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Wheat Crop Disaster Mitigation in Hebei Province P.R.China.A Case Study of Shijiazhuang Region.

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ABSTRACT: Wheat crop is very risky by nature, not only natural disasters but also other environmental factors such as political system, law, policy, social factors and many others has deeply affecting the wheat crop development in the province. However the current paper mainly concentrates on the three main kinds of natural disasters such as drought, wind hail and frost etc affecting the wheat crop development of Hebei province P.R.China. In order to evaluate and mitigate the province from the wheat natural disasters, the panel data from 1990-2012 of three wheat crop natural disasters affected and damaged areas are analyzed. It defined and measured the rates of disaster reduction and affected, gives the analysis and mitigation of wheat crop natural disasters. According to the extent and the area of distribution of a variety of disasters in the losses of crops, use basic statistical methods to analyze the development trend and the affected areas variation of various disasters, such as it discussed the natural disaster's long term changes in the diversity and complexity of features. And the average total disasters affected, damaged and absolutely no harvest area from drought, wind hail and frost from 2010-2014 in Shijiazhuang region are 0.0719, 0.00826 and 0.00153 million hectares respectively and the total amount of money loss are 239.68 million RMB. Finally from the prospective of macro policy the study responds and concludes some mitigation measures to compete with wheat crop natural disasters.
Keywords: Disaster Affected, Disaster Damaged, Natural Calamities, Wheat Risk

INTRODUCTION

Natural disasters such as drought, wind hail and frost etc are the main hurdles to the wheat production in Hebei province of P.R.China. Wheat risk management strategies means the alternative ways to avoid the wheat crop from different risks such as natural disaster, drought, wind hail, storm, frost, attack of insects and diseases etc, through different techniques such as crop insurance, contracts, options, diversification and different government programs etc. wheat crop is directly concerned with the development of wheat farms, which are directly exposed to natural perils. To avoid the wheat crop from major threats like natural disasters, risks and to improve the quality and quantity of wheat crop in the province need to make different strategic planning such as government assistance etc have been adopted by the farmers. But the wheat crop insurance is considered as the best mechanism to reduce financial damages. The country and province suffers from natural disasters have many characteristics such as different types, large scale of circulation, high frequency and massive losses etc. The environmental disasters and the accidents are the main sources of producing the wheat crop natural risks. Natural disasters include hydro-meteorological and geophysical disasters [1]. In 2011 drought mainly affected the provinces of Shandong, Jiangsu, Henan, Hebei and Shanxi grow more than two-thirds of the country's wheat. In Hebei province total 109 counties have scarcity of water for three months in the wheat main growth period, which covers 4 million hectares area, has a serious threat for the national food security and economic status of rural peoples. The price of domestic wheat goes highs on the Zhengzhou Commodity Exchange [2]. Agriculture first depends on natural environmental conditions. Natural resources and the environmental conditions are the material base for the national agricultural production. When an emergency occurs in the natural environment, it creates harmful affect to the agricultural sector. Natural environment usually refers to the non-human created material geography space. Natural sunlight, temperature, air, water, soil, wildlife, plants, other natural materials and works of non-human force

constituted the basic factors of the natural environment. In a macro aspect discussed the source of wheat production risks, to analyze the trends of natural disasters and to investigate the risk mitigation measures by means of market countermeasures to resist and compensate for the disaster losses. And study the relationship of different disasters on how their variation depends on various phases of development to determine the main impact factors and their measures. Mitigation aims are to prevent risks, decrease the disaster effects on life and property. Thus as provincial circulation of natural calamities and the degree of loss have varied in the gradient; the disaster affected areas should always be greater than the disaster damaged areas that mean the disasters have been reduced.

Therefore, the distinction between the two on behalf of the community is the prevention, mitigation and disaster resistant ability. Mitigation measures concentrate on protecting the most risky elements and activities. The weakest links in the various sectors of the economy will assist to protect the achievements of economic development. The mitigation stage differs from other stages in that it concentrates on long term measures for eliminating risks. The achievement of mitigation strategies is a part of the recovery process if it is applied after a calamity occurs [3].

