INTRODUCTION OF WEATHER INDEX INSURANCE IN UKRAINE – OBSTACLES AND OPPORTUNITIES

ROMAN SHYNKARENKO
Consultant, Project Manager, www.agroinsurance.com, Ukraine
rshynkarenko@agroinsurance.com

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Roman Shynkarenko

Abstract

Agricultural insurance in Ukraine is mostly offered on the basis of traditional products including PMCI, named perils and single peril coverage. The index concept was introduced in 2001 though until 2005 the insurance companies provided index crop insurance through area-based yield index program. The first weather index transactions (lack of rainfall index) were executed in 2005 for winter wheat at the South of Ukraine. The pilot project on weather index insurance was conducted by the World Bank organizations (IFC Agribusiness Development project and Commodity Risk Management Group) in 2003-2006. The project team proposed assistance in design and promotion of weather index insurance products for agricultural applications. Unfortunately, due to various reasons the project was not expanded. Although Ukraine has reasonable weather monitoring infrastructure and good data, the weather index insurance is not favored by the insurance companies due to new approach to insurance practice. The insurers and producers need to be further informed and educated about the basics of weather index insurance.

Keywords

Crop insurance, weather index, risk management, risk mitigation, crop insurance, farm management.

1. General Information on Agricultural Sector in Ukraine

Agricultural production in Ukraine constitutes approximately 15% of GDP. The sector producers around 40 million tons of grain crops, 6 million of oil crops, over 20 million tons of sugar beet, 28 million tons of vegetables and over 1,5 million tons of fruit commodities. Farmers cultivate around 36 million hectares of agricultural land.

The main risks for agricultural production are weather, price and institutional (including legislative) risks. The farmers can manage production and credit risks though they lack risk management instruments to secure their income. Insurance companies provide traditional coverage against most weather perils but they are unable to offer revenue insurance due to underdeveloped commodity exchange sector (price discovery). Most crops are sold to traders and processors right after harvesting.

Banks are actively providing credits to agricultural sector but prefer to secure loans through additional collateral but not through insurance instruments. They mostly accept formal insurance policies to comply with the legislative requirements to insure collateral property.

It is expected that Ukraine will enter WTO in late 2007 so the government is going to restructure agricultural support measures to comply with this organization's requirements. Government expenditures on risk mitigation measures and agricultural insurance program are part of the green

box so Ukrainian government considers development of agricultural insurance program within the next years.

2. Agricultural Insurance Market

The agricultural insurance market in underdeveloped in Ukraine. About 3% of field crops are insured by 37 insurance companies. The farmers insure about 3% of the crop area. During 2005-2007 about 1200 producers purchased insurance coverage in each year. There are about 16 thousand commercial farms and over 42 thousand private farmers in Ukraine. A little over 2% of farmers insure their crops.

The premium sum in 2006 is estimated to equal 28,7 million UAH (5,4 million USD). In 2005 the premium sum was approximately two times lower (12,8 million UAH). The insurers offer named peril, MPCI, yield index and single peril products. The government subsidizes 50% of the premium on MPCI and yield index products.

The list of insurance companies offering crop insurance is volatile. About 30% of the insurers constantly participate in government-supported crop insurance program, while other companies migrate in and out of the program according to their situational decisions. It should be noted that out of 10 companies with highest premiums, there are 7 regional small companies selling crop insurance in selected regions. The experts consider that regional risk accumulation can affect these companies' capacity to pay out compensation when high-volume risk events happened. Besides the market players think that small and affiliated insurance companies just use the opportunity to utilize government subsidy funds due to pure design of the crop insurance program. This situation is observed for the last 2 years and the experts hope that such problems will be corrected in the future.

3. Agricultural Index Insurance Concept

The concept of index insurance was initially introduced in Ukraine in 2001. Crop insurance was not developed in the country and the insurers were looking for effective new ways to insure agricultural crops. While single peril and MPCI products existed, the agricultural insurance suffered from low quality of these products and lack of farmers' trust to the insurance sector in general.

During 2001-2003 consulting companies and development organizations conducted a series of events to acquaint insurers and producers with the benefits of index insurance. The first area-based yield index insurance program was presented by one consulting company and it was accepted by the agricultural pool of insurance companies. The product was built on the basis of crop yield statistical data for 8-14 years starting from 1991. Although the product is offered in most regions of the country, there are some problem issues connected with the crop yield data quality, statistics reports and contracts administration. There are cases when local authorities distort yield records. Official statistical reports are published within 6-9 months after crop harvest and the insurers often use regional statistical reports (non-official) to process contracts faster. The crop yield is calculated based crop volume divided on area harvested omitting the areas affected by risk events. There is no special statistics on crop yield based on area planted which would take into account crop areas damaged or killed by risk events.

