Damage of Horticultural Crops and Vegetables Due to Excessive Rainfall: A Study in Purulia-I Block of Purulia District During the Year 2017

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Abstract: Sustainable development cannot be achieved without a major contribution from agriculture. The present study was carried out in Purulia-I block of Purulia district in West Bengal. This research was motivated by the concern that most farmers face heavy rains during the growing season and that crop damage and yield losses due to heavy rains cause extensive losses among farmers. The present study indicates that the total 287 hector area was damaged due to excessive rainfall in Purulia-I block where 496 hector area shown under vegetable cultivation. Total cultivable area in Purulia-I block was 19334.19 hector. It is also clearly notified that Dihdiha Gram Panchayat was highly affected (65.15%) by heavy rainfall where Manara Gram Panchayat (51.85%) was lowest in this block and the average damaged area under vegetable cultivation in Purulia-I block is 57.86 percent. Excessive rainfall has a detrimental impact on horticultural crops productivity but rainfall during the specific growth stage is rarely used in efficiency analysis. This study focuses on this available point and examines the influence of rainfall specifically encountered during the sowing stage and early vegetative growth stage and the flowering stage of different horticultural crops in Purulia district.

Keywords: Horticultural Crops, Vegetables, Damaged, Excessive Rainfall, Econometrics, Purulia

I. INTRODUCTION

Agriculture is one of the bases of the rural economy of Purulia district. The effect of excessive rainfall on any crop output at any location is very difficult to measure precisely. For, it is not only the volume of rainfall but also its distribution at different stages of the plant growth what influences the total output. Similarly, the volume and distribution of rain at the time of sowing, flowering, maturing, and harvesting affect crop yield. Consideration of these issues would necessitate introduction of a large number of explanatory variables into the agri-production-rainfall relationship. The problem is the short production data series of less than 20 years, which is available, does not provide enough scope for such a rigorous analysis. Use of a large number of explanatory variables in the structural equation will reduce the precious degrees of freedom for estimating the parameters with adequate level of confidence. Consequently, aggregation of the rainfall data from different parts of the country into some suitable rainfall index at the national level becomes necessary. Controlled rainfall variables, seed rate, human labor and land preparation cost are important parameters influencing pulses yield. In the efficiency model, levels of yield loss have a negative impact while being a male household head, access to government credit, access to training, locating farms in the Bago Region and possessing a large area of pulses have a positively significant effect on technical efficiency. Policy recommendations include the establishment of a safety network, such as crop insurance to protect farmers from losses due to unpredictable weather conditions, promoting training programs on cultural practices adapted to climate change, wide coverage of extension activities, giving priority to small-scale farmers and female farmer participation in training and extension activities and increasing the rate of credit availability to farmers. The key findings of the assessment show that the disaster had a severe impact on the livelihoods of families that rely on agriculture. Most villages in the six regions/states reported that large parts of their agricultural land were affected by the floods. The anticipated high production losses could expose an already vulnerable population to greater food insecurity and possibly malnutrition. Overall, there was also a significant accumulation of sediment and debris on agricultural land due to the disaster. Heavy machineries are needed to rehabilitate the land. Additional findings show that job opportunities such as agricultural casual labour, which is considered one of the most important income-generating activities for the rural population, have already diminished and will probably decrease even further during the upcoming monsoon harvest season. Women are expected to be more severely affected by this situation and the lack of work opportunities will have a significant impact on the livelihoods of many vulnerable women. Affected women's wages are already almost 20 percent lower than those of men, as reported in the results of the assessment. Seeds, fertilizers and tools were also lost in the disaster. With additional damage to irrigation systems, many farmers risk missing the start of the upcoming winter and summer agriculture seasons starting in October and January respectively. The replacement of agricultural inputs and tools as well as the rehabilitation of irrigation schemes is crucial to ensure that affected populations can continue agricultural activities in the coming seasons.

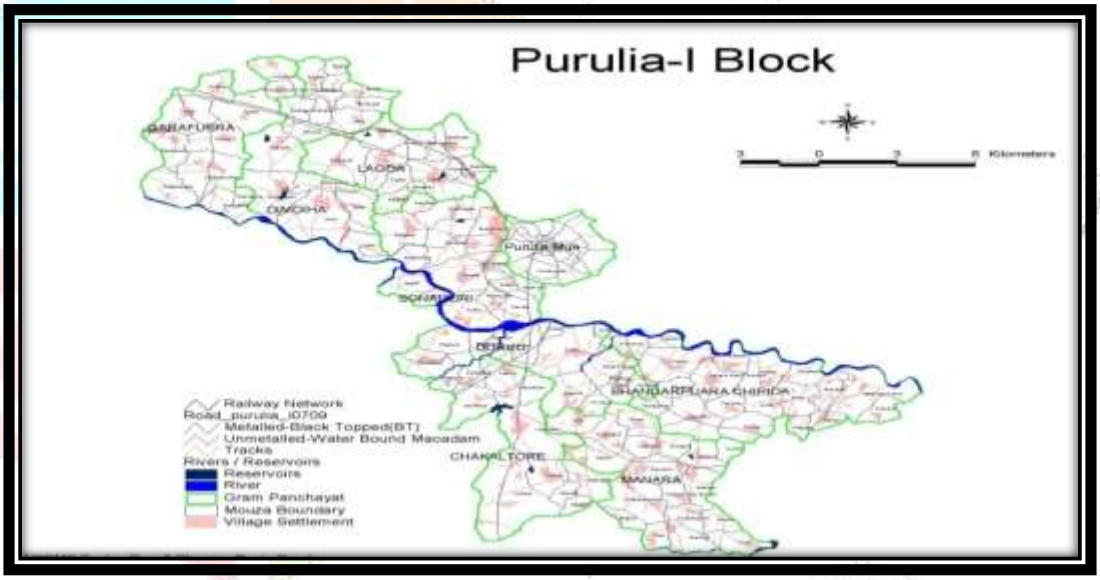
II. MATERIALS AND METHOD

The present study is based on an intensive fieldwork conducted in Purulia-I Block of Purulia district, West Bengal during the months of October 2017 to November 2017. Before the commencement of fieldwork, a pilot study was conducted during the month of September 2017. Based on that pilot study, Purulia-I Block of Purulia district were selected for final study. Purposive sampling method was used while selecting the study area.

