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Climate Change

Weather aberration and its impact on agriculture of Habra Block, North 24 Pgs, West Bengal

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ABSTRACT

Like other parts of the country south west monsoon is the main feature in the climate of West Bengal as well as North 24 pgs. It is the principal denominator of the prosperity of the state and the agro economy. The objective of the present paper is to evaluate the withdrawal of monsoon is far more gradual process than its onset. Monsoon normally withdraws from the state after some intermittent action by 10th October. But the dates of its withdrawal vary considerably (for a period of about one month) from one year to the other. During the period of last 43 years (1971-2013) the earliest and latest dates of withdrawal of monsoon from the state were 27th September, 1984 and 26th October, 2010 respectively. As the season is a period of transition this set pattern of expected average weather condition is disturbed frequently when monsoon withdraws early, withdrawal of monsoon is delayed, wet spell continues even after the usual dates of withdrawal of monsoon almost up to the end of October. With this backdrop this paper

has selected the agricultural practices of Habra block, N 24 pgs. Because agriculture is the most weather sensitive activities of man each of above climate variability's have their individual impact on agriculture.

Keywords: Cessation, Delayed, Nourishes, Onset, Withdrawal.

1. INTRODUCTION

Monsoon weather variation and its impact on agriculture like other parts of the country south west monsoon is the main feature in the climate of West Bengal as well as the principal denominator of the prosperity of the state and the agro-economy (Misra, 2004). The state receives 73 to 80 percent of he normal annual rainfall during the season which not only nourishes the kharif crops but enriches all sources of irrigation to enable cultivation of a wide variety of crops during rabi and pre-kharif season. As a result all sections of people starting from a farmer to the scientist and from a common man to the policy makers at the highest level are keen to know detail about the variation of weather of the season, its causes and effects especially on agriculture.

Monsoon season does not necessarily mean continuously uniform rain all over the state throughout the entire tenure of the season but the distribution of rainfall suffers from remarkable spatial and temporal variation over different years and from one region to the other in the same year (Misra, 2008). This spatial and temporal variation of rainfall depends on a rainfall depends on a number of complex factors some of these are constant or static while others vary from year to the next. Some of the principal factors are as follows 1. Location of the place with respect to the moisture bearing monsoon air current, 2. Position of land and water, 3. Relief, 4. Dates of onset, withdrawal and consequent span of monsoon, 5. Break in the monsoon and its duration, 6. General strength of monsoon, 7. Position and movement of the axis of the monsoon trough, 8. Frequency and movement of depressions, and 9. Formation of other low pressure systems.

The normal date of monsoon over the sub-Himalayan West Bengal is usually two days earlier than the date of onset of monsoon over Gangetic West Bengal. However, the dates of onset and withdrawal of monsoon in the state suffers from considerable variation from one year to the next. Since 1971 the earliest and latest dates of onset of monsoon over Gangetic West Bengal (Kolkata) are 28th May in 1999 and 26th June 1983 respectively. The dates of withdrawal of monsoon during the same period were also 26th September 1984 and 29th October 1974 respectively (Mishra, 2004). Like other parts of the country south west monsoon is the main feature in the climate of west Bengal as well as the principal denominator of the prosperity of the state and the agro-economy (Mishra, 2006a; 2006b). It is well known that Indian summer monsoon rainfall displays multi-decadal variations in which there is a clustering of wet or dry anomalies (Guhathakurata and Rajeevan, 2006, Onset of monsoon is getting delayed and monsoon precipitation has become very erratic. In 2008-09, i.e. July 2008 to June 2009, a large part of the Gangetic West Bengal recorded heavy to very heavy rainfall in the 1st half (IMD, 2007). After the earlier than normal arrival on May 23, monsoon rains were deficient during the first half of June, but advanced rapidly in the second half to officially cover the entire country by July 1. Nevertheless, rains during June 1 through July 22 were significantly below normal in the major rice growing states of Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal and Assam (Govindan, 2009).

The Spatial and timely distribution of monsoon rains do have a significant impact on the agricultural produce and their prices. The kharif sowing commences with the onset of monsoon, while Rabi sowing takes place during October- December (Ghanekar and Choudhury, 2007). Monsoon normally withdraws from the state after some intermittent action by 10th October. But the dates of its withdrawal vary considerably (for a period of about one month) from one year to the other. During the period of last 43 years (1971-2013) the earliest and latest dates of withdrawal of monsoon from the state were 27th September, 1984 and 26th October, 2010 respectively (Mishra, 2013). Unusually prolonged heat wave burning pre-kharif crops during last summer, delayed and weak monsoon resulting in the remarkable rainfall deficiency during the first half brining down the progress of Aman transplantation below 50% up to the 7th of August has made the kharif production target doubtful, (Mishra, 2013). The actual distribution of crops plants is determined by the combined influence of physiological, economic, social, technological, and historic forces; but no crop can attain importance in an agricultural system unless it is adapted to prevailing environmental conditions, (Critchfield, 2006). Variability of monsoon rain is on the rise with increasing incidences of partial break in one region and heavy rainfall in the other, causing partial droughts and floods (Mishra, 2014; Kasahun Kitila Hunde, 2015). The overall objective of this paper is how the early cessation of rainfall affects the standing crop (inadequate grain filling, crop failure due to increase salinity, pest and disease attack etc.) in North 24 Parganas, West Bengal and how does it affects on khariff and rabi crops as well including management thereof.

2. MATERIALS AND METHODS

The study is done on the basis of both primary and secondary data. Primary data is obtained from household surveys through questionnaire and meetings with the officials. Total 100 households are surveyed randomly. Some of the data and/or information is also collected from government officials. Secondary data mainly monthly distribution of rainfall and rainy days of each of the month along with related maps are collected IMD, Kolkata. The collected data is analyzed by taking the help of some SPSS and cartographic techniques for various aspects of agricultural problem and also disabilities due to the variation of withdrawal of monsoon. All the state and district level maps are collected from the Google site. Municipal maps, and Panchayet maps are collected from the

municipality and the Gram Panchayet office. The Google image of 2002 and 2014 are used to delineate the actual area. All the maps are digitized by using PCI Geometica ver. 9. GPS is used to locate the village potholes within the Habra block I.

2.1. The study area

North 24 Pargan's is a district in Southern West Bengal, of eastern India, North 24 Pargan's extends in the (tropical zone) from latitude 22°11′6′′ N to 23 ° 15 ′ 2′′ N and from longitude 88° 20′ E to 89° 5′ E. Within this district Habra is the study block in which my study area or village Anowarberia is situated.

Anowarberia is an isolated village in Habra, North 24 Parganas District, West Bengal (figure 1) and is 6 km from the main city Habra.(Latitude 22.5671^0 N Longitude, 88.2539^0 E, altitude 13 m) mainly inhabited by farmer people. They earn 80% from the agricultural practices of this village. And the agriculture of the village is usually controlled by monsoon characteristics. That's why the variation (earliest or latest) of withdrawal of monsoon rain hampered the agricultural production as well as the economy of the village.

The climate of this village is tropical like the rest of the Gangetic West Bengal. The hallmark is the monsoon, which lasts from early June to mid September. The weather remains dry during the winter (mid Nov to mid Feb) and humid during summer. The annual rainfall is found as 1,579 mm (normal), temperature 41 ° C in May (Max) and 10° C in January (Min) and relative humidity ranges between 50 % in March and 90% in July. Soil status varies from alluvial to clay loam. The ratio of land High: Medium: Low is determined as 44: 39 : 17. Soil is fertile enough for cultivation. There is presence of much amount of moisture in soil because *Padma* River is passing through this region.