Currently yield index insurance in Ukraine is available for major field crops (cereals, oil and technical crops). It's share in crop insurance portfolio amounts to 25%. Yield index products are offered by 15 insurance companies out of total 37 working in the crop insurance segment.

Traditional agricultural insurance products are expensive to administrate in Ukraine because of big distances between the cities and villages. Most insurers do not have the developed regional network of branch offices. The impact of problems related to asymmetric information (anti-selection and moral hazard) is considerable. The insurance companies are looking for instruments to address these problems. Index insurance solutions look very promising in this respect.

It should be pointed out that weather index insurance concept is not accepted by insurers and producers in spite of promotional and educational efforts invested by the international and local experts during 2001-2006. Ukrainian insurance market continues to experiment with traditional insurance products and it mostly relies on government crop insurance subsidies. The area-based yield index products are a combination of traditional and yield index concepts. The yield index products are very different from those used in other countries.

4. Regulatory Aspects

Initially the concept of weather index insurance was unknown to Ukrainian insurance regulator (The State Committee for Regulation of Non-banking Finance Institutions (further – regulator)). During 2001-2005 the project team provided lots of information on agricultural insurance to the staff of the regulator. Two specialized training session were conducted and one of them was specifically on weather index insurance.

According to Ukrainian legislation, the insurer has to develop and to submit the rules of insurance for any new type of the product. The regulator approves these rules of insurance if the documents found corresponding to the active legislation. The insurance products cannot be sold prior to such approval.

Currently the registration procedure for weather index package takes four weeks so the insurance companies planning to introduce weather index products should plan their activities accordingly.

The insurance companies have no problems with the registration and approval of the weather index insurance package. The regulator is sufficiently informed about specifics of index products but for the time being the products can be used exclusively for agricultural applications. According to the guidelines the farmer (the insured) should prove the acreage of the crops to be covered by insurance contract. This limits the potential use of weather indexes by agribusiness and finance institutions. The current regulator position is that weather index can be purchased only by farmers.

5. Monitoring Infrastructure in Ukraine and Weather Data

Ukraine has good weather recording system, which corresponds with requirements of World Meteorological Organization (WMO). There are 187 weather stations in the country. Eight official weather stations are located in the pilot region of Kherson oblast. The data is collected manually eight times per day. The stations have strict procedures for data collection and the probability of human error is small. Some weather stations operate since the end of 19 century. Automatic weather registers are not common; only five official weather stations in Ukraine are equipped with modern equipment.

Weather data for years before 1995 is present in hard copy only. Over 40 weather stations supply data to WMO on daily basis. The weather database includes all the necessary weather parameters needed to design index structures – temperature (daily average, max and min), precipitation (mm), relative air humidity, wind speed and direction. The weather data is considered to be expensive which is prohibitive for insurance companies to design new products. The Hydrometeorological

Center of Ukraine (Ukrmet) does not have pricing policy for weather data. The authorities negotiate prices with each interested client. Currently 30 years of weather database for one station cost from 3000 to 5000 USD. Official weather reports cost around 15 USD for monthly report and daily weather information costs around 1 USD for a daily report.

6. Crop Yield Data

Ukraine has reasonable crops yield statistics which is easy to obtain at the State Statistics Committee. The data is also available at regional departments of agriculture. The data is present in electronic format and it is ready for use. Cost of crop yield statistical data is reasonable. The yield database used for designing of weather index products in 2005 included 30 years of rayon average yields for such crops as winter wheat, spring barley and sunflower. The experts proposed initially to target the widest segment of producers to get good participation.

The yield database had some quality problems. The farmers and representatives of local administrative bodies accepted that crop yields were sometimes under- and over-reporting. Before 1990-1992, the farms over-reported yields at approximately 20%. After 1992 most farms reported lower yields (15-20%) fearing that they would need to pay high taxes. Such practice was used especially in bad years with a hope that the government would reimburse losses through ad hoc payments and subsidies. The experts took into account these data quality factors to adjust the yield database.

Yield records are available for other crops, so the insurers can obtain them from the oblast authorities in case they decide to design weather index structures for other applications. The average rayon yield is recorded based on farms reports, which have to be submitted to the department of agriculture and to the state statistics department. The official annual yield report is published by the central office of the State Statistics Committee at the beginning of the next year, usually by the end of March.

7. Weather Index Insurance Pilot Project

The weather index insurance pilot project was implemented in Ukraine during 2003-2005 by the World Bank organizations - IFC Agribusiness Development project and Commodity Risk Management Group. The partners proposed insurance companies assistance in design and promotion of weather index insurance products for agricultural applications. The team identified considerable need in insurance products to mitigate weather risks. Initially the experts expected that the regional pilot projects could be done in several regions to diversify risk portfolio and to test various index structures.