Factors Affecting the Wheat Crop Production Risk

The three main meterological disasters affected and damaged areas such as drought, wind hail and frost from 1990-2012 to the wheat crop are given below in the following table 1.

Table 1. The Wheat Crop Affected and Damaged Areas in Hebei Province [Unit: - 10^6 hec]

Years	Drought Affected	Drought Damaged	Wind hail Affected	Wind hail damaged	Frost Affected	Frost damaged
1990	0.053	0.005	0.963	0.168	0	0
1991	0.639	0.133	0.212	0.023	0.036	0
1992	1.335	0.073	0.268	0.048	0.057	0.011
1993	0.956	0.182	0.338	0.105	0.03	0.005
1994	0.844	0.09	0.145	0.043	0.032	0.004
1995	0.334	0.011	0.232	0.058	0.179	0.051
1996	0.5	0.05	0.204	0.045	0	0
1997	1.983	0.39	0.098	0.016	0	0
1998	0.436	0.087	0.508	0.115	0.036	0.006
1999	1.867	0.522	0.288	0.053	0.002	0.001
2000	1.64	0.54	0.08	0.02	0	0
2001	1.73	0.239	0.15	0.03	0.03	0
2002	1.6	0.455	0.18	0.105	0.042	0.003
2003	1.183	0.193	0.602	0.106	0.002	0
2004	0.314	0.026	0.413	0.106	0.043	0.004
2005	0.257	0.113	0.108	0.023	0.006	0.001
2006	0.867	0.145	0.287	0.053	0.142	0.018
2007	0.829	0.252	0.169	0.033	0.067	0.004
2008	0.48	0.053	0.314	0.078	0.011	0.007
2009	1.063	0.418	0.445	0.092	0.085	0.003
2010	0.432	0.137	0.081	0.011	0.271	0.027
2011	0.372	0.028	0.06	0.018	0.007	0.001
2012	0.213	0.025	0.124	0.012	0.157	0.037
Average	0.866	0.181	0.273	0.059	0.054	0.008

Source:- China's planting information nets "http://zzys.agri.gov.cn[4]

Drought

Drought is one of the most serious, frequently and largely occurs meteorological disasters influencing the wheat crop growth in Hebei province. The above data in table 1 showed that the 23 years average drought affected and damaged areas in Hebei province are 0.866 and 0.181 million hectares, The range of Hebei province winter wheat water requirement is about 400-500 mm. But the wheat growth was in the periods of fall, winter and springs that lack of rainfall water. During these periods the quantity of rainfall water is less than one half the water demand of wheat. For example, the precipitation during the growing period of wheat in central Hebei Baoding, Shijiazhuang and in most counties of South Central Xingtai and Cangzhou area is only 150-200 mm, Hengshui and Cangzhou area is only about 200 mm of precipitation, along the Taihang Mountain Laiyuan, Fuping, Ping Shan and jingxing mountain county are sloping land, poor soil and rainfall seldom. To provide adequate soil moisture precipitation annually in July, August, September and early October plays a very important role for winter wheat growth, development and yield formation, but still can not meet the water demand of the entire growth period. Due to soil

drought or atmospheric drought, moisture of wheat root absorption from soil are difficult to compensate the transpiration consumption and makes the plant water imbalance caused by abnormal and wheat growth wilted, died and eventually lead to lower quality and less yield. The drought affected the wheat crop in the sowing stage, joint heading stage and the grain filling stage. And the tendencies of the wheat drought affected and damaged areas are given below in figure 1.