Physiographically, Purulia, the westernmost district of West Bengal, is well known as a drought prone district and falls within the semi-arid region of the state. Cultivation of this district is predominantly mono-cropped. Out of total geographical land 52.47 % are used for agriculture. 29.69 % are under forest coverage (including social forestry) and 10.15 % are identified as Wasteland. Soil erosion is the most prominent phenomenon of the district resulting huge deposition of fertile soil in the valley region. Vast areas of land remained uncultivable wasteland. Out of the total agricultural holding about 73 % belongs to small and marginal farmers having scattered and fragmented smallholding. About 90 % of the population lives in villages and about 44 % of the rural population is below poverty line.

The completed data sheet shall be scrutinized, verified, edited and arranged serially. For coding, three master-code sheets shall be prepared, one for the data collected from the general farmer, another for the data collected from local rural people and the third for the data collected from agriculture officials. The data related to the study were feed into a computer and verified in order to eliminate errors. One way and two-way tabular analysis with appropriate statistics like percentage, average, and co-relation were used in the analysis of data.

Map of Purulia-I Block, Purulia District:

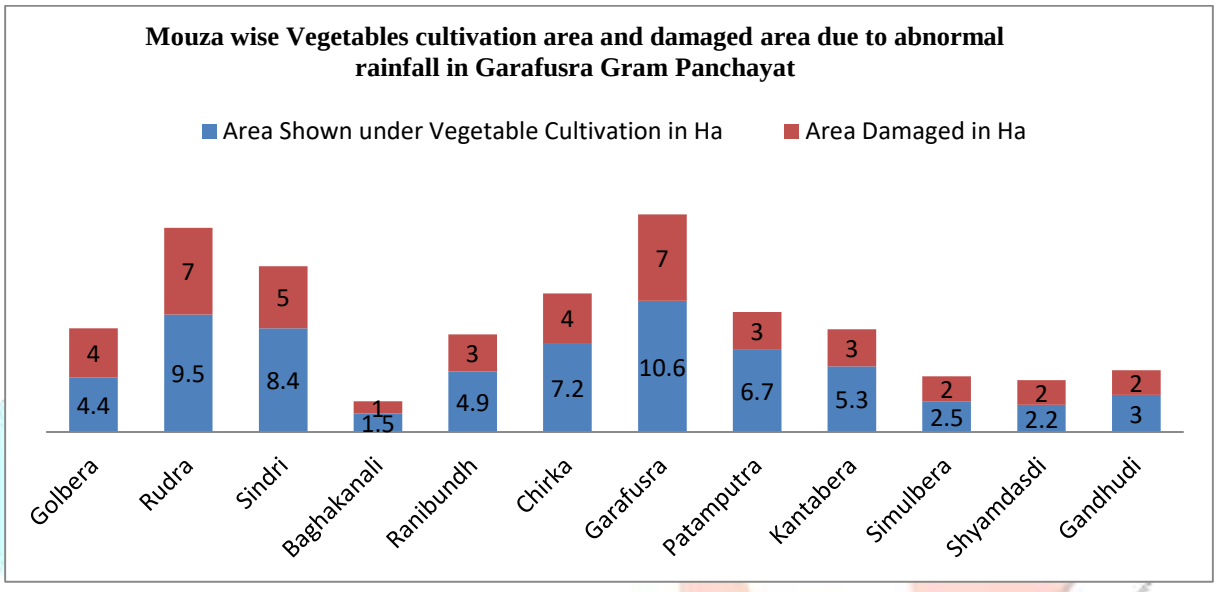


III. RESULT AND DISCUSSION:

Table 1: Mouza wise Agricultural land, Horticultural crops cultivation area and damaged area due to excessive rainfall under Garafusra Gram Panchayat.

Sl No	Name of the GP	Mouza	JL No	Geo Area(Ha)	Cultivable Area(HA)	Area Shown under Vegetable Cultivation in Ha	Area Damaged in Ha	Damaged In %
1	**Garafusra**	Golbera	1	228.24	155	4.4	4	90.90%
2		Rudra	2	486.84	332	9.5	7	73.68%
3		Sindri	3	443.94	293	8.4	5	59.52%
4		Baghakanali	4	19.83	16	1.5	1	66.66%
5		Ranibundh	5	243.22	173	4.9	3	61.22%
6		Chirka	6	368.67	251	7.2	4	55.55%
7		Garafusra	7	535	370	10.6	7	60.03%

8		Patamputra	8	330.22	233	6.7	3	44.77%
9		Kantabera	9	270.74	184	5.3	3	56.60%
10		Simulbera	10	76.49	52	2.5	2	80.0 %
11		Shyamdasdi	18	111.29	76	2.2	2	90.90%
12		Gandhudi	19	254.14	175	3.0	2	66.66%
Total=				3368.62	2310	66.1	43	65.05%