The pilot project team consulted 6 insurance companies that expressed interest in testing weather index products. Due to various issues the team ended up with one company that sold first weather index contracts in 2005.

The pilot project was conducted at the South of Ukraine in Kherson oblast. This oblast is a risky region for agricultural production. The farmers often suffer from low temperatures during winter, drought in spring and summer, spring late frosts and other weather perils. Drought insurance for field crops is mostly offered through MPCI product. Insurance of vegetables and fruits is mostly not offered in Ukraine due to lack of specific insurance knowledge at the insurance companies.

Initially the project team designed several trial weather index structures for producers. This included ***winter killing temperatures (for winter crops), lack of rainfall, Selyaninov hydrothermal ratio (SHR) and temperature stress structures (for all crops during April-June)***.

Later it was decided to omit winter risks as winterkill insurance program provided better coverage to farmers.

The project understood that four technical steps were essential for developing a successful index-based weather insurance pilot program:

- Identification of the weather exposure of crops and farmers in the region;
- Quantification of the financial impact of adverse weather conditions on farmers revenues and/or input/production costs;
- Development of the insurance contract structure that pays out when adverse weather conditions occur;
- Execution of the contracts in optimal form to reinsure the risk in the international markets.

7.1. Short Information on Pilot Region

Kherson oblast has 1,970 million hectares of arable land (426,000 ha under irrigation). There are 412 commercial and 2900 private farms. The annual major crop production is 1,5 million tons of cereal crops, 90,000 tons of corn and 280,000 tons of sunflower. The farmers also produce 245,000 tons of potato; 495,000 tons of vegetables; 221,000 tons of melons and gourds and 32,000 tons of grape. The total annual value of production is approximately 400 million USD ($220 mln – field crops and $180 mln – of vegetables and grapes). It was considered that ***rain-fed field crops and high-value crops could be insured*** through weather index products. Initially the potential insured crop-value could be approximately ***50 million USD*** but with much higher growth in the future.

7.2. Research and consultations

The project team conducted consultations with farmers, local authorities and scientists. Approximately 400 producers were questioned during training and informational events. The consultants conducted interviews with the potential buyers (50 farmers) of weather index products within the range of two weather stations (Kherson and Behtery). The findings of the research were used for design of final structures at the beginning of 2005.

It was decided to concentrate efforts on the index structures for most important crop in the region - winter wheat. Winter wheat has the biggest area and considerable value at risk (1.5-2 million ton produced in the oblast annually with an approximate crop value of 250 million USD). Most of winter wheat in is cultivated without irrigation.

The project requested an analytical report from Ukrainian Hydrometeorological service to better understand the vegetation cycle of winter wheat, major risk during each phase and critical weather parameters. The service provided vegetation and risk-sensitivity report for grain crops (wheat, rye and barley) for which the existing computer simulation models were applied. The agro-meteorologists suggested that insurance coverage period had to target the leaf-tube formation – earing phase (April 15 – May 25) for winter wheat, which was responsible for formation of stems per plant. The optimal weather parameters for this period are 15-17°C of daily average temperature and 47 mm of rainfall. Daily Max temperature higher than +30°C and less than 30 mm of rainfall are critical trigger levels.

Consultations with farmers showed that producers were mostly concerned about later protection period from May 1 till mid- June when winter wheat was in earing – milk ripeness phases. The farmers indicated that they were mostly interested of the quality of kernels in the ear. The number

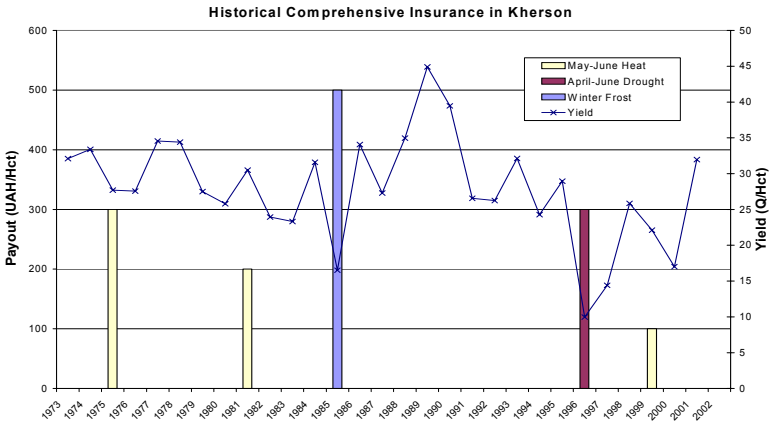
of stems was not important if the kernels did not develop. At the same time, the farmers agreed that high temperature and lack of rainfall were the main risks.