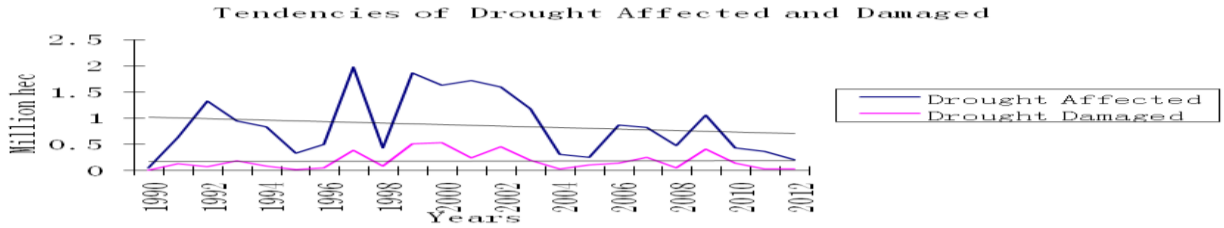

Figure 1.
Source:- Author's Calculation

In figure 1, the curve DA and DAT shows the drought affected and drought affected tendency, while DD and DDT shows the yearly change of drought damage and drought damage tendency areas. After the period 1990-2000, both droughts affected and finally damaged disaster areas have been decreasing obviously. But both the drought affected and damaged areas are greater than wind hail and frost, which are 72.59 and 72.98 percents of the above mentioned total disaster affected and damaged areas. The average wheat drought affected and damaged areas 0.866 and 0.181 million hectares in the study area ranging from 0.053 and 0.005 to 1.983 and 0.540 million hectares with standard deviation of 0.5 and 0.169.

Dry Hot Wind

Dry hot wind is the second natural disaster affecting and damaging the wheat crop after drought in the study area. Dry hot wind is a natural disaster to the wheat crop in the province caused by the weather of high temperature and low humidity is accompanied by certain wind. In flowering and filling stage of wheat, the balance of water and photosynthesis strongly damage the wheat and wheat grain, the less damage year of the winter wheat area in Hebei province, which reduces yield up to 10%. And the serious yield reduction year is 10-20% or above. The table 1 data indicates that the wind hail is the second natural disaster, which affected and damaged the wheat crop areas after drought. The average wheat wind hail affected and damaged areas are 0. 273 and 0.059 million hectares ranging from 0.060 and 0.011 to 0.963 and 0.168 million hectares with standard deviations of 0.208 and 0.042 respectively. The average wind hail affected and damaged areas comprise 22.883 and 23.790 percentages to the total of both natural disasters. In figure 2, the WA and WAT shows the wind hail affected and wind hail affected tendencies, while WD and WDT shows the wind hail damage and wind hail damage tendencies respectively.

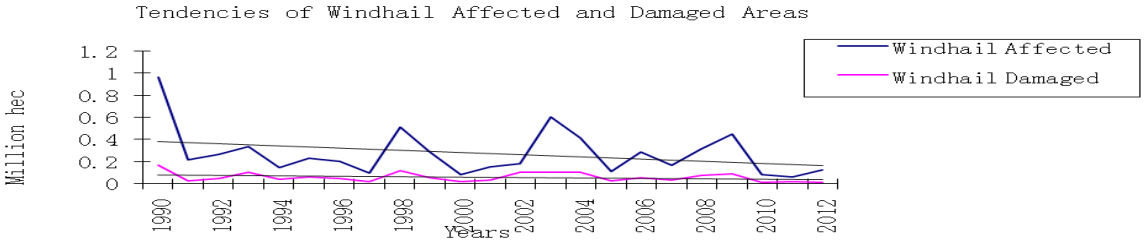

Figure 2.
Source:- Author's Calculation

Frost

The occurrence of frost frequency is lower than the drought and wind hail, but the damage to the wheat production are more than the other kinds of disasters. In 1977 and 1980, the occurrence of freeze led to the reduction of wheat production. The wheat in North China especially in Hebei province in 1957, 1961, 1968, 1969,