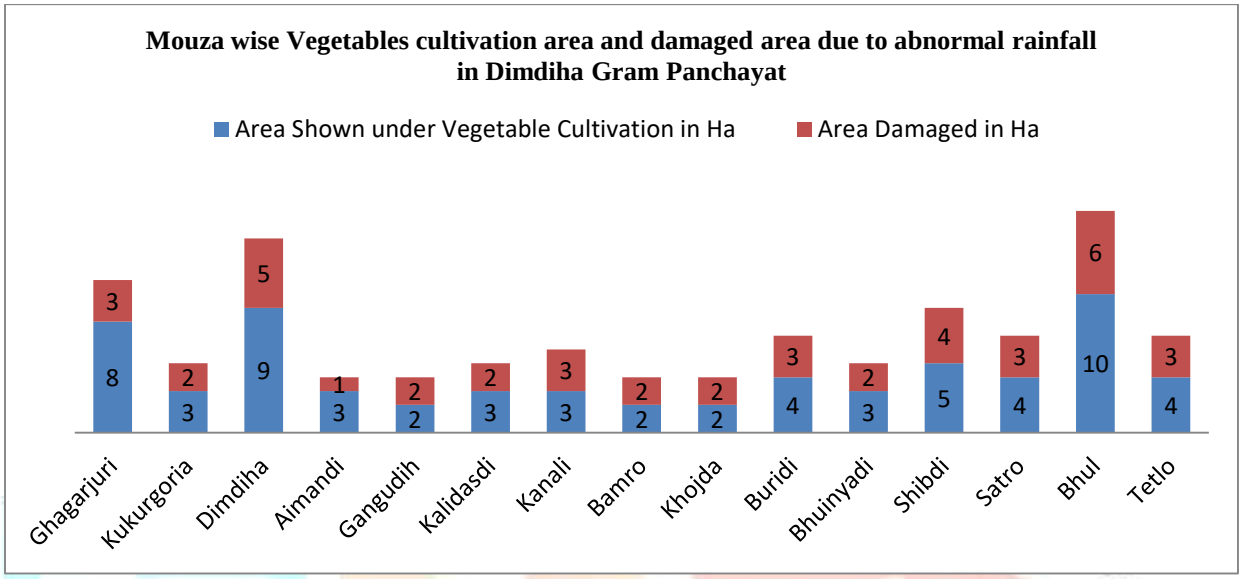


It could be observed from table 1 that total 43 hector area was damaged due to excessive rainfall in Garafusra Gram Panchayat where 66.1 hector area shown under vegetable cultivation. Total cultivable area in Garafusra Gram Panchayat was 2310 hector. From the above table it clearly shows that Golbera and Shyamdasdi mouza were highly affected (90.90%) by heavy rainfall where Patamputra mouza (44.77%) was lowest in this Gram Panchayat. From the above results it was found that the average damaged area under vegetable cultivation is 65.05 percent.

Table 2: Mouza wise Agricultural land, Horticultural crops cultivation area and damaged area due to excessive rainfall under Dimdiha Gram Panchayat.

Sl No	Name of the GP	Mouza	JL No	Geo Area(Ha)	Cultivable Area(HA)	Area Shown under Vegetable Cultivation in Ha	Area Damaged in Ha	Damaged In %
1	Dimdiha	Ghagarjuri	11	492.91	322	8	3	37.5%
2		Kukurgoria	12	184.94	120	3	2	66.66%
3		Dimdiha	14	513.96	335	9	5	55.55%
4		Aimandi	15	157.83	102	3	1	33.33%
5		Gangudih	16	108.86	71	2	2	100%
6		Kalidasdi	17	178.28	116	3	2	66.66%
7		Kanali	20	180.49	117.4	3	3	100%
8		Bamro	21	63.54	40	2	2	100%
9		Khojda	22	132.97	85	2	2	100%
10		Buridi	23	113.31	73	4	3	75.0%
11		Bhuinyadi	24	162.68	105	3	2	66.66%
12		Shibdi	25	256.57	168	5	4	80.0%

13		Satro	34	239.17	155	4	3	75.0%
14		Bhul	35	704.56	460	10	6	60.0%
15		Tetlo	36	245.24	159	4	3	75.0%
Total=				**3735.31**	**2428.4**	66	**43**	**65.15%**



It was found from table 2 that total 43 hector area was damaged due to excessive rainfall in Dimdiha Gram Panchayat where 66 hector area shown under vegetable cultivation. Total cultivable area in Dimdiha Gram Panchayat was 2428.4 hector. From the above table it clearly shows that Gangudih, kanali, Bamro and Khojda mouza were highly affected (100%) by heavy rainfall where Aimandi mouza (33.33%) was lowest in this Gram Panchayat. From the above results it was found that the average damaged area under vegetable cultivation is 65.15 percent.

Table 3: Mouza wise Agricultural land, Horticultural crops cultivation area and damaged area due to excessive rainfall under Lagda Gram Panchayat.