Muslims are mainly engaged in farming, besides fishing and agricultural activities. The average size of agricultural landholdings is 3.2 Bigha. The economy of the village is very much dependent on the monsoons. The success and failure of the agriculture and consequently the cascading effect is transmitted throughout the economy of the village. In such a condition, prediction of the monsoon becomes a necessity. If the expected average weather does not prevail it often leads to a huge economic loss.

3. RESULTS AND DISCUSSIONS

In order to know the agricultural problem of Habra as well as Anowerberia village, almost all the farmers of the village are faced during each monsoon season. A series of questions were also asked to the farmers and agricultural laborers. The representation of the data is represented below. The frequency distribution tables show in responses of all 70 house hold.

3.1. Total Members, Age-Sex Structure, Educational Qualification

In above Table 1, According to my survey the total number of household is 70. I made an observation that in 70 household the total number of member is 420. In which 211 are male (50.24%) and 209 are female (49.76%). Most of the people in this village belongs to 14-60 age group class, i.e. 151 male (35.95%) and 163 female (38.81%). Education level of this village is poor, especially in case of female. Only 7.86 % of male and 4.05 % of females are well educated in comprising to the rest male and female members of the village.

3.2. Occupational Variation and Yearly Income and Expenditure of the Villagers

The study revealed that mainly peoples are dominated in the field of agricultural practices. Most of the people of the village are mainly depends on agriculture as well as agricultural based activities such as field labor for field preparation activities and vegetable business as their main occupation. That is around 22.61% of the villagers involved in agriculture based work. About 11.2% are engaged with vegetables business and around 9.28% villagers are as field laborers. The rest portion of the percentage of the villagers involved in different services i.e. around 5.71% and remains 5.47% involved with other activities as depicted in Figure 2.

It also stated that there is a village where peoples are dominated mainly for of an agriculture based economy. Majority of the people are engaged in cultivation. So they get the major portion of their income from this activity. The income level for the study area is classified into three classes. Here it is observed that more than half of people that is 58.57 % have their yearly income below 50,000. About 38.57 % have yearly income not exit to 100000 (Figure 3). According to study, only 2 families have their yearly income above 10, 00, 00 indicating a very poor life style and living standard of those villagers. One of the most vital reasons of this low income level from the agriculture is the variable and" Khamkheyali" withdrawal of monsoon that indicates low and poor yield of crops. Figure 4 depicted about 70% of the villagers try to keep their expenditure within 45,000 and besides 27.14% try to keep their expenditure much below of 10, 00, 00.

3.3. Amount of Agricultural Land and Land Situation of the Villagers

The study revealed that agriculture as well as cultivation is the main occupation of the villagers and it is a hierarchical profession of the villagers from ancient days. Each of village peoples has agricultural land. More than half of villagers i.e. 58.57 % have an average land 5-6 Bigha. About 21.43% have agricultural land above 6-7 Bigha, a huge quantity. The rest 20% villagers have a land of minimum 2-3 Bigha depicted as figures 5 and 6. It is essential to say that in this village there is found not a single family without agricultural land.

In an average the land situation of this village is up to moderate type. Low lands are not found here so much. I observed that there is highest amount of upland that each family of this village is the owner of upland. Besides maximum of them also have medium type of land. But in a very few case there is the existence of low land.

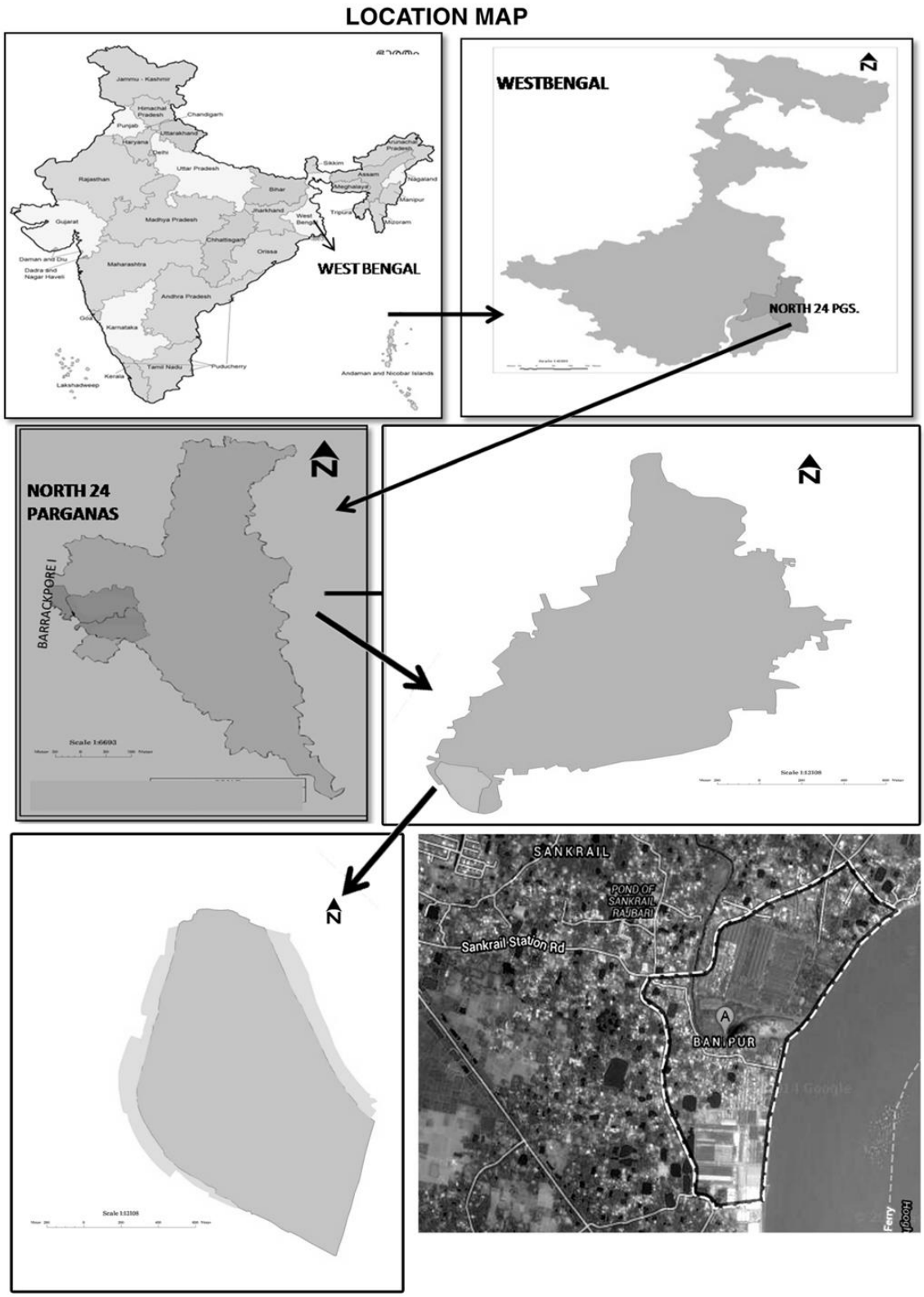

Figure 1
Location map of the study area

3.4. Major Crops Cultivated during the Kharif and Rabi Season

From the overall study of the agricultural practices of the village it is notified that their agriculture is divided into three seasons. These are pre kharif, kharif and rabi season. But in this case it is highlighted the two seasons mainly kharif and Rabi because these two crops are cultivated during the transitional period of the cessation of monsoon rainfall. During kharif season Aman, Aus and Jute are broadly cultivated in this village. Especially cultivation of Aman paddy is common for all the family. But in rabi season mainly Wheat, Mustered, some vegetables and season flower cultivations are practiced by the local villagers. But the recent trend of agricultural practices of this village shows a lack in their activity. This is because of the high variation of monsoonal withdrawal in every year. In spite of this Aman, Aus, Jute (kharif) and Wheat, Mustard (rabi) are the main cultivable crops of this village (Figure 7).