1977, 1980, 1988 and 1994, 1995, 2006, 2010 and 2012 etc are the most serious years affected due to low temperature. There are various reasons, types will cause frost. The wheat will be easily suffered by frost in the period of wintering, reviving, long time and low temperature are easy to cause freezing injury. The type of frost damages can be divided into the following. Winter intense cooling type, the long winter cold, drought freezing, thawing and comprehensive factors, with the gradual change of climate, from 1980's, warming in winter in the north, the production conditions improved, a large area of devastating dead seedling has rarely occur, so peoples ignored frost factors in winter wheat breeding and cultivation measures. Reduce the freeze injury to defense the relative reduction of wheat production. However, the average temperature rise but frost still exists. In some warm winter, wheat due to the higher temperature, cold resistance of wheat is not enough, lead to the weakness of the wheat due to rapid cooling temperature before winter, violent or dry freeze and frost are likely lead to very serious damages. At present the frost occurrence leads the ear and particle numbers decreased are still quite common. Serious freezing injury of wheat in our province occurred from 2004 to 2006 did not take defensive measures in a timely manner and exerted a great influence on wheat growth. From the table 1 historical data from 1990-2012, in 1995 0.179 and 0.051 million hectare of land, in 2006, 0.142 and 0.018 million hectares and the most serious year is 2010, where 0.271 and 0.027 million hectare of wheat land is affected and damaged. In our province, north south temperature difference, freezing injury index varies by species, damage index in various developmental stages have different. With the climate warming, warm winter year increase, long cold frost occurrence frequency decreased gradually after 2000, frequency is close to zero. In winter and early spring cooling type freezing and thawing freezing gradually increased due to the temperature changing intensity. At the same time, the rising temperature increases the evaporation lead to the excess before winter and dry freezing and freezing damage frequency also increased, because of its characteristics of accumulated disasters, frost is often caused by many reasons, production serious freeze injury years are often common features from several types of damages, but their contribution factors on the damage such as temperature in November 2005 in Hebei province was significantly high, in 2-4 December sudden cooling, wheat cold resistance training is insufficient, a hidden danger of wheat damage occurs, in 3-4 February 2006, again cooling process resulting in a large area of wheat frost. The average wheat frost affected and damaged areas are 0.054 and 0.008 million hectare are minimum among the other disaster affected and damaged areas, contributes 4.526% and 3.226 % of the total wheat disaster affected and damaged areas. In figure 3, FA and FAT represents the frost affected and frost affected tendency, while FD and FDT showed the frost damage and frost damage tendency respectively. The figure 3 and table 2 shows the frost affected and damaged areas tendencies has been increasing, which has a little affect on province winter wheat crop production. The average wheat frost affected and damaged areas are 0.054 and 0.008 million hectares ranging from 0 to 0.271 and 0.051 million hectares with standard deviations of 0.070 and 0.013 respectively.

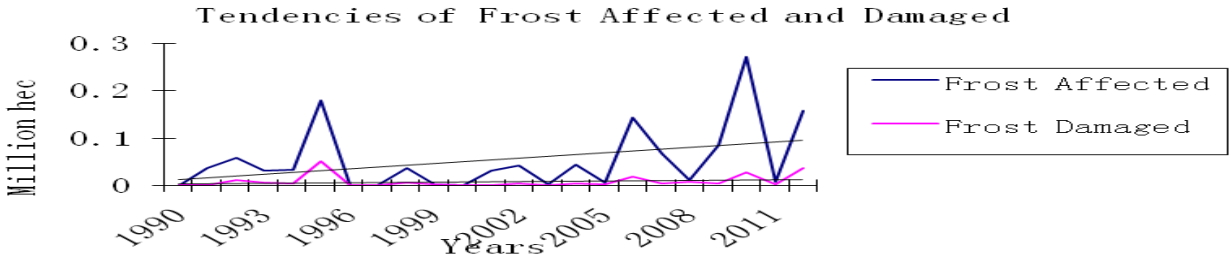

Figure 3.
Source:- Author's Research

And to know the periodic tendency of average disaster affected and damaged area from 1960-2012 divided the data into two groups, the first period from 1990-2000 and the second from 2001-2012.

Table 2 Average Affected and Damaged Areas Comparison [Unit: - 10^6 hec]

Years	1990-2000		2001-2012		Remarks/Change	
Disasters	Affected	Damaged	Affected	Damaged	Affected	Damaged
Drought	0.962	0.189	0.778	0.174	Decrease	Decrease
Wind hail	0.303	0.063	0.244	0.056	Decrease	Decrease
Frost	0.034	0.007	0.072	0.009	Increase	Increase

Source: - Calculation based on table 1

The data significantly showed that drought, wind hail average disasters affected and damaged areas tendency decreased, while the frost average disaster affected and damaged areas are increased, which is also obvious from the above table 2 and figure 3.

