

## Research Article



## Effects of Flood-2010 on Agricultural Sector in Khyber Pakhtunkhwa: A Case of District Charsadda

Shahid Iqbal<sup>1\*</sup>, Amir Nawaz Khan<sup>2</sup>, Mushtaq Ahmad Jadoon<sup>3</sup> and Intikhab Alam<sup>3</sup>

<sup>1</sup>Centre for Disaster preparedness and Management, The University of Agriculture, Peshawar, Khyber Pakhtunkhwa, Pakistan; <sup>2</sup>Faculty of life and Environmental Sciences, The University of Peshawar, Khyber Pakhtunkhwa, Pakistan; <sup>3</sup>Department of Rural Sociology, The University of Agriculture, Peshawar, Khyber Pakhtunkhwa, Pakistan.

**Abstract** | The present study probes the effects of floods-2010 on agriculture sector in Khyber Pakhtunkhwa. Data for the study were collected through a pretested interview schedule from 364 respondents belonging to 5 randomly selected villages of District Charsadda. The study findings reveal a significant difference in the area under wheat, maize and vegetables after the flood. At the same time, the area under sugarcane and fodder had also decreased to some extent. Similarly, the use of chemical fertilizers and farm yard manure was also decreased due to decrease in the income of the households after the floods-2010 while an increase, though non-significant, was reported with respect to use of agricultural chemicals. The floods-2010 has also had adverse effects on crops production where significant decrease has occurred in wheat, sugarcane and maize production. The most important effect was that vegetables growing were stopped after the floods-2010. The study recommends to address the issues through the involvement of both the agricultural extension and research with major emphasis on cash and off-seasoned crops after resolving land demarcation issue and revival of water channels along with introduction of micro credit schemes.

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\***Correspondence** | Shahid Iqbal, Centre for Disaster preparedness and Management, University of Peshawar, Khyber Pakhtunkhwa, Pakistan; **Email:** siqbal@uop.edu.pk

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### Introduction

Pakistan after its independence has experienced flood disasters several times. Some important events occurred in 1950, 1956, 1957, 1973, 1976, 1978, 1988, 1992, 2010, 2011 and 2014 and 2016 (AFR, 2016). These floods caused damages in all the provinces including FATA, Azad Jammu & Kashmir as well as Gilgit-Baltistan. Floods- 2010 was perhaps major disaster of its type. It was caused by monsoon rainfall that started on July 27, 2010. There was heavy downpour in most parts of Khyber Pakhtunkhwa province which resulted great dam-

ages to the economy with major destruction in certain regions such as Peshawar Mardan, Nowshera, Charsadda and Swat (NDMA, 2010). Khan and Ali (2014) report that Pakistan suffered great losses due to floods-2010 owing to high rainfall in the summer season. They considered Floods-2010 as the most dreadful in the history of Pakistan in terms of damages. Floods-2010 inundated about 100,000 sq. km. of area spreading over 75 districts of the country. It has been estimated that 1/10th of the total population has been affected from the floods-2010. Two thousand deaths were also reported due to this menace (Dorosh, 2010).

The floods-2010 has caused heavy losses to the agriculture such as seed stocks, livestock, and farmland as well as irrigation infrastructure and pushed the people towards poverty. The floods left the small farmers in miserable conditions because majority of them were highly dependent on crop production. The total loss of Floods-2010 has been calculated as Rs.765 billion at that time. This was a great loss to the economy of the country. The Floods-2010 has been regarded more damaging than that of Indonesian Tsunami 2004 (Arshad and Shafi, 2010). These floods weakened agriculture sector in many ways such as contamination of water bodies, destruction of irrigation channels, fatalities to livestock, loss of harvest, loss of standing crops and increased chances of epidemic diseases in animals and human beings (Devereux, 2007).

Probing the effects of floods is a common need of the day because of their frequent occurrence and effects especially on agriculture sector: the major source of livelihood of the majority population in rural areas of Pakistan. Such an effort will not only help find the major causes of floods, their effects but also major solutions in the shape of contingency planning for meeting the future disasters. A study examining such effects on agricultural sector can further address the issue from its socioeconomic contribution on the livelihood of the population in rural areas.

## Materials and Methods

The present study probes the effects of Flood-2010 on agriculture sector in Khyber Pakhtunkhwa. Cross sectional research design was used to find out the impact of flood-2010 by making a comparison between pre and post-floods position. District Charsadda of Khyber Pakhtunkhwa was universe of the study as it was the most severely damaged district by the floods. According to the government reports, the most damaged villages in the District were Maria, Umarzai, Turngzai, Utman Zai, Nissatta, Rajjar, Hisarar Yaseen Zai, Sarki Titara, Aba Zai, Mirza Dher, Ziam, Ghandira, Hisara Nehri, Showdag, Shabqadar, Agra, Daulat Pura, Haji Zai, Hasasn Zai, Kangra, Katuzai, Matta Mughal Khel, Panj Pao and Tarnab. However, keeping in view of limitation of the study, the present research was confined to 5 randomly selected villages namely Hajizai, Katozai, Panj Pao, Tarnab and Hissara Nehri. Lottery method was applied to select the villages. These were the areas that were not only affected more but also contained the population belonging to

different sizes of farm and ownership statuses. Migration to safe area after floods-2010 was also reported more in these areas, as the houses of majority of the people were damaged completely and partially at least along with severe damages to agriculture, crops, water channels and infrastructure facilities (NDMA, 2010).

