZ of Assam.

Treatment	Crop Sequence			Yield (tones/ha)			Rice equivalent yield (tones/ha)	Production efficiency (kg/ha/day)	Land use efficiency (kg/day/ha)
	Rainy	Winter	Summer	Rainy	Winter	Summer			
T_1	Rice	French bean	Maize (Grain)	4.15	10.00	5.50	23.22	64.03	76.13
T_2	Rice	Pea	Okra	4.13	1.10	17.00	22.57	61.75	62.69
T_3	Rice	Mustard	Cowpea	4.10	1.05	5.00	10.14	29.85	29.82
T_4	Rice	Potato	Colacasia	4.03	15.00	1.30	14.35	59.79	42.21
T_5	Rice	Cabbage	Cucumber	4.12	18.00	5.10	16.49	80.06	48.50
T_6	Rice	Tomato	Ridge gourd	4.02	25.00	9.00	17.14	113.49	51.16
T_7	Rice	Brinjal	Black gram	4.09	20.00	1.00	12.86	74.90	38.39
T_8	Rice	Garlic	Sesamum	4.12	7.00	0.80	18.43	34.06	52.66
T_9	Rice	Onion	Pumpkin	4.03	15.00	7.50	15.00	73.69	41.67

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