3.5. Different Affected Stages of Crops Due To the Early Cessation of Monsoonal Rain

Since agriculture is the most weather sensitive activities of man climate variability's have their individual impacts on agriculture. Regarding of this incidences early retreat of monsoonal rainfall creates their vigorous impact on agriculture of this village. It is seen from the dates of withdrawal of monsoon from this part of the district that there are repeated instances when monsoon withdrawn even in the last week of September (27th September 1984, 29th September 1994). There are also instances when monsoon withdrawal is declared almost after complete cessation rain for about 10 days or more prior to it (Figure 8).

Due to such problematic situation almost all the stages of growth of the crops are hampered. Such incidence leads to acute moisture stress to the standing Aman paddy. This empty of moisture effects- Panicle initiation and Flower emergence stages of standing crops, besides inadequate grain filing, crop failure due to increase salinity, pest and disease attack and sometime as a result of these length of ears of paddy will be reduced.

3.6. Crops affected due to the Extension of Monsoonal Rain

Table 2 highlights that there are instances when monsoon withdrawal on the other hand is considerably delayed (29th October 1974, 26th October 2010, 22nd October 2007, and 21st October 2013) or wet spell continued for a longer time even after the withdrawal of monsoon as it occurred in 2003, 2005 and 2013.

It is noticed that in such cases a chain reaction starts viz. (i) Sprouting will occur, (ii) cost of harvesting increase, (iii) field preparation and sowing of all Rabi crops delayed. This are leads to an extensive and far reaching negative results. Table 2 also indicates that the problem occurrence of sprouting and high harvesting cost, both are common for all observed family but the another problem that delayed Rabi land preparation is not common for all family. This is because all the families of this village are not interested in cultivation during rabi season, due to this prolongation of monsoon precipitation. That's why this land preparation problem of rabi crops is not so much effective for those families in this village

3.7. The Crops That Are Get Effected Due To This Variation of Monsoonal Withdrawal

Figure 9 depicted that variability of withdrawal of monsoon is the major problem for the standing kharif crops and the just next coming Rabi crops. To avoid this variation problem of withdrawal of monsoon some of the cultivators of the village now put a stop to the rabi paddy cultivation. That's why the proportion of damage of rabi crops is small in comprising to the kharif paddy. The mentioned diagram howing that as cultivation of kharif paddy is must for every family, kharif crops are highly damaged due to this early or latest withdrawal of monsoon rain. Here the most effected crops are usually Aman paddy as well as Aus and Jute.But due to the less cultivation of rabi crops, their injury is not so much effective.

Table 1

Demographic Information of the study area

Total	No. Of Total Member	Sex		Age-Sex Structure						Education											
		Total Male	Total Female	<14		14-60		>60		Illiterate		I-Iv	V-Viii		Ix-X				Xi-Xii	>Xii	
				M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
In Figure	420	211	209	26	17	151	163	34	29	19	51	34	35	52	39	42	49	28	21	33	17
In Percentage	100	50.2	49.8	6.2	4.1	36	38.8	8.1	6.9	4.5	12.1	8.1	8.3	12.4	9.3	10	11.7	6.7	5	7.9	4.1