Different sampling methods are generally considered to measure a study parameters, however, the reliability of the data depends on the use of appropriate research methods along with a sample size that give a real picture of the population (Sekaran, 2003). The study is based on both the secondary and primary data. The secondary data were collected from the all the available material whereas the primary data were collected from those respondents who were depending on agriculture and flood-2010 had affected it either completely or partially. To study the effects of floods-2010 on agriculture sector, a number of sampling methods were considered however, systematic sampling method was adopted due to the lack of sampling frame i.e. the household list from the secondary sources. Sample size is the other important step for an empirical study where the determination of sample size depends on statistical and non-statistical consideration. The latter include availability of time, human and financial resources whereas the former calls for level of decision, confidence interval and degree of variability heterogeneity or dispersion in the population (Cooper and Emeory, 2000). According to 1998 District Census Report there were 7010 households in the study area (GoP, 1999), however, keeping in view of time, human and financial limitations, data were collected from 364 households in the study area. Sample size were drawn by using the table designed by Sekaran (2003) who state that a sample size between 50 to 500 is appropriate for drawing good results. Proportionate allocation was made to determine the sample size from each of the selected village. Data in the sampled area were collected through a pretested interview schedule from the elders or head of the those households who were directly or indirectly depending on agriculture and related occupations and had loss in floods-2010 in shape of residence, fodder and grain stores, irrigation channels, infrastructure, livestock, soil erosion and decrease in agriculture land, input use, and agriculture production. Frequencies, percentages and paired t-test methods were used to find out the effects of flood-2010 on agricultural area and production. Paired t-test is a statistical procedure used to compare two means belonging to the same unit, individual or object

**Table 1:** *Effects of floods-2010 on area under crops.*

S. No	Area Under Crops	After Flood*	Before Flood*	Difference*	T-value	P-value
1	Maize Area	10.84	11.79	-.95268	-3.965	.000
2	Sugarcane Area	13.92	14.70	-.83650	-1.840	.067
3	Fodder area	1.81	1.88	-.07477	-1.302	.196
4	Vegetables area	3.14	3.28	-.14286	-2.121	.043
5	Wheat area	14.14	16.43	-2.30745	-6.136	.000

Source: Survey, 2016; \*Kanal: 1/8 Acre.

representing two different times which in present case was pre and post flood-2010 situations with reference to agricultural area and production. The two situations were not only different but also related and the present study probed whether the difference between two means was zero or not.

### *Effects on agriculture*

Agriculture was the major livelihood source of the people in the study area. It was basically a high fertile area in Pakistan and irrigated by Kabul River and its tributaries. It made the area as the major agricultural land where people were involved in all sorts of agricultural related activities. Maize, Sugarcane, Potato, wheat, fodder and other vegetables were the main crops grown in the study area. This section describes the effect of flood-2010 on cultivated land, input use and crop production after flood.

## Results and Discussion

### *Cropped area*

There had been a significant change after the flood in the total area under crops. Table 1 while describing the difference in the total cultivated area states that the area under maize crops decreased from average area of 11.79 Kanals per farm family before floods-2010 to 10.84 Kanals after floods-2010 with a mean difference of -.95268 Kanals per household. It was a significant change (.000) with -.3.965t-value. The other major difference in area under crops after the floods-2010 was wheat area which again decreased from 16.43 Kanals per sampled family before floods-2010 to 10.14 after the floods-2010 with a mean difference, t and p values of -2.31, 6.136 and 0.000 respectively.

In case of other crops, a significant change was also found in area under other vegetables which decreased from 3.281 Kanals per family before floods-2010 to 3.14 Kanals after the floods-2010 with mean differ-

ence of -.14286 along with 0.043, -2.121 p and t values respectively.

Regarding other crops, though the change in area under sugarcane is not significantly different ( $p=.067$ ), however, it decreased from 14.70/Kanals per family before floods-2010 to 13.92 Kanals after floods-2010. The change in fodder was again non-significant (0.196) with small t-value of -1.302, however, it was also decreased from 1.88 Kanals before floods-2010 to 1.81 Kanals per household after floods-2010. Parker (2000) similarly reported that floods disaster frequently destroyed the crops and livestock such as the reduction in area under crops, crop production and livestock size. Similarly, Magole (2005) found destruction of cultivation land in flood plains.

Table 1 as a whole reveals a significant change in area under crops. The major change in this respect was found highly significant in area under maize and wheat crops. At the same time, floods-2010 also affected the area under vegetables and sugarcane.