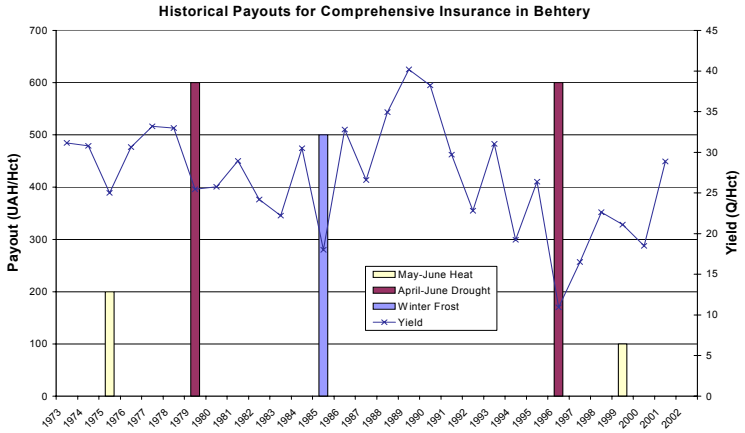
Finally, the experts decided to design weather index structures for Kherson region for the period from **April 15 until June 15**. The structures had to **capture low rainfall (less than 70% from normal 80 mm) and impact of high temperatures (over +30°C or excessive accumulated temperatures)**. **SHR index structure could be offered as an alternative product** to capture joint impact of high temperatures and low rainfall to crops.

The interviewed farmers confirmed that they could be ***interested in weather index structures providing protection from severe drought***. The major concern was basis risk. The stations were located at a distance from the farms and ***basis risk could be a problem with rainfall structures***. At the same time, farmers advised that several locations had specific microclimate and index obviously would not reflect the weather pattern at those places.

High temperature structure was the least interesting option to the farmers who accepted that moisture stress would affect more damage to the crop than temperature stress. The farmers understood the logics of SHR structure but they needed more information on the methodology and loss adjustment procedures. They were anxious to know if their calculation of SHR index could be different from Ukrmet data and how the index should be calculated. The experts accepted that the farmers had to be trained and better informed to display more interest in these weather indexes in the future.

The graphs below represent historical payouts at two weather stations in Kherson oblast for the period from 1973 until 2002 (as designed in March 2004). During the last three years oblast suffered from winterkill and spring drought in 2003, excessive rainfall in 2004 and drought in 2005.





7.3. Identification of the Weather Exposure

The pilot region of Kherson oblast is located in the southern part of Ukraine. The climate of this region belongs to the Atlantic continental climate Winter wheat is one of the main grain crops in the region and the main grain crop in the country. The vegetation cycle of winter wheat consists of the following phenological stages: germination, sprouting, bushing, leaf-tube formation, earing, flowering and ripening (milk, wax and full ripeness). Each phonological stage has its own weather requirements for optimum growth and maturity.

Winter wheat yield data for Kherson oblast display that there is significant variability in yield in the region, which reflects the agro-climatic risk inherent to the oblast. The project team interviewed farmers in the region who suggested that the greatest perceived risk for wheat production was drought followed by frost, storm/hail and fire. Most farmers considered that pest attacks are a manageable risk that can be controlled using modern technologies and pesticides. The team established that winter wheat yield varies in the region from as low as 17 q/ha to 43 q/ha. Most cases of extremely low yields were explained by extreme weather condition including drought and winterkill. The experts understood that there was potential for index-based weather insurance products in the region.

7.4. Weather Index Design

Development of index weather insurance structure is based on the correlation of a measurable weather index to crop yield. The experts should look at how the weather variables influenced or not yield. It is important to discuss the weather factors and their impact on crops with the producers and agricultural meteorological specialists. There should be a strong correlation between the weather index and crop yield. In case the index designer would establish a sufficient level of correlation of these parameters, the producers can insure production risk by purchasing a contract that pays if the specified weather event occurred (or did not occur).

As it was established that yield data in Ukraine is not reliable (due to over- and underreporting) it was important to get sufficient scientific information on the impact of the weather factors on yield formation and to establish the correlation of these factors. The experts used the report provided by Ukrmet to identify the degree of weather impact to crop. This report and farmers assessments were used as the basis for developing weather index structures for insurance of winter wheat in the pilot region.