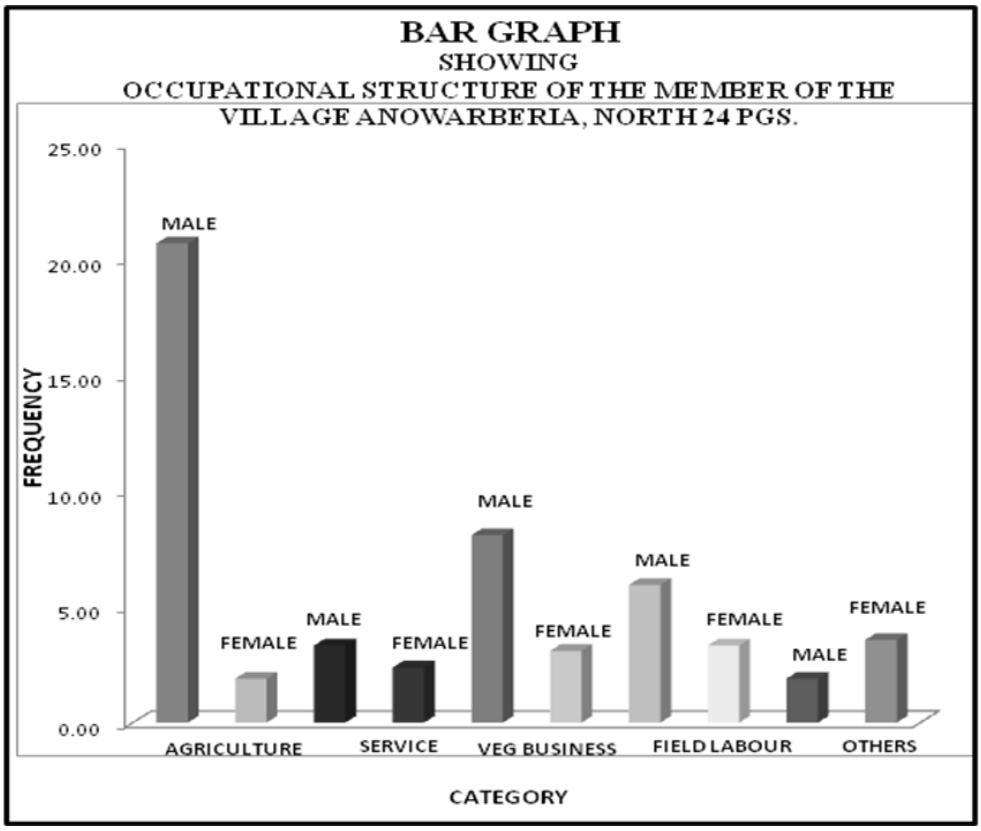

Figure 2
Occupational structure of the sample population of the study area

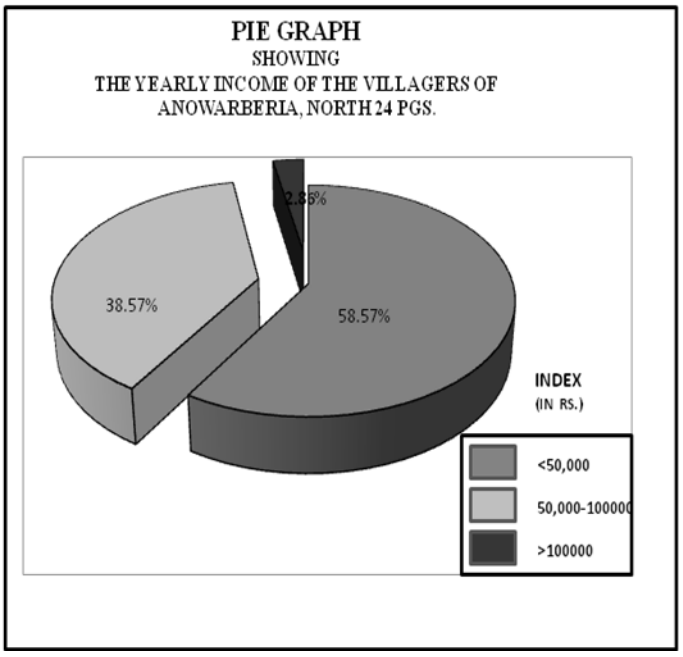

Figure 3
Yearly income of the village

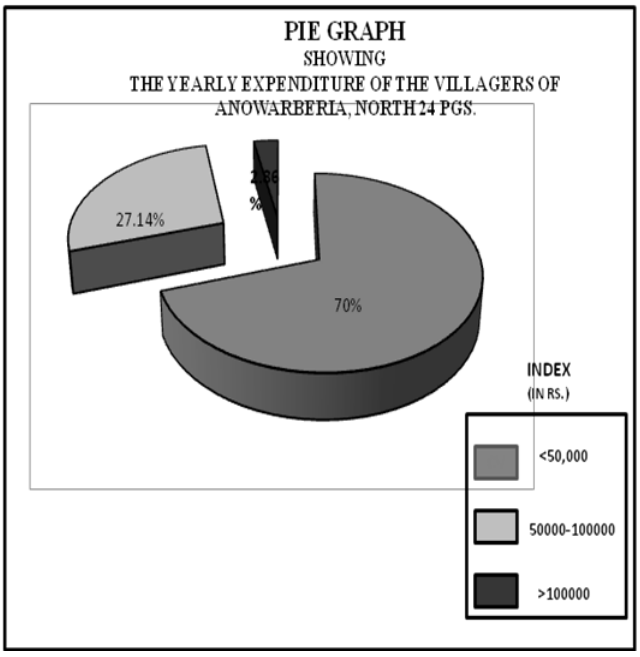

Figure 4
Yearly expenditure of the village

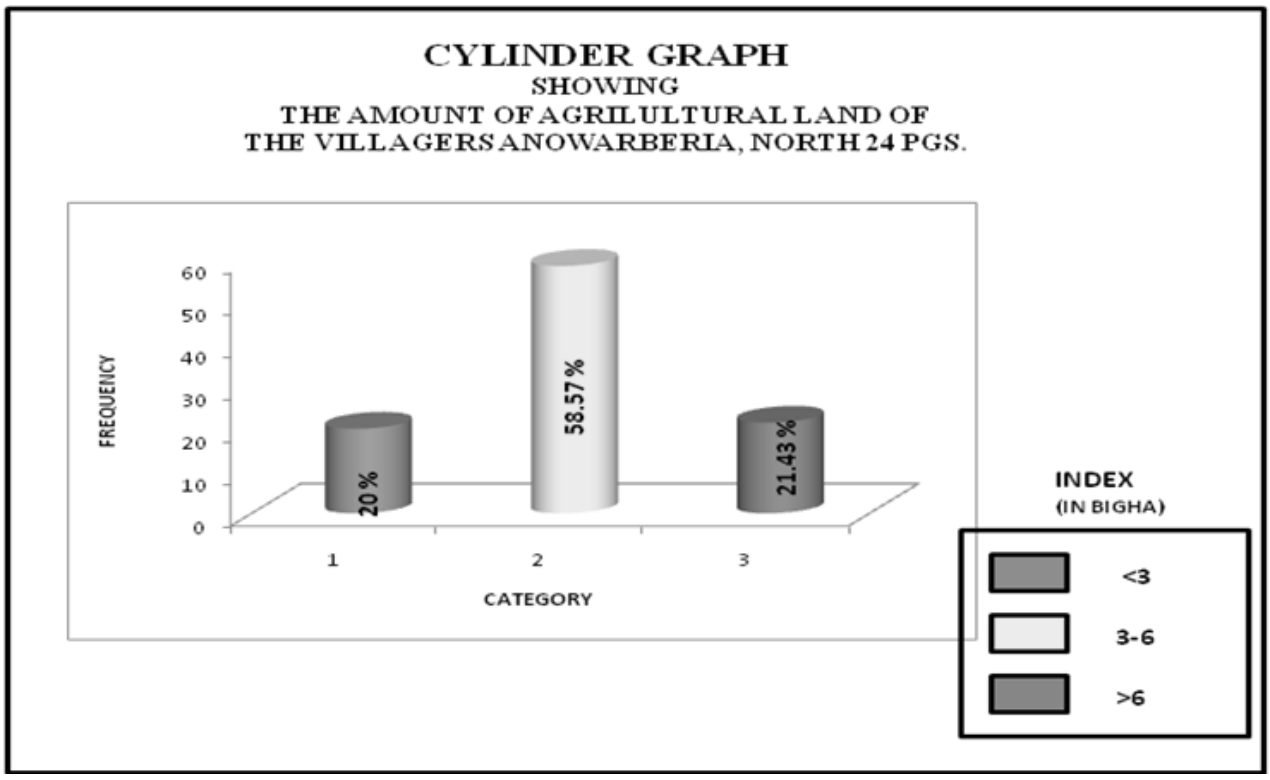

Figure 5
Amount of agricultural land of the villagers

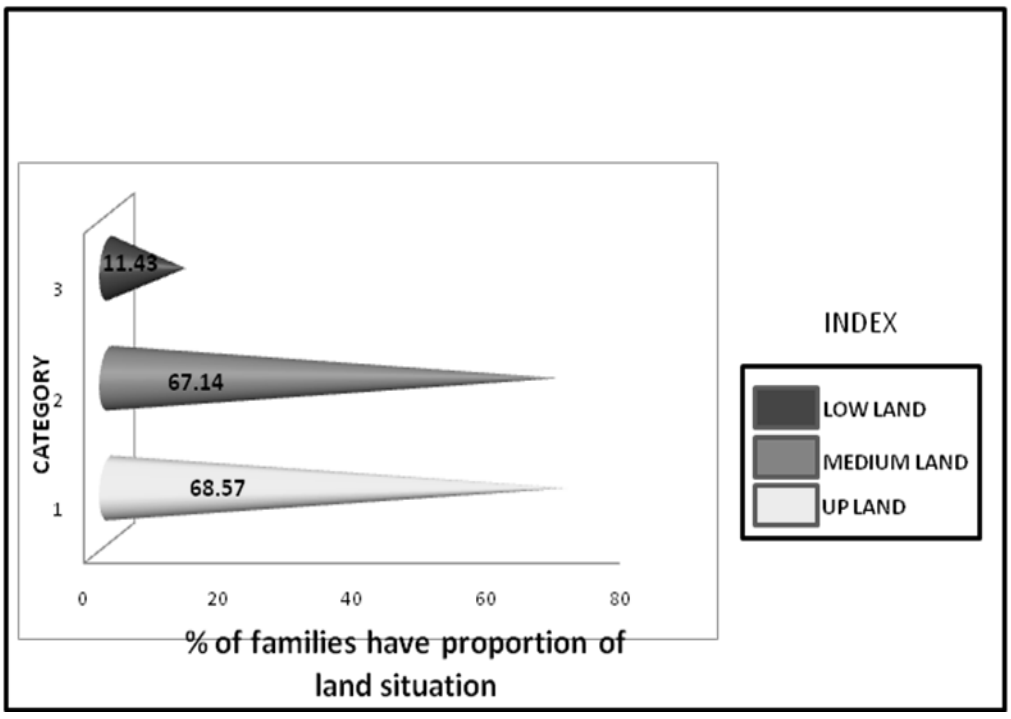

Figure 6
The proportion of land situation of the sample population of the study area