Table 3 Percentage Comparison of Affected and Damaged Areas of Hebei Province to P.R.China [Unit10^6 hec]

	Drought		Wind hail		Frost	
Disaster	Affected	Damaged	Affected	Damaged	Affected	Damaged
China	12.32	2.581	2.35	0.576	1.91	0.372
Hebei	0.866	0.181	0.273	0.059	0.054	0.008
Percentage	7.029	7.019	11.617	10.243	2.827	2.151

Source:- Calculation based on table 1

The overall 23 years average natural disasters of Hebei Province i.e. wind hail, drought and frost affected areas are (11.617%), (7.029%) and (2.827%), and while wind hail, drought and frost damaged areas are (10.243%), (7.019%) and (2.151%) to that of P.R.China respectively. To understand the problems of the natural disasters risks of the wheat crop, the tendencies of the disasters affected and damaged areas of drought, wind hail and frost are shown graphically below in figure 4 and 5. The tendencies are determined based on the data in table 1.

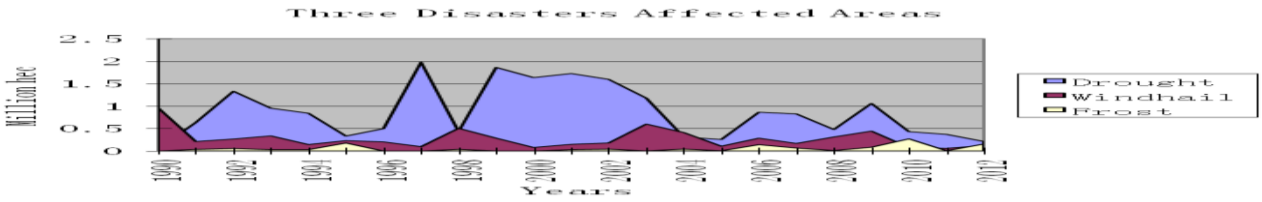

Figure 4.
Source:- Author's Calculation

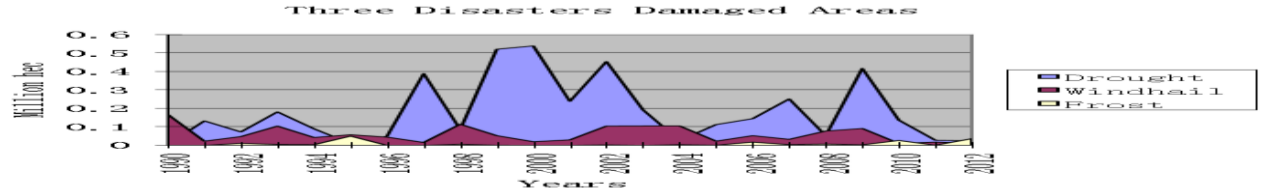

Figure 5.
Source:- Author's Calculation

Basic Statistical Analysis

Meterological disasters occurrence are mainly exogenous factors, but its mitigation is mainly endogenous function. The statistical data and information initial analysis can be given for the causes of natural disasters reduction and prevention. Let's assume that the rate of disaster reduction tendencies can be measured by subtracting the disaster damaged areas from its affected areas and then dividing by the disaster affected area as shown in table 4. Seeing from a macro aspect, preventing and resisting natural disaster is an important economic achievement, which may use different disaster mitigation area to express. So that (D, t) to express each kind of disasters collected variation for year (t). Suppose that the rate of disaster reduction is a concept of representing the disaster mitigation. Mathematically to calculate the rate of disaster reduction in different cases we use the following formula. Rrd (%) = F (Da, t)-F(Dd, t)/F(Da, t). Here F(Da, t) and F(Dd, t) expresses annual disaster affected and finally damaged areas, and assume there is always existed $F(Da,t)\geq F(Dd,t) \geq 0$. So that Ra=F (Da, t)/F (Dd, t) as a rate of disaster affected and both Rr+Ra=1 and $1\geq Rr\geq 0$, $1\geq Ra\geq 0$. In table 4, the rate of disaster reduction (R_{rd}%) for frost in the year 1991, 2001 and 2003 showed 1, that means there is no disaster damaged areas to wheat production in Hebei province.