7.5. Identification of weather risks

The main critical factor for high winter wheat yields in the Kherson region is moisture. Winter wheat can dramatically reduce yield if air and/ or soil moisture is low. The probability of a severe and medium drought in the region during the vegetative period of this crop is 15-20% for air drought and 40-50% for soil drought. The critical periods when yield formation is depending on moisture are leaf-tube formation, earing, milk ripeness and kernel formation phases. These vegetation stages usually last from April 15 till June 15. Lack of moisture during these stages decrease the number of stems and kernels and directly affects the quality of grain. During last 7 years drought was registered in 2000, 2002, 2003, 2007, when the amount of rainfall during April – June was less than 50% of the required amount. During 1970-1999 severe droughts were registered 2-3 times per ten years. Traditional insurance products do not provide measurable protection to producers as the loss adjustment procedures are subjective and depend on the qualification of experts and position of each insurance company. Otherwise, the weather index

calculated for Kherson region offered exact payout amounts per measurable lack of moisture required for good crop.

Index structures designed for Kherson region captured drought risk from mid-April to June and addressed the disparity between the traditional insurance coverage offered and identified production risks faced by the farmers.

7.6. Selyaninov Hydrothermal Ratio (SHR)

SHR is used by agricultural specialists and meteorologists to measure the severity of drought. There are two types of agricultural drought: air and soil drought. Air drought describes conditions where precipitation is low and high air temperature persists against the background of low relative air humidity (less than 30 percent). Air drought negatively affects plant vegetation and considerably reduces crop yield. Soil drought describes the excessive dryness of soil. Soil drought is characterized by the lack of soil moisture available for crop growth and development.

The project team considered to offer SHR index as one of the options to producers who are interested to measure drought conditions in money terms, i.e. payout on drought coverage depending on objective weather parameters. SHR can be used as an index to monitor the impact of air drought on winter wheat crop yields.

Main features of air drought are long rainless period, high air temperature and low air humidity which can be measured using the Selyaninov Hydrothermal Ratio (SHR). SHR for critical vegetation periods (April 15-June 15) of winter wheat in Kherson regions can be defined as:

$$SHR = \Sigma_{15\ April\text{-}June}\ Daily\ Rainfall\ /\ 0.1 * \Sigma_{15\ April\text{-}June}\ Average\ Daily\ Temperature$$

SHR is calculated for periods when daily average temperature is above +10 deg C. The SHR does not always serve as a reliable criterion of agricultural drought because it does not take soil moisture into account, it is the only objective indicator that can be used to capture drought risk during the vegetative period.

Conditions for the best harvest of winter wheat are when SHR = 1.0-1.4. When the SHR is greater than or equal to 1.6 plant yields will be depressed by excessive moisture. When the SHR is less than or equal to 0.6, plants are depressed by drought conditions. In general SHR = 0.5 coincides with regions of semi-desert climate conditions. Results from the UHC's crop model[1] suggest that the impact of SHR during the vegetative growth stage April 15th – June 30th on yields can be defined as follows:

SHR	Description	Yield Loss
1.6	Excessive Humidity	30 percent+
1.3-1.6	Damp	-
1.2-1.0	Sufficient Humidity	-
0.9-0.7	Dry	-
< 0.7	Drought Conditions	-

[1] Data from *"Agroclimatic Conditions and Assessment of Weather Risks for Growing Winter Wheat in Kherson Oblast"*, T. Adamenko, July 2004, Ukrianinan Hydrometeorological Centre, Kiev

0.5-0.6	Medium Drought	20 percent
0.4-0.5	Severe Drought	20-50 percent
< 0.4	Extreme Drought	50 percent +

Example of weather index structure based on SHR index (designed by Jo Syroka, WB)

Buyer:	Farmer Z 1 Wheat Street, Bethery, Kherson, UA
Seller:	ABC Insurance Company
Hectares of Winter Wheat Insured:	100 Hectares
Calculation Period:	15th April 2005 – 30th June 2005 (inclusive)
Location:	Behtery WMO 12345
Index, SHR:	**SHR = Index 1 / (Index 2 * Scaling Factor)** Where: **Index 1** = Cumulative Capped Daily Rainfall measured during the Calculation Period at Location. Measuring Unit: mm **Index 2** = Cumulative Daily Average Temperature measured during the Calculation Period at Location. Measuring Unit: Degrees Celsius **Scaling Factor** = 0.1
Capped Daily Rainfall	Capped Daily Rainfall = min(50, Daily Rainfall Total) Measuring Unit: mm
Strike, K:	0.4
Maximum Payout, M:	1000 UAH per Hectare Insured
Settlement Calculation:	If the **Index SHR** is greater than the **Strike K** no payment is made. If the **Index SHR** is less than or equal to the **Strike K** the **Buyer** receives a payout **X** per hectare insured from the **Seller** according to the following **Settlement Calculation**: **If 0.36 < max(K – SHR, 0) < 0.41, X = 500 UAH** **If 0.31 < max(K – SHR, 0) < 0.36, X = 600 UAH** **If 0.26 < max(K – SHR, 0) < 0.31, X = 700 UAH** **If 0.21 < max(K – SHR, 0) < 0.26, X = 800 UAH** **If 0.16 < max(K – SHR, 0) < 0.21, X = 900 UAH** **If max(K – SHR, 0) < 0.16, X = 1000 UAH**
Maximum Settlement:	The maximum payment that can be made from the **Seller** to the **Buye**r is 100,000 UAH.
Premium:	The **Buyer** will pay the **Seller** a premium of 12,000 UAH for the weather protection outlined above.
Settlement Data:	Ukrainian Hydrometeorological Centre, Kiev
Settlement Date:	Within 45 days of the end of the **Calculation Period**.