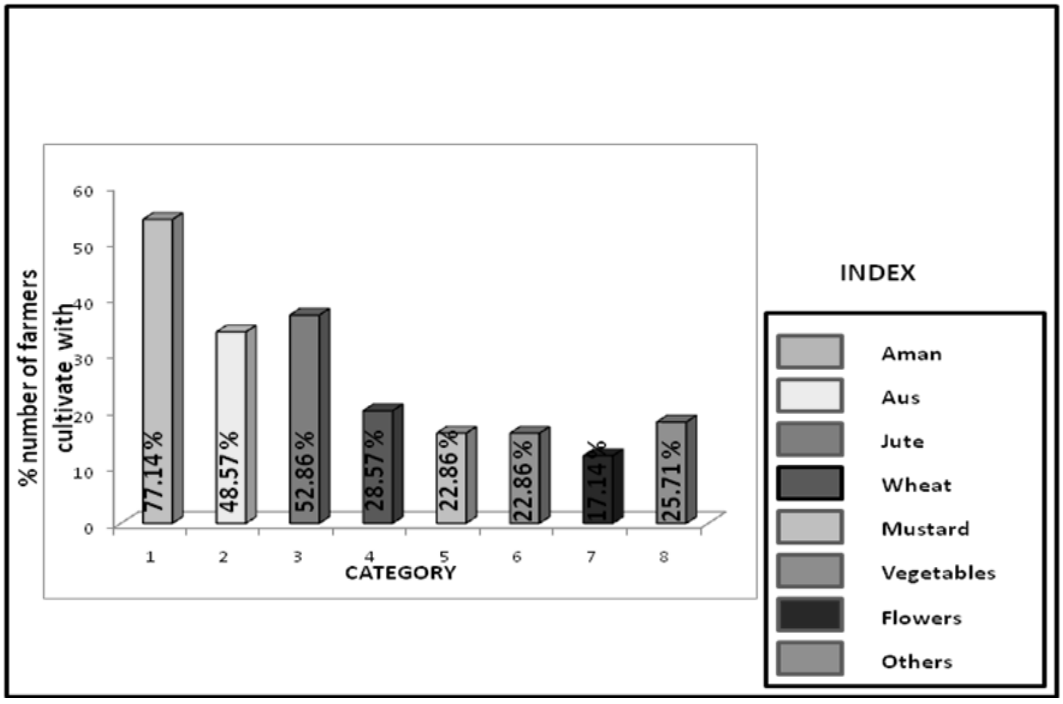

Figure 7
Different crops cultivated during kharif and Rabi seasons of the study area

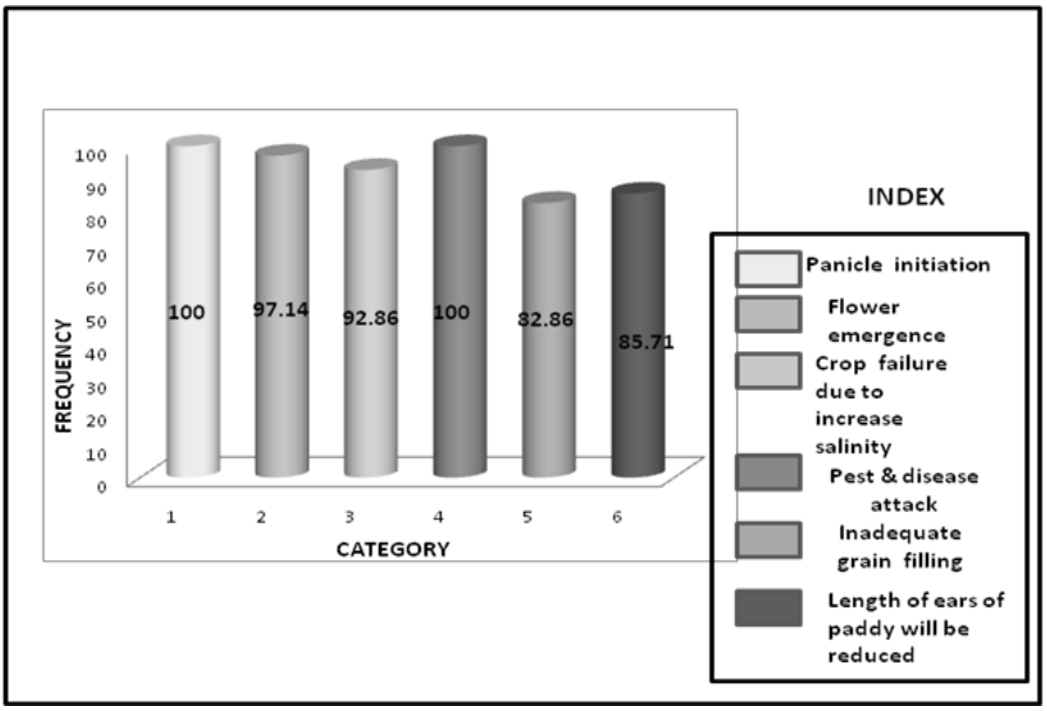

Figure 8
Effected stages of crops during the period of early withdrawal of Monsoon of the study area

Table 2

		If rainy spells extends almost the end of October, crops are effected due to		
Total	**Number of household**	**Sprouting will occur**	**Increased harvesting cost**	**Field preparation for Rabi crops delayed**
In figure	70	70	70	62
In percentage	100	100	100	88.57

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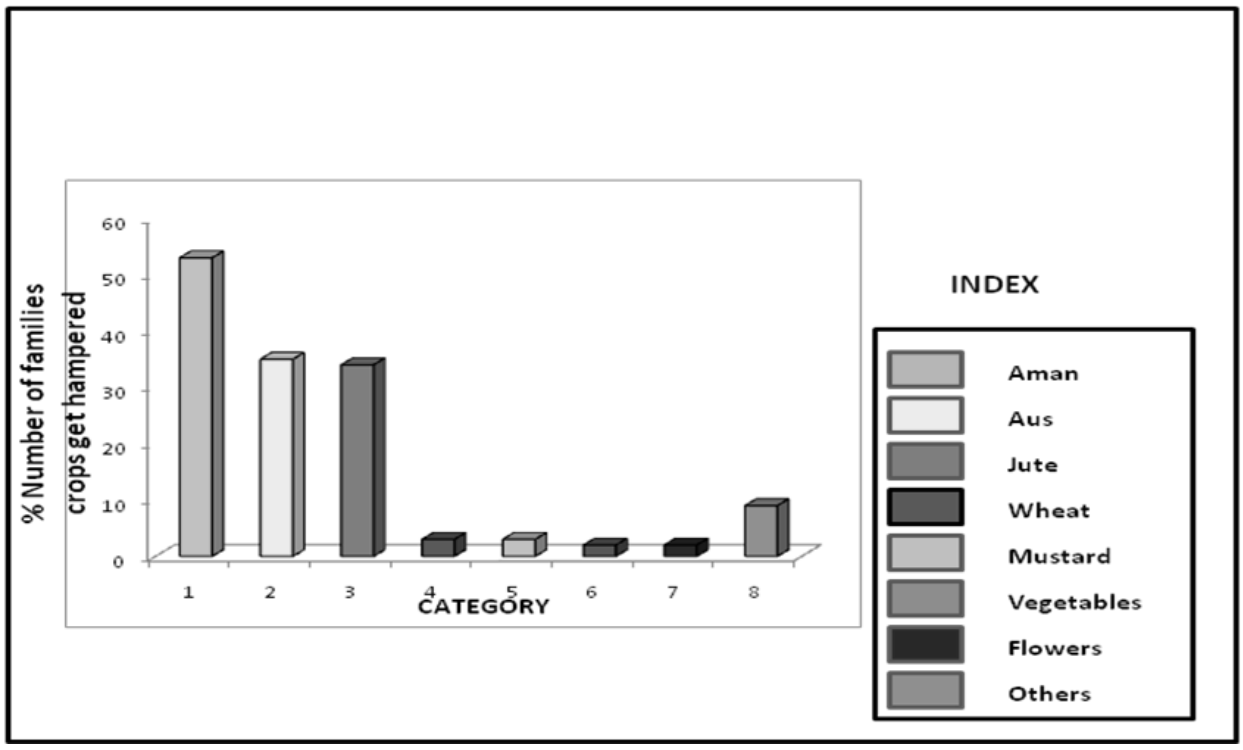