Table 4. The rate of disaster reduction (Rrd %)

Year	Drought	Wind hail	Frost
1990	0.906	0.826	0
1991	0.792	0.892	1
1992	0.945	0.821	0.807
1993	0.809	0.689	0.833
1994	0.893	0.703	0.875
1995	0.967	0.75	0.715
1996	0.9	0.779	0
1997	0.803	0.837	0
1998	0.8	0.777	0.833
1999	0.72	0.816	0.5
2000	0.671	0.75	0
2001	0.862	0.8	1
2002	0.716	0.417	0.929
2003	0.837	0.824	1
2004	0.917	0.743	0.907
`2005	0.561	0.787	0.833
2006	0.833	0.815	0.873
2007	0.696	0.805	0.94
2008	0.889	0.752	0.364
2009	0.607	0.793	0.965
2010	0.683	0.864	0.9
2011	0.925	0.7	0.857
2012	0.882	0.903	0.764

Source: - Calculations based on table 1

The Case Study of Shijiazhuang Region

In 2014 the Shijiazhuang city of Hebei province has statistical area of 5050000 acres, 56000 acres of land increased as compare to last year. The wheat sowing technology and climatic conditions are generally favorable to yield, total output and is expected more than double in history. The data in table 5 showed the total wheat disaster affected, damaged and absolutely no harvest area from the meterological disasters such as drought, wind hail and frost and the amount of money loss in RMB from 2010-2014 in Shijiazhuang region. The data showed that in 2010, the wheat crop affected, damaged and absolutely no harvest area are only due to very low temperature in Shijiazhuang specific counties Xinle, Yuanshi and Xingtang and the total economic losses occur to the wheat crop due to the frost are 212.772 million RMB. And the total disaster affected, damaged and absolutely no harvest areas due to frost are 0.104, 0.020 and 0.007 million hectares respectively. And in 2011, the wheat crop affected, damaged and no harvest area are only due to drought and wind hail, where the total disaster affected area are 0.188 million hectare. The disaster damaged area are 0.0113 million hectare and absolutely no harvest area is only due to wind hail that is 6.66667E-05 million hectare, and the total amount of money loss in Pingshan, Xingtang and lingshou counties are 1.664 million RMB due to the wind hail and drought. And in 2012, the wheat crop total disaster affected area are 0.0025 million hectares only due to drought and wind hail, which are 0.0005 and 0.002 million hectares respectively. Damaged and absolutely no harvest area are 0.001 and 0.0003 million hectares. And which economically loss the counties of pingshan, xinle and gaoyi in Shijiazhuang region totally 8.94 million RMB. And in 2013, the total disaster affected area are 0.027 million hectare due to drought and wind hail and disaster damaged area are 0.002 million hectare and absolutely no harvest areas due to drought, wind hail and frost. And this year the total economic losses to wheat crop are 10.989 million RMB in Jinzhou, zhaoxian, gaocheng counties in Shijiazhuang region. And in 2014 the total disaster affected, damaged and absolutely no harvest area in Luquan, Shengze and xingtang counties of Shijiazhuang regions are 0.038, 0.007 and 0.0003 million hectares respectively, where totally economic loss are 5.315 million RMB. Thus the total disaster affected, damaged and absolutely no harvest areas due to drought, wind hail and frost in the above ten counties of Shijiazhuang region of Xinle, yuanshi, xingtang, Pingshan, lingshou, gaoyi, Jinzhou, zhaoxian, gaocheng, Luquan and Shengze are 0.0719, 0.00826 and 0.00153 million hectares respectively, and the totally economic losses to the wheat crop due to the drought, wind hail and frost during the period from 2010-2014 are 239.68 million RMB. And the disaster affected, damaged and absolutely no harvest areas, the amount of money loss and the counties affected in Shijiazhuang region are shown in the following pie chart.