Sl No	Name of the GP	Mouza	JL No	Geo Area(Ha)	Cultivable Area(HA)	Area Shown under Vegetable Cultivation in Ha	Area Damaged in Ha	Damaged In %
1	Lagda	Belkuri	13	593.68	460	13	6	46.15%
2		Hulka	26	255.36	238	6	3	50.0%
3		Kultar	28	171.18	125	3	1	33.33%
4		Chakra	29	282.47	205	6	3	50.0%
5		Polkiri	30	135.07	100	3	2	66.66%
6		Boroyadih	31	44.11	37	1	1	100%
7		Baghudi	33	141.24	98	3	2	66.66%
8		Lagda	68	428.57	378	10	5	50.0%
9		Dhadka	69	106.03	72	2	1	50.0%
10		Mahalitora	71	103.2	78	2	2	100%
11		Nadiara	74	333.52	270	7	4	57.14%
Total=				2594.43	2061	56	30	53.57%

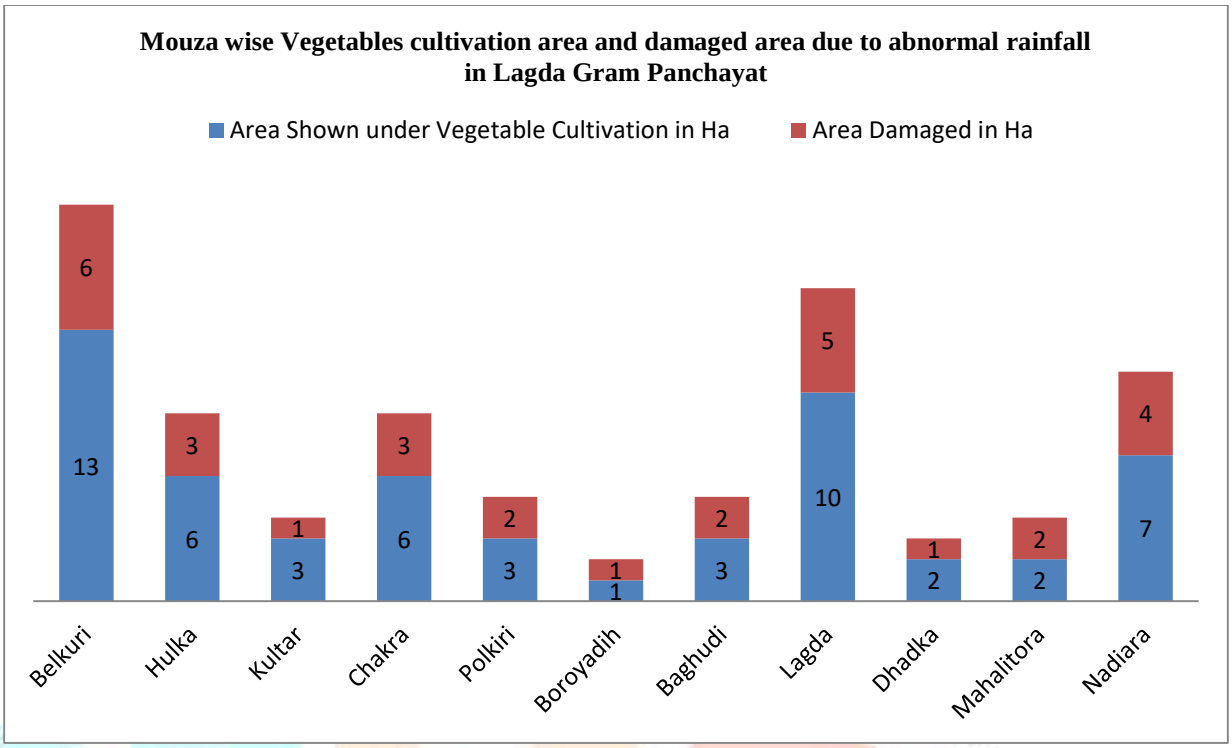
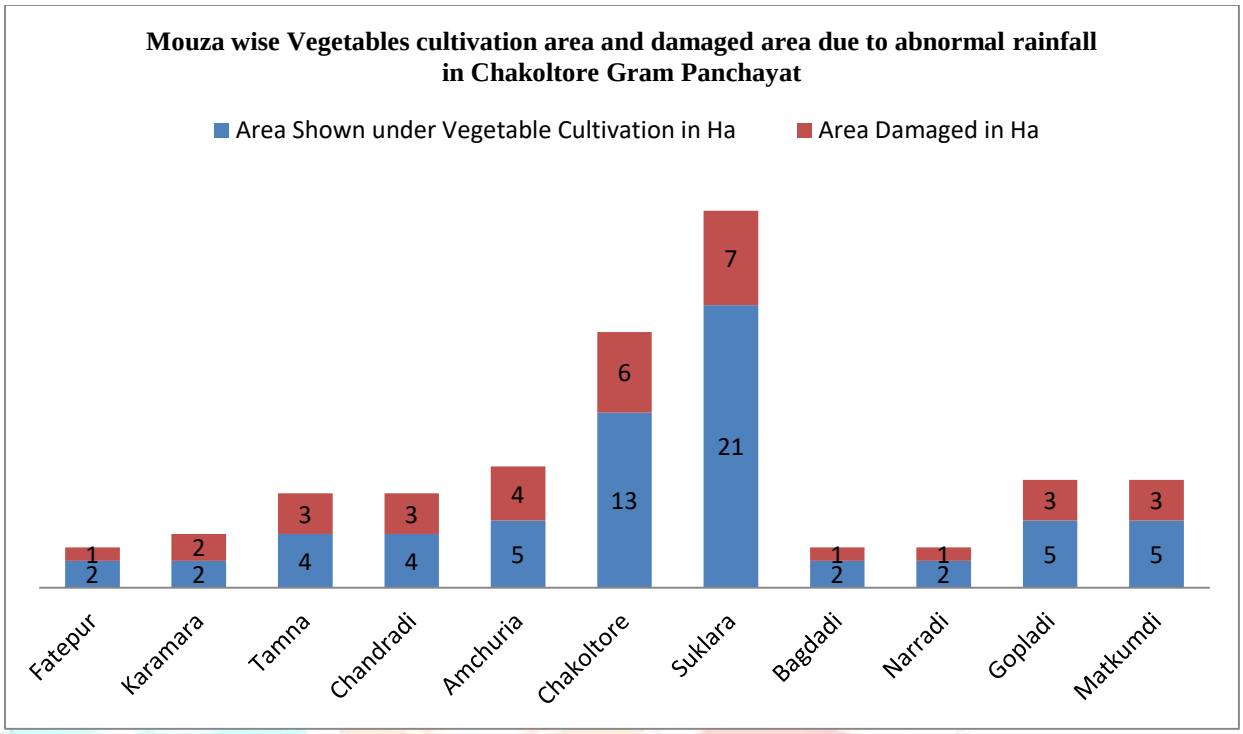