Figure 9
The proportion of hampered crops due to the problematic withdrawal of Monsoon rain of the study area

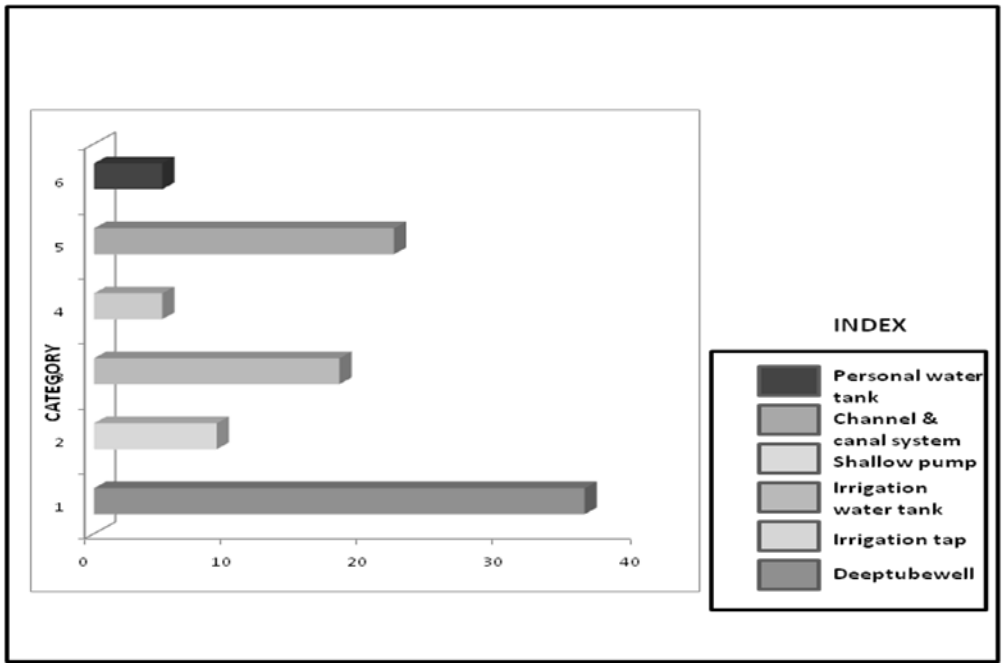

Figure 10
The source of irrigation facility of the study area

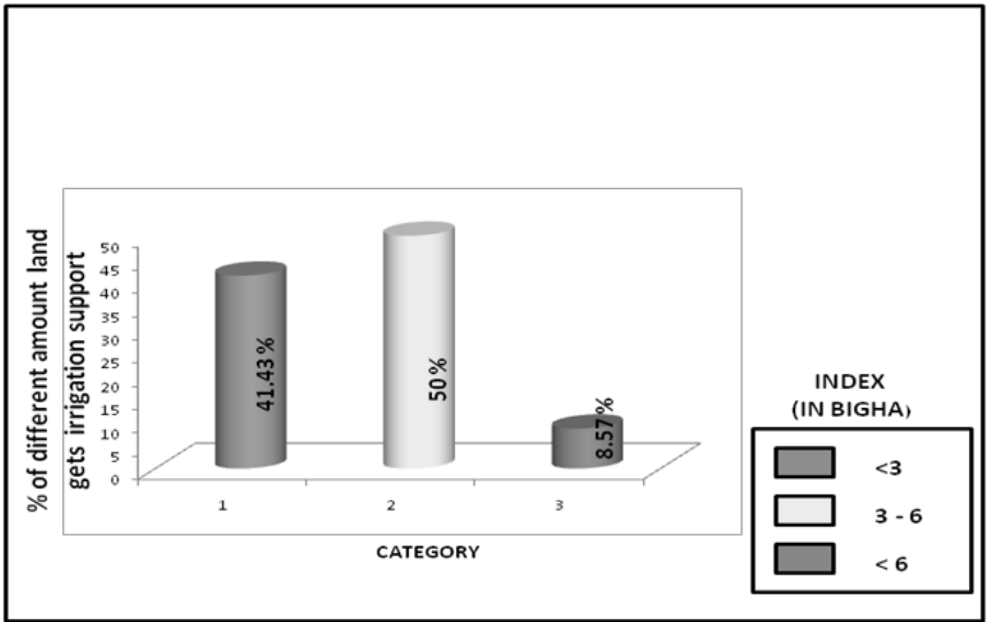

Figure 11
The irrigation facility of the agricultural land of the study area

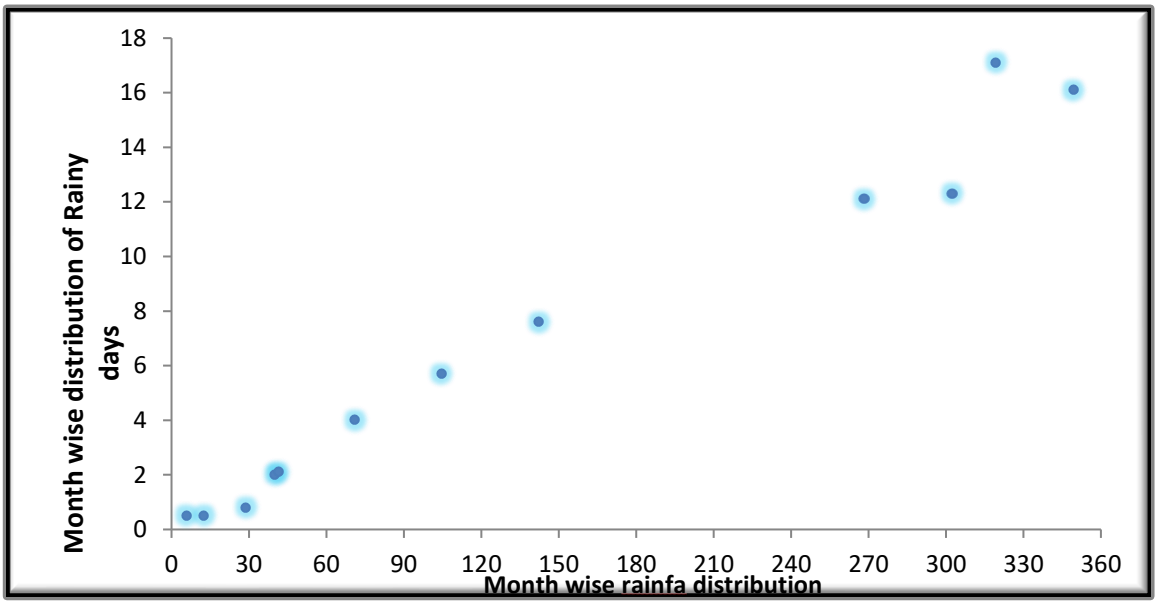

Figure 12
Scatter diagram showing relation between rainfall and rainy days of Habra block