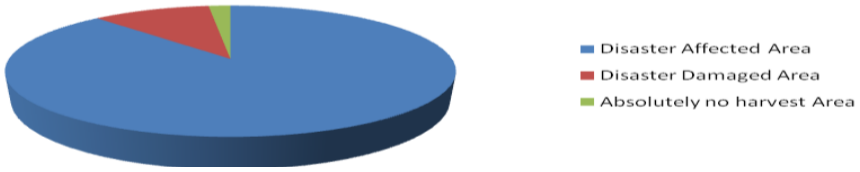

Figure 6.
Source: - Author's Calculation

Countermeasures

Prevention Measures from Drought, Frost, Wind hail and Insects Attacks and Diseases

The main prevention measures to resist the wheat crop from drought, frost, wind hail and attack of insects and diseases are suggested. Breeding new varities such as cultivate drought resistant varieties, cultivation measures (covering straw, hoeing and repression), drought resistance sowing, irrigation, water saving irrigation areas are needed to increase to prevent the wheat crop from drought.

The frost affected and damaged areas are increasing and cannot be control the weather events, but can minimize the effect of cold winter on winter wheat crop by using techniques such as timely sowing or sowing a little later, young and strong seedling, strong and cold resistance wheat varieties according to the weather conditions such as irrigation mulching, hoeing and insulation etc. growing cultivars with long and low temperature vernalization requirement, enough basal dressing of phosphorus and potassium but less nitrogen, pressing operation after sowing, pre-winter irrigation in later November or early December.

And from the wind hail irrigation, spraying and enhanced the fertilizing ability to resist the wheat crop before dry hot wind. The winter wheat is largely affected due to drought, frost and wind hail, therefore the provincial government needs to initiate a relief and financial assistance program for the drought, frost and wind hail affected wheat farmers of the province. And do a good job for the timely and sufficiently use and spray of herbicides, pesticides and insecticides on wheat crop for the prevention, control, monitoring and forecasting of wheat insects, diseases and pests risks through rules and regulation of agriculture.

Socio Economic Development and Construction to Resist Natural Disasters

The wheat is an important staple crop plays an important role in the national economy, but exposed to natural disasters. Improve the ability of the wheat crop to resist natural disasters is the main area in the socio economic development and construction, and should need to support in information, infrastructure construction, early warning, social security systems, social organizations and reaction ability.

Establishment of the Wheat Natural Disasters Mitigation Department

Establishment of the wheat natural disasters mitigation department to mitigate the winter wheat from natural risk, the central and provincial governments prepare a plan to ensure the annual budgeting processes for wheat development. To address wheat risk, hazard and to minimize residual disaster risk, develop initiatives by controlling economic and infrastructure development and to reduce exposure to calamities. The provincial government must establish at least one emergency management and geographic information centre to support risk management and implement these public information and management plan to mitigate the wheat natural calamities risks from the province.

Infrastructure Construction and Management to Stability the Wheat Production

Information, Infrastructure Construction and Management to study the stability problem of wheat production, need to examine, recognizing the risk and uncertainty facing by wheat crop sector. Risk detection needed to search for the risk initial source and involved in the wheat natural disasters and the uncertainty realistic background. Therefore information construction and management is the most important contribution to the identification of natural disasters, early warning prevention, disaster response literacy and information about the wheat related social organization. To avoid and fight with natural disasters need huge force, energy and material, it is usually inactive but the most vital defense force. To fight with drought has a long history in the province, such as irrigation, governance mountain and river management combined. Chinese people to fight with natural calamities in the past have made great achievements, but there is a big space to compete with the needs of modernization.

Strengthen the infrastructure construction for the improvement of wheat production, farmland capital construction is the foundation of wheat production; tractor road construction is necessary for the implementation of wheat mechanization, based on the experience of developing countries in wheat development to a certain stage and combined with the actual situation of the country's arable land remediation. For the majority of our small land area, farmland inadequate facilities, low operating efficiency of mechanical problems, must take effective measures to implement the arable land from small and large, irregular sorting rules, leveling uneven finishing infrastructure projects such as wheat mechanization, strengthen tractor roads, drains discharge farmland infrastructure, strengthening wheat infrastructure development, improve machine efficiency, save resource consumption, promote sustainable and healthy development of mechanized wheat production.