Table 3 illustrates that total 30 hector area was damaged due to excessive rainfall in Lagda Gram Panchayat where 56 hector area shown under vegetable cultivation. Total cultivable area in Lagda Gram Panchayat was 2061 hector. From the above table it clearly shows that Boroyadih and Mahalitora mouza were highly affected (100%) by excessive rainfall where Kultar mouza (33.33%) was lowest in this Gram Panchayat. From the above results it was found that the average damaged area under vegetable cultivation is 53.57 percent.

Table 4: Mouza wise Agricultural land, Horticultural crops cultivation area and damaged area due to excessive rainfall under Chakoltore Gram Panchayat.

Sl No	Name of the GP	Mouza	JL No	Geo Area(Ha)	Cultivable Area(HA)	Area Shown under Vegetable Cultivation in Ha	Area Damaged in Ha	Damaged In %
1	**Chakoltore**	Fatepur	48	108.5	66	2	1	50.0%
2		Karamara	49	130.17	80	2	2	100%
3		Tamna	50	257.38	159	4	3	75.0%
4		Chandradi	204	259.4	160	4	3	75.0%
5		Amchuria	205	311.18	192	5	4	80.0%
6		Chakoltore	207	632.12	493	13	6	46.15%
7		Suklara	208	1069.19	765	21	7	33.33%
8		Bagdadi	209	91.86	56	2	1	50.0%
9		Narradi	210	95.1	58	2	1	50.0%
10		Gopladi	211	282.88	175	5	3	60.0%
11		Matkumdi	212	287.73	179	5	3	60.0%
Total=				3525.51	2383	64	**34**	**53.12%**

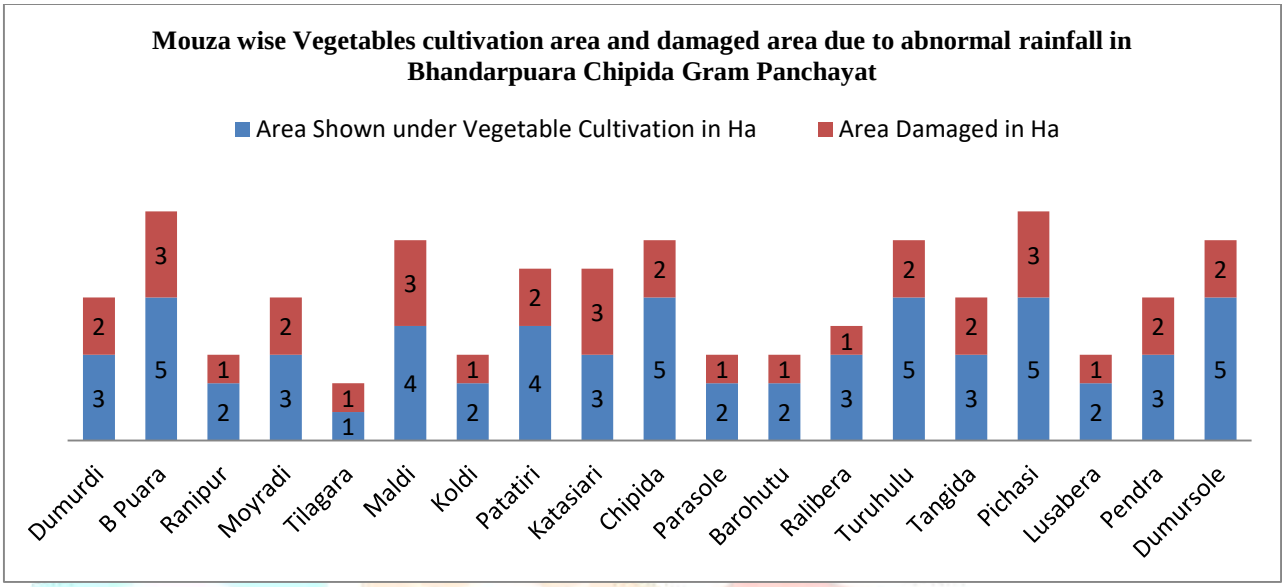


It could be observed from table 4 that total 34 hector area was damaged due to excessive rainfall in Chakoltore Gram Panchayat where 64 hector area shown under vegetable cultivation. Total cultivable area in Garafusra Gram Panchayat was 2383 hector. From the above table it clearly indicates that Karamara mouza was highly affected (100%) by erratic rainfall where Suklara mouza (33.33%) was lowest in this Gram Panchayat. From the above results it clearly shows that the average damaged area under vegetable cultivation is 53.12 percent.

Table 5: Mouza wise Agricultural land, Horticultural crops cultivation area and damaged area due to excessive rainfall under Bhandarpuara Chipida Gram Panchayat.