7.7. Quantification of Weather Impact

After capturing the impact of weather, it is important to calculate the financial impact of weather events on the producers.

Initially the designer should establish the maximum protection sum required for coverage period. For winter risks the team considered to accept the sum of production costs per autumn-winter period for winter wheat. Though for later vegetation phases the experts proposed to offer several

price options for the producers to choose the suitable variant. For the pilot project the insurance sum was established at the level of production costs (if the producer willing to save money on insurance) and at the revenue level per crop hectare. The farmers in Ukraine can be divided into three groups of producers with minimum, medium and higher technological levels. During interviews it was established that farmers were interested in insurance sum per hectare at the level of 100, 200 and 300 USD. The advanced farmers spend around 1000 UAH (200 USD) of production costs per hectare. The designers proposed that the insurers could establish higher insurance sum level if the clients desired but not higher than selling price of average yield per hectare, i.e. 4 tons of wheat grain at 200 USD per ton or 800 USD/ha.

Further it is important to establish the tick size or the producers' exposure per unit of the index. The sum per unit of index should be calculated on the basis of professional assessment of crop losses that can be done with the help of computer modes or multi-year observations. Besides it is necessary to fix the limit when the farmer will get full payout. The limit should correspond to the weather parameters when the crop would be totally lost or harvesting will be loss-making. Calculating the limit and tick size for a contract to protect a farmer's revenue is a little more difficult as harvest-time commodity prices are not known in advance when the insurance is purchased. Commodity prices also often vary in response to extreme production shocks and it is often difficult to quantify the production (weather)-price correlation, particularly in emerging commodity markets where prices are not always stable. However estimates for the harvest-time price can be made e.g. last year's harvest-price or the five-year average September price from the local commodities exchange could be used as a best estimate. The project team assumed that most farmers could be buying weather insurance contracts to cover their production and input costs.

7.8. The Structure of Weather Insurance Contract

The insurance sum per contract can not exceed the maximum estimated loss to the farmer. This can be identified as the number of hectares planted multiplied to price of a crop weighting unit (ton). In Ukraine all farmers should submit reports to the state offices with the indication of the crop yield in the previous years and area planted in production year. The insured area can not exceed the reported planted area which is easy to establish through statistical forms. The farmer should be liable for correctness of the reported area of the crop. The price of commodity should be calculated on the basis of average selling price (five year period) or minimum purchase price on the state programs (state reserve, etc.)

7.9. Contract Key Entries

In addition to defining the index, the buyer/seller information (names, crop and area insured), limit and tick-size, an index-based weather insurance contract must also include the following information:

- Location – the weather station at which the weather variables used to construct the index are measured and recorded;
- Calculation period – the risk protection period of the contract;
- Strike – the index level at which weather protection is triggered;
- Premium – the cost of the insurance per hectare insured;

Index-based insurance contracts must be written on the nearest UHC weather station to the farmer's land in order to provide the best possible coverage for the farmer client. Because of the basis risk the project team advised to offer insurance contract only to farmers located within 30 km from the reference weather station. Temperature exhibits less spatial variability than rainfall so on temperature stress structures the radius of farms participating could be increased to 70 or

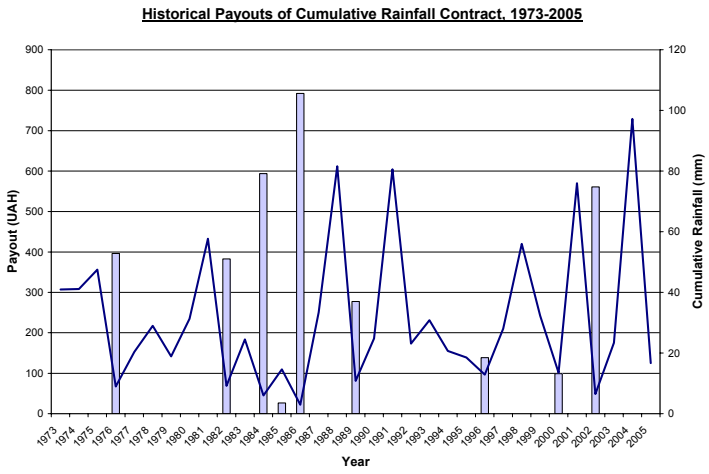
even 100 km. Final settlement of the weather insurance contracts typically occur up to 45 days after the end of the calculation period, once the collected weather data has been cross checked and quality controlled by the UHC.