Steps to Manage Disaster Mitigation and Environmental Protection

The disaster mitigation and environmental protection is necessary to develop the wheat crop. By use of modern bio-technology, to develop wheat species which can resist against drought stress, water logging, sand-fixing, chilling. Adjust and optimize the structure of wheat production, restore vegetation and improve the ecological environment.

Training and Educational Program to Manage Natural Disasters Events

The provincial government develops appropriate training and educational programs to improve the wheat grower's community awareness about wheat natural disaster events. The provincial wheat National Disaster Management Office should concentrate on post disaster response, recovery and rehabilitation. The NDMO include a number of individuals responsible for the disaster management, the National Disaster Management Council, the absence of suitable information to predict, respond to disaster measures e.g. hazard maps, the scale of flood and disaster impacts. Disaster management constitutes early warning systems, emergency plans, equipment, trained and knowledgeable people to monitor the hazards. The weak early warning system raises the vulnerability of the poor along with their ability to make decisions during an emergency. In recent years, the irregularity has badly affected the struggle to distribute warnings in time to different parts of province. In addition, poor communication, proper rescue equipment, insufficient personnel training in disaster management have resulted in inefficient operation of the disaster management team in some parts of the province.

Social Security System

To develop the social security system and wheat insurance to compete with natural disasters, it is necessary to prepare a cover work plan for the calamities management. The planning system, the system of financial funds, social organization, mobilization of actions mechanism, ecological environmental compensation and disaster relief system are established to manage macro wheat risk. Wheat risk management depends on most favorable combination of technical and financial tools. Since wheat insurance is considered as the best and effective wheat risk mitigation tool in the world. So government should concentrate to create awareness on the adoption of wheat insurance. Final, disaster management study includes disaster forecasting, preventing, mitigation, transfer, scatter and disaster relief.

By means of modern technology people predict about the occurrence of natural disasters and the information is the first necessary condition. To prevent disasters except required information, a sufficient condition is the social infrastructure. Without information, the disaster risk prevention will become difficult and will be a game in the existence of uncertainty. Weaken infrastructure could not fight to massive natural disaster and to deduct the bigger damage. Even west scholar thinks that the management of disaster risk has taken a vital part in disaster reduction, relief, shifting, scattering and a powerful tool of national economic system. But in China state should take disaster prevention construction system in the first place to allocate financial funds as public goods, because of enormous natural disasters do not driven by market forces alone can solve the external uncertainties, emergency plans are necessary but infrastructure construction must be endlessly.

Engineering and Non Engineering Measures

The wheat growers needs to adopt the non engineering measures such as changing wheat production inputs and adjusting seeding or harvesting dates to protect wheat production against drought and the engineering measures such as government policy support against drought, releasing early warning information, post disaster services, technical assistance, financial and physical supports have significantly improved wheat grower's ability to adapt to drought and further a higher level of social capital in a farm household significantly increases their adaptation capacity against drought.

Table 5. The Case Study of Shijiazhuang Region [Area=M hec and Amount= M RMB]

year	Disaster Affected Area	Drought	Wind hail	Frost	Disaster Damaged Area	Drought	Wind hail	Frost	Absolutely no harvest	Wind hail	Frost	Money Loss	The hardest hit county(city)
2010	0.104	-	-	0.104	0.020	-	-	0.020	0.007		0.007	212.772	Xinle, Yuanshi, xingtang
2011	0.188	0.185	0.003	-	0.0113	0.011	0.0003		6.66667E-05	6.66667E-05	-	1.664	Pingshan, xingtang,lingshou
2012	0.0025	0.0005	0.002	-	0.001	-	0.001	-	0.0003	0.0003	-	8.94	pingshan、xinle、gaoyi
2013	0.027	0.002	0.025	-	0.002	-	0.002	-	0	0	-	10.989	Jinzhou,zhaoxian,gaocheng
2014	0.038	-	0.038	-	0.007	-	0.007	-	0.0003	0.0003	-	5.315	Luquan shengze xingtang
Average	0.0719				0.00826				0.00153			239.68	

Source:- Shijiazhuang Agricultural Department[5]

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