Sl No	Name of the GP	Mouza	JL No	Geo Area(Ha)	Cultivable Area(HA)	Area Shown under Vegetable Cultivation in Ha	Area Damaged in Ha	Damaged In %
1	Bhandarpuara Chipida	Dumurdi	176	195.2	117	3	2	66.66%
2		B Puara	175	570	342	5	3	60.0%
3		Ranipur	177	119.2	75	2	1	50.0%
4		Moyradi	180	186.4	112	3	2	66.66%
5		Tilagara	178	101.6	60	1	1	100%
6		Maldi	179	267.2	160	4	3	75.0%
7		Koldi	186	150.2	90	2	1	50.0%
8		Patatiri	182	366.6	220	4	2	50.0%
9		Katasiari	181	186	110	3	3	100%
10		Chipida	189	470	280	5	2	40.0%
11		Parasole	190	126.4	72	2	1	50.0%
12		Barohutu	198	140.4	84	2	1	50.0%
13		Ralibera	183	176	105	3	1	33.33%
14		Turuhulu	184	316	190	5	2	40.0%
15		Tangida	185	176	105	3	2	66.66%
16		Pichasi	191	174	280	5	3	60.0%
17		Lusabera	192	119	68	2	1	50.0%

18		Pendra	187	282	170	3	2	66.66%
19		Dumursole	193	333.6	200	5	2	40.0%
Total=				**4455.8**	**2840**	60	**35**	**58.33%**



It was found from table 5 that total 35 hector area was damaged due to erratic rainfall in Bhandarpuara Chipida Gram Panchayat where 60 hector area shown under vegetable cultivation. Total cultivable area in Bhandarpuara Chipida Gram Panchayat was 2840 hector. From the above table it clearly indicates that Tilagara and Kantasiari mouza were highly affected (100%) by erratic rainfall where Ralibera mouza (33.33%) was lowest in this Gram Panchayat. From the above results it clearly shows that the average damaged area under vegetable cultivation is 58.33 percent.

Table 6: Mouza wise Agricultural land, Horticultural crops cultivation area and damaged area due to excessive rainfall under Durku Gram Panchayat.

Sl No	Name of the GP	Mouza	JL No	Geo Area(Ha)	Cultivable Area(HA)	Area Shown under Vegetable Cultivation in Ha	Area Damaged in Ha	Damaged In %
1	Durku	Gosaidi	202	128.29	88	2	1	50.0%
2		Digsili	203	341.86	280	7	4	57.14%
3		Sundradi	197	114.12	78	2	1	50.0%
4		Petadi	196	155	106	3	1	33.33%
5		Beliapathar	194	279.23	190	5	3	60.0%
6		Hirakhaf	195	15.38	10	0	0	0%
7		Doldari	56	52.61	36	1	1	100%
8		Durku	55	585.25	482	12	5	41.66%
9		Uchali	54	99.96	68	2	1	50.0%
10		Damda	53	340.75	234	6	4	66.66%
11		Dhekia	52	106.03	73	2	1	50.0%
12		Barakdi	51	114.53	78	2	1	50.0%
13		Rampur	47	316.16	290	7	4	57.14%
14		Pandramma	85	319.7	219	5	2	40.0%
15		Telidi	82	261	190	5	3	60.0%
16		Satsimulia	83	113.72	80	2	2	100%
Total=				**3343.59**	**2502**	63	**34**	**53.96%**