### *Agricultural Input use*

Agricultural inputs are the major factors of production. Proper use of inputs directly affected the agricultural production and consequently the livelihood of the people. Table 2 while describing the input use before and after floods-2010 states a significant decrease (0.000) in the chemical fertilizers for Kharif crop. The amount decreased from 2.55 bags per family before floods-2010 to 2.293 bags per family after floods-2010 with mean difference and t-value of -.264 and -3.685 respectively. The same was again found with respect to chemical fertilizer application on Rabbi crops. Though the p-values describing change was not highly significant (0.044), it again decreased from 3.379 bags per family before floods-2010 to 3.219 bags after floods-2010 with mean difference -.16011 and t-value -2.023.

**Table 2:** *Effects of floods-2010 on agricultural input use.*

S.No	Input used	After Flood	Before Flood	Difference	T-value	P-value
1	Chemical Fertilizer (Kharif) (Bags)	2.2938	2.5579	-.26409	-3.685	.000
2	Chemical Fertilizer (Rabi) (Bags)	3.2191	3.3792	-.16011	-2.023	.044
3	Farm Yard Manure (Kharif) (Trolly)	1.3399	2.2688	-.92885	-4.879	.000
4	Farm Yard Manure Rabi (Trolly)	1.5056	2.3277	-.82210	-5.934	.000
5	Agricultural Chemical Kharif (Bottles)	2.0118	1.9882	.02360	1.016	.310
6	Agricultural Chemical Rabi (Bottles)	2.0640	2.0581	.00581	.196	.845

Source: Survey, 2016.

**Table 3:** *Effects of floods-2010 on crops production.*

S.No	Crops Production	After Floods*	Before Floods*	Difference*	T-value	P-value
1	Maize	11.66	17.94	-6.27918	-6.716	.000
2	Sugar Cane	29.76	47.69	-17.93156	-9.853	.000
3	Vegetables	0.00	0.1481	-.14815	-2.126	.043
4	Wheat	37.41	56.37	-18.96273	-10.096	.000

Source: Survey, 2016; \*: 40 kg Mond.

In case of farmyard manure for Kharif crop, the quantity again decreased from 2.268 trollies per family before floods-2010 to 1.339 after floods-2010. The mean difference was -.9288 along with -4.879 t-value. Same was the case with farmyard manure use for Rabi crop with a decrease from 2.3277 trollies before floods-2010 to 1.5056 after floods-2010. The mean difference was -.8221 while t-value and p-value were -5.934 and 0.000 respectively.

The use of insecticides/pesticides for Kharif crops increased from 1.9882 bottles per family before floods-2010 to 2.0118 after floods-2010. The values of mean difference and t-values are not high along with non-significant p-value. Same was the case in connection with pesticides/insecticide use for Rabi crops where a very minor increase i-e .00581 bottle was found after floods-2010. Similarly [Smith and Ward \(1998\)](#) report high losses of crops, livestock and agriculture infrastructure in rural areas especially to subsistent and small scale farmers. [Du Plessis \(1988\)](#) found that farming sector was severely hit by 1983, 1984, and 1985 floods in South Africa and due to this farming community social economic condition became miserable as in certain areas the outcome was nil and they were forced to take loans to meet their daily needs. It further compelled them to invest less in input use.

[Table 2](#) as a whole reveals a decrease in the use of chemical fertilizer and farm yard manure with respect

to both Kharif and Rabi crops. On the other hand, a very small quantity of pesticides/insecticide use was found after the flood.

### Crops production

Like area, floods-2010 made significant effect on the crops production in the sampled area and [Table 3](#) reports that in case of maize, production was decreased significantly (0.000) from 17.94 monds per family before floods-2010 to 11.66/40 kg mond after floods-2010 with a mean difference of -6.716. Same was the case with respect to wheat production which also decreased from 56.37 monds(40 kg.) per family before floods-2010 to 37.41 monds (40 kg.) per family after floods-2010. The mean difference was -18.96273, with t-value -10.096 and p-values (0.000) were also higher than the maize crops.

Same were the results with respect to sugarcane where the production had decreased from 47.69 mond per family before floods-2010 to 29.76monds(40 kg.) after floods-2010. All the other indicators are also high i.e. mean difference (-17.93156), t-value (-9.853) and p-value (0.000). However, the results are in not in line with [Bukhari et al. \(2017\)](#) who stated that the wheat production in the flooded area increased as the less fertile soil turned to rich fertile soil which ultimately has increased the production of wheat in the area.

The results ([Table 3](#)) as a whole report a significant decrease in the crop production after floods-2010.

## Conclusions

The study reveals a significant effect of flood-2010 on agriculture in the study area. It started with decrease in area under crops through soil erosion or merger under the water. The major change in this respect was found in the area under maize and wheat crops. At the same time area under vegetables, sugarcane and fodder was also decreased. On the other hand, the destruction to livelihood sources directly affected the agricultural input use where major decrease was reported in the use of chemical fertilizer and farm yard manure with respect to both Kharif and Rabi crops. All these significantly affected the production of three major crops wheat, sugarcane and maize.

## Author's Contribution

**Shahid Iqbal:** Conceived the idea, carried out the research and collected the data.

**Amir Nawaz Khan:** Main supervisor, guided the project and edited the manuscript.

**Mushtaq Ahmad Jadoon:** Helped and suggested in designing the research, proofread the manuscript technically.

**Intikhab Alam:** Helped in synthesizing the literature.

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