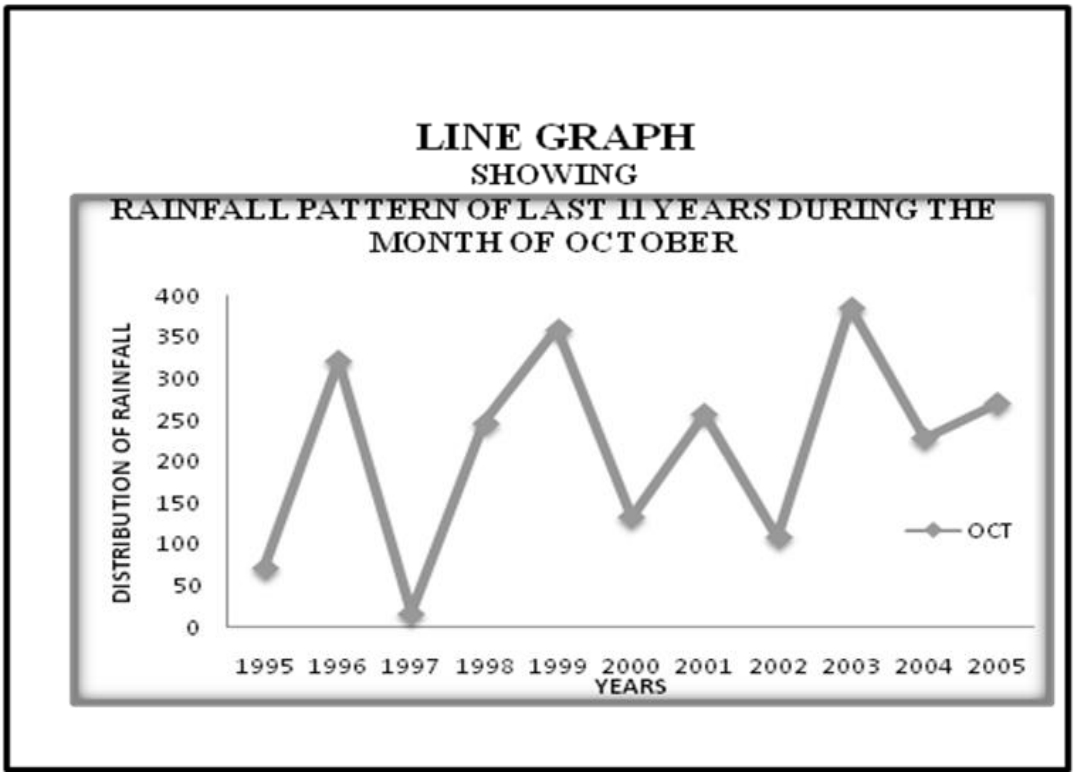

Figure 13
Average Rainfall Pattern for the month of October

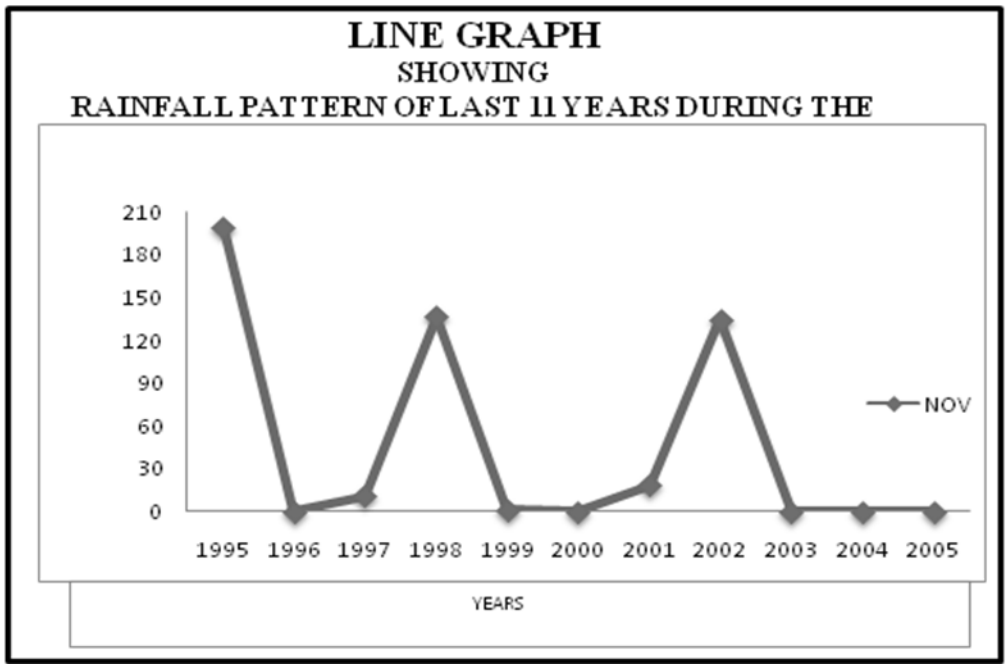

Figure 14
Average Rainfall Pattern for the month of November

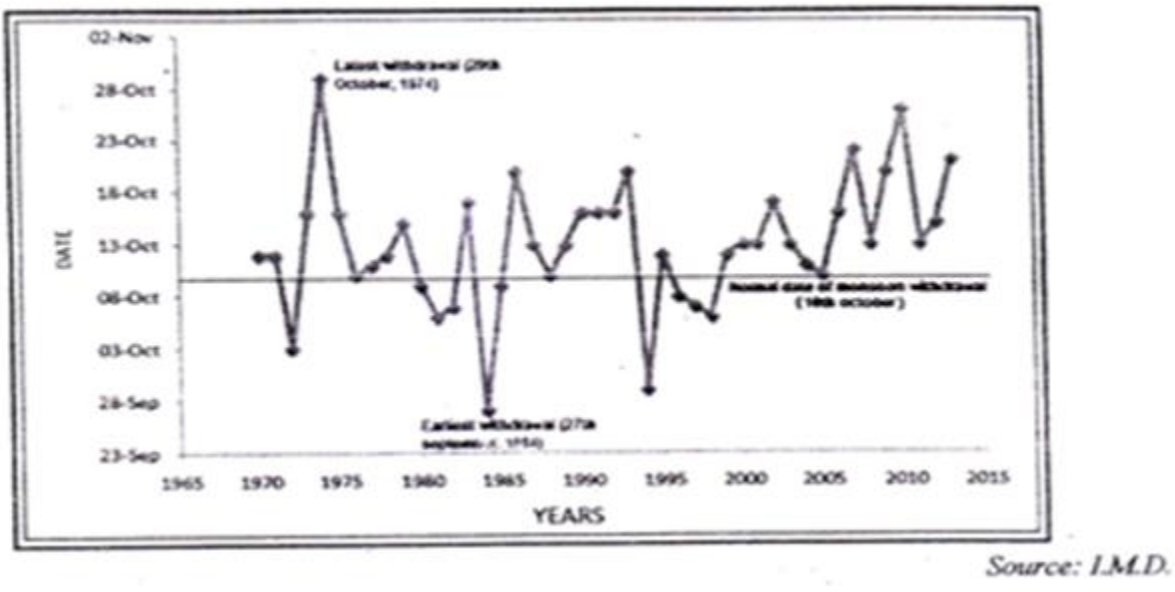

Figure 15
Dates of withdrawal of monsoon from Gangetic West Bengal (1970-2013)

3.8. Irrigation Facility Available

From the information of my primary survey it is observed that every family of this village have some and minimum irrigational facility. Here have not a single family without artificial source of water. Most of the family has deep tubewell facility. Maximum have channel and canal irrigation system within their cultivable land. Some farmer have irrigation water tank. Besides in case of high

income group or family with having a land amount of more than 7-8 bigha depicted in Figure 10, they are the owner of personal water tank. Here within this village Shallow pump and Irrigation tap also found. All this artificial source of water helps the economic structure for villager's people who are mainly depended on agriculture activity (Figure 10).