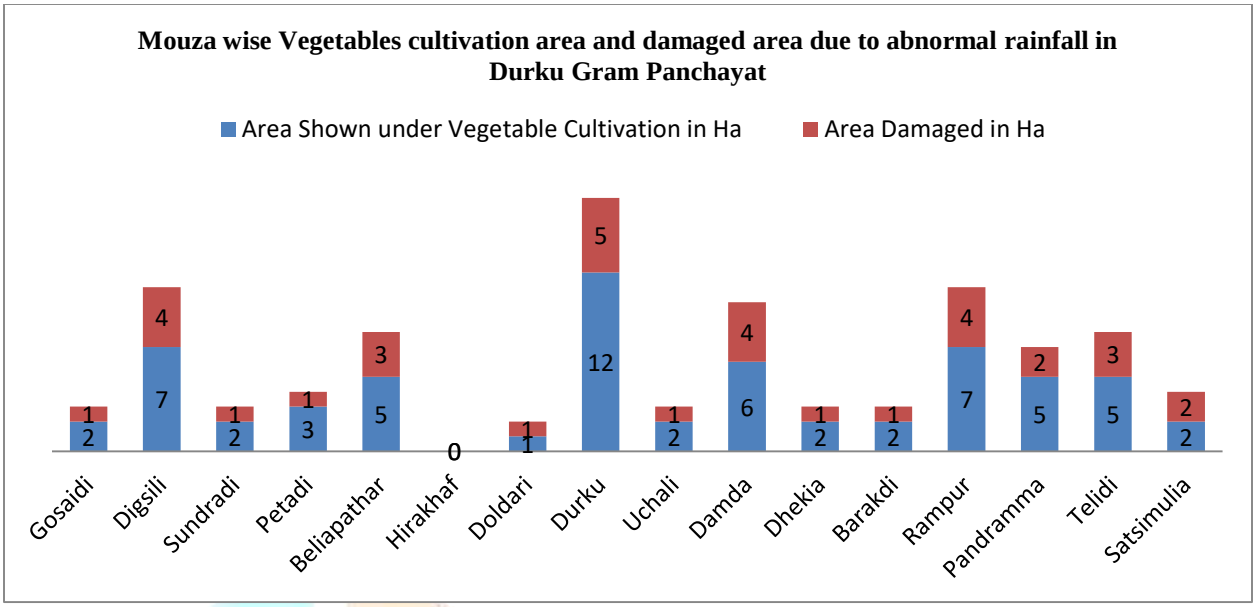
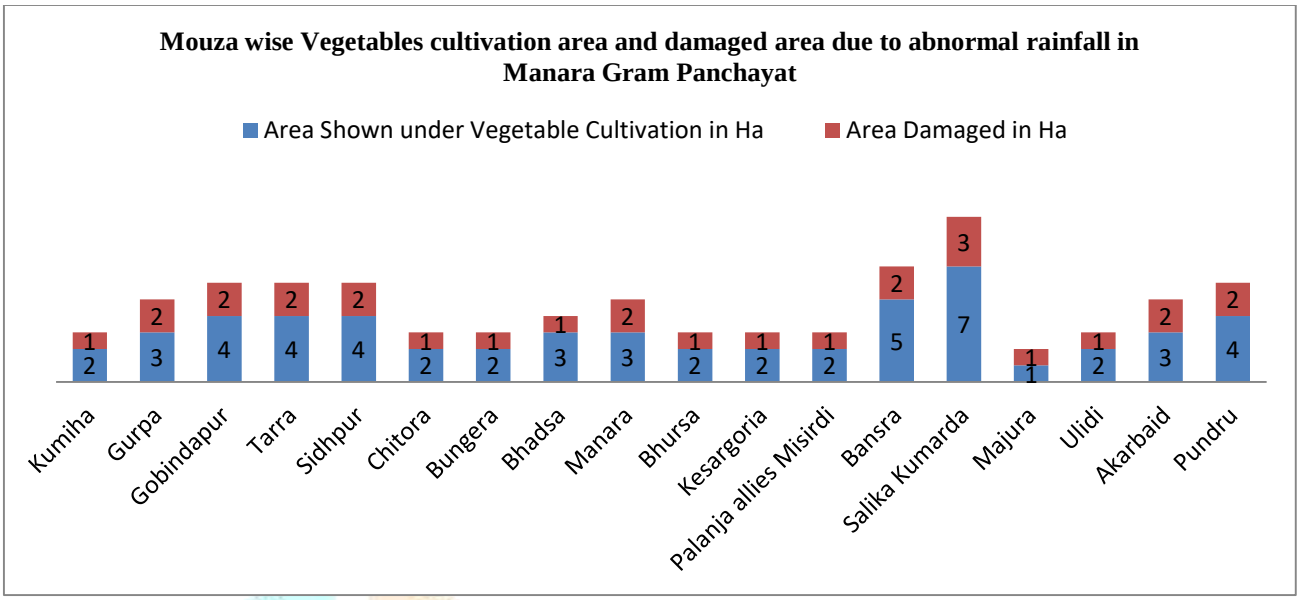


Table 6 illustrates that total 34 hector area was damaged due to excessive rainfall in Durku Gram Panchayat where 63 hector area shown under vegetable cultivation. Total cultivable area in Durku Gram Panchayat was 2502 hector. From the above table it clearly shows that Doldari and Satsimulia mouza were highly affected (100%) by excessive rainfall where Petadi mouza (33.33%) was lowest in this Gram Panchayat. From the above results it was found that the average damaged area under vegetable cultivation is 53.96 percent.

Table 7: Mouza wise Agricultural land, Horticultural crops cultivation area and damaged area due to excessive rainfall under Manara Gram Panchayat.

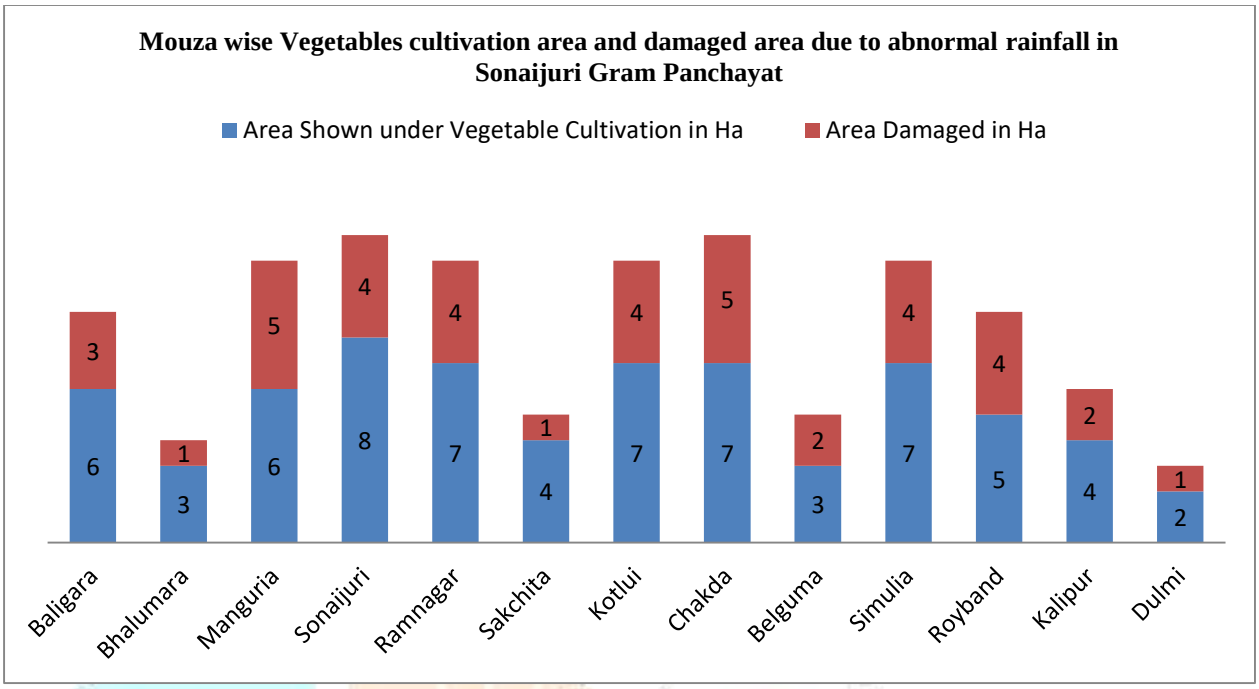
Sl No	Name of the GP	Mouza	JL No	Geo Area(Ha)	Cultivable Area(HA)	Area Shown under Vegetable Cultivation in Ha	Area Damaged in Ha	Damaged In %
1	Manara	Kumiha	188	111.69	79.94	2	1	50.0%
2		Gurpa	199	254.14	179	3	2	66.66%
3		Gobindapur	200	271.54	191.41	4	2	50.0%
4		Tarra	201	254.55	179.5	4	2	50.0%
5		Sidhpur	213	269.52	184.8	4	2	50.0%
6		Chitora	214	146.9	103.71	2	1	50.0%
7		Bungera	215	166.33	117.16	2	1	50.0%
8		Bhadsa	216	222.58	156.83	3	1	33.33%
9		Manara	217	243.62	171.7	3	2	66.66%
10		Bhursa	218	160.66	113.34	2	1	50.0%
11		Kesargoria	219	180.49	127.26	2	1	50.0%
12		Palanja allies Misirdi	220	139.12	98.21	2	1	50.0%
13		Bansra	221	338.32	237.89	5	2	40.0%
14		Salika Kumarda	222	474.3	334.57	7	3	42.85%
15		Majura	223	104.41	73.8	1	1	100%
16		Ulidi	224	126.26	79.14	2	1	50.0%
17		Akarbaid	225	254.55	179.27	3	2	66.66%
18		Pundru	226	256.98	180.88	4	2	50.0%
Total=				**3975.96**	**2788.41**	54	**28**	**51.85%**