8. Weather Index Products Offered in Ukraine

The team proposed the participating insurance company to market 3 weather index structures which were jointly produced by the project team and insurance company specialists. The clients were offered (a) the cumulative rainfall index; (b) the temperature stress index (tmax higher 30 degrees Celsius) and (c) Selyaninov hydrothermal index which accounted the joint impact of high temperatures and lack of rainfall. All three structures were developed for the period from April 15 until June 15, 2005. The team proposed three insurance sum options amounting to 500 UAH, 1000 UAH and 1500 UAH reflecting the different inputs costs and technologies used by major producers groups (small farms, average farms and commercial farms).

The products were designed by the team of experts. Most of calculations and structuring was done by CRMG consultant Jo Syroka. The Team designed three weather index structures for two stations in Kherson oblast – Kherson and Behtery. The insurer decided to concentrate at these stations as they were close to Kherson city and it was easier from administrative point of view. Farmers from six rayons could purchase weather index insurance to protect grain crops including winter wheat and rye, spring wheat, barley and rye from drought. The farmers could choose 500 UAH, 1000 UAH and 1500 UAH[2] coverage option depending on their cost of production per hectare. Premium is proportionately increased with the coverage option.

Moisture stress structure ("lack of rainfall") – is based on the quantity of rainfall (mm) recorded during protection period.



Station Location	Coverage (UAH)	Premium (UAH)	Strike Level (mm)	Index Step (mm)	Payout per Step (UAH)	Max Payout @ (mm)	Average Annual Value (mm)
Kherson	500	29	70	10	100	30	113
Behtery	500	48	50	5	100	30	87
Note: when index value equals strike level, the farmer gets 100 UAH.							

[2] Approximately USD 100, 200 and 300 per hectare at National Bank of Ukraine currency exchange rate.

Temperature stress – is based on the number of days with the max daily temperature higher than +30°C recorded during protection period. Every next day is valued in units in the following way – 2nd day – 1 unit, 3rd day – 2 units, 4th day – 3 units, etc.

Station Location	Coverage (UAH)	Premium (UAH)	Strike Level (units)	Index Step (units)	Payout per Step (UAH)	Max payout @ (units)
Kherson	500	48	50	10	50	100
Behtery	500	34	50	10	50	100
Note: when index value equals 50 units, the farmer gets 250 UAH.						

Drought index structure – is based on SHR value calculated during protection period. SHR equals the sum of daily rainfall divided by the sum of average daily temperature (above +10°C) and multiplied at 0,1. See more on SHR in Executive Summary "Crop Disaster Assistance in Ukraine…"

Station Location	Coverage (UAH)	Premium (UAH)	Strike Level (SHR index)	Index Step	Payout per Step (UAH)	Max Payout @ SHR index	Average Annual Value (mm)
Kherson	500	22	0,50	0,05	50	0,15	0,87
Behtery	500	52	0,45	0,05	50	0,15	0,73
Note: when index value equals strike level, the farmer gets 150 UAH in Kherson and 200 UAH in Behtery.							

The structure of the contracts sold in April 2005

After communication with the potential clients the insurance company issued policies based on lack of rainfall index (moisture stress structure). The contract insured winter wheat against drought (insufficient rainfall). The major contract features were the following:

Crop	winter wheat
Yield output	2 tons per ha at 250 UAH/ton
Location	Gola Pristan rayon, Kherson oblast
Reference weather station	Behtery, official state weather station (46`15`` N 32`18`` E)
Index	insufficient rainfall (lack of precipitation)
Protection period	April 15 until June 30, 2005.
Trigger	50 mm
Index limit	30 mm
Exposure	100 UAH (20 USD) per 5 mm per ha
Max payout	500 UAH/ha
Premium	40 UAH/ha
Insured area	5 ha (per contract)
Total max payout	2500 UAH (per contract)

9. Marketing Campaign

The participating insurance company registered the rules of index insurance only by the end of March which limited the reasonable time for good marketing campaign. As the result the insurer managed to sell only two "cumulative rainfall index" contracts for Behtery weather station. It should be fair to note that the company managed to sell only 6 MPCI contracts in 2005 spring season.