3.9. Amount of Agricultural Land Get Irrigation Support

As this village have moderate type of irrigation facility that's why all the land get well moisture support. Especially those lands which have an amount of 1 to 6 Bigha gets well facility depicted in Figure 11. But in case of high or big size of land irrigation support will be not so good and poor. This is particularly low or small income of the villagers. Because of low income they not able to afford modern infrastructural facility in case of irrigation system but big amount of land tend to get modern and improved infrastructural as well as technological support in the field of irrigation.

3.10. Rainfall and Rainy Days of Habra Block

The weather report of India Meteorological Department provides an average distribution of rainfall in respect to the rainy days of Habra block, North 24 pgs. Naturally there is a positive relation between rainfall and rainy days. As usual Habra gets highest rainfall during monsoonal season i.e the month of June, July, August, and September (302.5 mm, 349.5 mm, 319.4 mm, 268.4 mm) in comprising to this highest value of rainfall the rainy days are also respectively high (12.3 days, 16.1days, 17.1days,12.1days). After that the rainfall tend to dissipate as the normal dates of withdrawal of monsoon is 10th October as shown in Figure 12.

3.11. Rainfall Distribution and Variation during the Period of Retreating Monsoon

The season of retreating monsoon (October-November) is a period of transition between two principal seasons i.e., outgoing warm rainy monsoon and incoming dry cold winter. The change begins in early October and usually completed by the end of November. The retreating monsoonal period is mainly indicated the month of October and November. Because the usual dates of withdrawal of monsoon is 10th October. But in most of the year due to the problematic variation of withdrawal of monsoon the withdrawal date is not limited or fixed within this 10th October and sometimes monsoon is withdrawn even in the last week of September. Similarly on the other hand monsoon withdrawn is considerably delayed even in last week of October. Normally the precipitation distribution of October and November is explained here.

3.12. Distribution of Rainfall of the Month October& November

Figure 13 indicates the precipitation pattern of the October month during last 11 years in Habra block. This line graph shows heavy rainfall even in the normal withdrawal month during the years of 1996, 1999, 2001, 2003 and 2005. This shows the latest withdrawal of monsoon precipitation. Within those year crops get hampered due to over saturation. Similarly the year 1997 shows early cessation. Those years crops are also get hampered due to increase salinity and pest and disease attack. Figure 14 indicates the variable withdrawal of monsoon of the last 11 years during the month of November in Habra block. It indicates here that the amount of precipitation is 200 mm in the year of 1995. That is the latest cessation of monsoon and the year of 1998 also have late monsoon withdrawal. Particularly this year kharif as well as Rabi crops get hampered. Besides the year of 2000 and 2004 show the normal trend of withdrawal of monsoon rainfall.

3.13. Dates of Withdrawal of Monsoon from North 24 Pgs (1970-2013)

Figure 15 highlights that the dates of withdrawal of monsoon from this part of the district that there are repeated instances when monsoon withdrawn even in the last week of September (27th September 1984, 29th September 1994). There are also instances when monsoon withdrawal is declared almost after complete cessation rain for about 10 days or more prior to it. There are instances when monsoon withdrawal on the other hand is considerably delayed (29th October 1974, 26th October 2010, 22nd October 2007, and 21st October 2013) or wet spell continued for a longer time even after the withdrawal of monsoon as it occurred in 2003, 2005 and 2013.

It is observed during the year of 2013 monsoon withdrawn from the district on 21st October but rainy spell continued up to 27th following severe cyclonic storm phailin during the second week and deep depression thereafter, during the last week of the month. Due to heavy to very heavy rain North 24 pgs came under the grip of flood causing huge loss of paddy, vegetables, flowers and delaying the entire process of field preparation and sowing of rabi crops. Similar situation also occurred during 2003 and 2005 when the coastal district especially Medinipur and North 24 pgs recorded unprecedented very heavy rainfall causing flood in the third week of October after usual withdrawal of monsoon.

4. CONCLUSION

Such variations are integral part of monsoon weather over this part of the country and the effects are also inevitable. However, to minimize loss especially in the field of agriculture contingency plan against each of the above incidences are to be drawn up before hand and implementation of the same to be done well in time.

It can be stated that the district was mainly rain fed and mono cropped during the pre-independence period when crop failure and occasional famine was a regular phenomena. It has made a steady progress in agriculture during the past independence era through during the gradual development of irrigation facilities, introduction of high yielding varieties and adaption of improved

technology by the cultivators. Now the district has attained surplus production in case of paddy, oil seeds, jute and vegetables. The agriculture extension wing of the state Government has played the vital role in achieving the success.

Cultivation of boro paddy needs huge amount of water and it is cultivated mainly the non-rainy season. The huge water used in boro cultivation may profitably be utilized for the cultivation of other crops whose water requirement is varied from 1/5 to 1/10th of boro paddy's water. So avoiding boro cultivation farmer should go for cultivation of less water consuming crops like wheat, pulses and oilseeds as well as vegetables, which is more economic. By this way the cropping of this block can be considerably increased. Finally the cropping pattern in other words the selection of crops should be made in such a way that the crops are environmentally suitable, socially acceptable and economically profitable.

SUMMARY OF RESEARCH

North 24 pgs experiences the following major types of weather variation during monsoon which has profound impact on the entire agricultural scenario of the block during kharif and rabi season.

- Too early or considerably delayed onset.
- Vigorous start of monsoon.
- Prolonged break in monsoon.
- Continuous or unusually prolonged wet spell,
- Early withdrawal, or
- Too delayed withdrawal of monsoon.

This above mentioned weather as well as monsoonal variation effects or hampered crops intensively. Early retreat of monsoon leads to acute moisture stress to the standing Aman paddy during the period of panicle initiation and flower emergence as well as grain filling ultimately leading to considerable production loss especially in the western tract and upland situations. On the other hand as a consequences of the prolonged rainy season

- Matured early variety paddy damage,
- Harvesting of medium duration varieties of paddy delayed, all leads to considerable production loss,
- Cost of harvesting increase,
- Land preparation and sowing of all Rabi crops delayed considerably. So the effects are extensive and far reaching.

FUTURE ISSUES

Few suggestions as to adaptation with the variable retreat character of monsoon climate in North 24 pgs can be put down as the following:

- Taking up all possible measures to increase water resources and reserves at all levels.
- Water conservation measures to be adopted at all levels with the ultimate aim of minimizing the wastage of water, because farmers of the village faced a acute stress of moisture whenever monsoon withdrawn early.
- Crop planning and variety selection to be done, keeping in view the long-term changes of weather elements.
- Change in cropping pattern and cropping sequence, if necessary.
- Change in the land-use pattern of the village.
- Close monitoring of weather elements and their effect on standing crops with a view to evolve and adopt appropriate agro-technique to bring the situation under control to the maximum possible extent.
- For each incidences of probable abnormal behavior of weather, area-specific contingency plans to be prepared beforehand so that action can be initiated at very outset. Awareness among the farming community and common man of the village (Anowerberia) about the distinguishing characteristics and nature of monsoon weather with possible cause and impact.
- Sowing and cultivation of medium as well as short duration range seeds or crops in spite of long duration crops.
- Environment impact assessment to be done in this village level also to gain maximum production.

DISCLOSURE STATEMENT

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