It was found from table 7 that total 28 hector area was damaged due to erratic rainfall in Manara Gram Panchayat where 54 hector area shown under vegetable cultivation. Total cultivable area in Manara Gram Panchayat was 2788.41 hector. From the above table it clearly indicates that Majura mouza was highly affected (100%) by erratic rainfall where Bhadsa mouza (33.33%) was lowest in this Gram Panchayat. From the above results it clearly shows that the average damaged area under vegetable cultivation is 51.85 percent.

Table 8: Mouza wise Agricultural land, Horticultural crops cultivation area and damaged area due to excessive rainfall under Sonaijuri Gram Panchayat.

Sl No	Name of the GP	Mouza	JL No	Geo Area(Ha)	Cultivable Area(HA)	Area Shown under Vegetable Cultivation in Ha	Area Damaged in Ha	Damaged In %
1	Sonaijuri	Baligara	37	372.72	253.5	6	3	50.0%
2		Bhalumara	38	164.52	111.5	3	1	33.33%
3		Manguria	40	143.66	97.5	6	5	83.33%
4		Sonaijuri	39	375.95	254	8	4	50.0%
5		Ramnagar	67	329.82	224.5	7	4	57.14%
6		Sakchita	32	119.79	92.5	4	1	25.0%
7		Kotlui	46	361.79	232	7	4	57.14%
8		Chakda	42	430.99	291.5	7	5	71.42%
9		Belguma	41	133.55	92	3	2	66.66%
10		Simulia	44	272.76	183	7	4	57.14%
11		Royband	45	109.68	86.86	5	4	80.0%
12		Kalipur	43	61.92	52.52	4	2	50.0%
13		Dulmi	289	58.68	50	2	1	50.0 %
Total=				**2935.83**	**2021.38**	67	**40**	**59.70**



It could be observed from table 8 that total 40 hector area was damaged due to excessive rainfall in Sonaijuri Gram Panchayat where 67 hector area shown under vegetable cultivation. Total cultivable area in Sonaijuri Gram Panchayat was 2021.38 hector. From the above table it clearly shows that Manguria mouza was highly affected (83.33%) by excessive rainfall where Sakchita mouza (25%) was lowest in this Gram Panchayat. From the above results it was found that the average damaged area under vegetable cultivation is 59.70 percent.

IV. CONCLUSION

The people of the study area mainly derive their livelihood by using the agricultural resources of the district not in an effective manner but simply in a careless mood. Excessive rainfall has a detrimental impact on horticultural crops productivity but rainfall during the specific growth stage is rarely used in efficiency analysis. This study focuses on this available point and examines the influence of rainfall specifically encountered during the sowing stage and early vegetative growth stage and the flowering stage of different horticultural crops in Purulia district. Policy recommendations include the establishment of a safety network, such as crop insurance to protect farmers from losses due to unpredictable weather conditions, promoting training programs on cultural practices adapted to climate change, wide coverage of extension activities, giving priority to small-scale farmers and female farmer participation in training and extension activities and increasing the rate of credit availability to farmers. Based on the results of the study, encouraging female and small-scale farmers to participate in training programs would be beneficial for improving the performance of farming practices resulting in higher technical efficiency and, hence, productivity. Furthermore, if farmer organizations can introduce a safety network, such as a crop insurance program for farmers, the efficiency of a cooperative may become significant. The results indicate that conducting practical, effective and efficient training programs that educate horticultural crops farmers can increase the technical efficiency among pulse farmers and can increase productivity

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