The insurance company established an office in Kherson in the second half of 2004 and the regional staff was unable to sell crop insurance. The office did not have contacts with farmers. Evidently, the branch managers favored other types of insurance that were easier to sell. The regional staff did not have agricultural insurance experience and the branch started active operations only in the beginning of 2005. At that time, the company had no access to potential clients and they had no good contacts with farming community.

Кредо-Класик

Закрите акціонерне товариство
страхову компанію „Кредо-Класик"

Заява на страхування врожаю на основі погодного індексу

Назва Страхувальника
Адреса Страхувальника
Дата подання заяви
Назва продукту (необхідне зазначити)
Посуха (гідро-термічний коефіцієнт)
Температурний стрес
Рівень опадів
Погодна станція
Максимальне відшкодування, грн./1 га 500 1000 1500 (необхідне зазначити)
Майновий інтерес Страхувальника, пов'язаний із впливом погодного індексу (необхідне зазначити)
володіння, розпорядження посівами сільськогосподарських культур
кредитування, інвестування сільськогосподарського виробництва
Гранична сума майнового інтересу Страхувальника
площа посіву сільськогосподарських культур, га 26.5
загальна сума кредиту, інвестицій, грн.
Документальне підтвердження майнового інтересу Страхувальника
№, дата форми с/х 4
№, дата контракту на видачу кредиту (позики)
Місце розміщення посівів: область Херсонська, район Голопристанський
Обсяг майнового інтересу, що підлягає страхуванню
площа посіву с/г культури (вказати назву культури) озима пшениця, га 5
Загальна страхова сума 2500,00 (дві тисячі п'ятсот грн.
Період страхування з 15 квітня до 30 червня
Чи діють на даний час інші договори страхування, пов'язані із посівами Страхувальника ? (так/ні)
Чи страхували ви раніше посіви, врожай с/г культур ? (так/ні)
Я заявляю, що подана в даній заяві інформація (незалежно від того, заповнено анкету мною особисто або уповноваженою мною особою) є достовірною . Я згідний з тим, що у випадку надання невірної, неповної або недостовірної інформації ХАТ СК "Кредо-Класик" має право відновити у виплаті страхового відшкодування
Харків
"14" квітня 2005 р.
(підпис)
Венгенко О.О.
(ПІБ)

The weather index insurance informational campaign went only for thirty or forty days. Representatives of insurance company participated in several training events organized in February and March 2005. The company placed information about weather index pilot in regional and national mass media and tried to promote weather insurance through oblast agricultural administration. The beginning of 2005 was difficult time in Ukraine when most of official institutions underwent serious reorganization after Orange Revolution so the regional authorities provided no assistance.

10. Weather Index Contracts Performance

There were only two contracts sold based on lack of rainfall weather index. The total amount of rainfall during the protection period (April 15 – June 30) was 81,8 mm[3]. This is close to the 30 years' average which constitutes 87 mm. The farmers got no payouts but they were dissatisfied with the weather index contract. They informed that he had no rain for 65 days at his fields. The weather station at Behtery recorded very low rainfall at its location in April, May and first half of June. Most of the rainfall occurred within the period of June 15-30 (51,9 mm) when the farmers did not need rain. Moreover, the last day of June delivered 27 mm of rainfall and this strongly affected the index value.

Table 1: Distribution of the rainfall at Behtery weather station during drought protection period in 2005

April 1 – 15	April 16 – 30	May 1 – 31	June 1 – 15	June 16 - 30	Total
0	0.8	16.7	12.4	51.9	
0.8		16.7	64.3		81.8

The farmers claimed that the end of June was the period when they were getting ready to harvest cereal crops and it is better for them to harvest dry grain to save costs on drying. The year 2005 was very unusual from the rainfall pattern point of view. The weather station recorded 51,9 mm of rainfall during June 15 – 30 in 2005. The similar situation occurred in 1977 when the station recorded 58,2 mm during the same period. The 30 years average rainfall during this period is 13,57 mm.

According to Ukrmet information the average amount of rainfall at Behtery weather station is:

[3] See Annex 1 – Official Ukrmet report on rainfall level at Behtery weather station during April 1 – June 30

- **April 15 – May 22 – 47 mm** (within the average range of 36 – 50 mm). This amount corresponds to 80% of the cereal crops' need in moisture during this period (leaf-tube to earing phases);
- **May 23 – June 13 – 33 mm** (30 – 35 mm average range). This amount corresponds to 90% of the plants' need in moisture during this period (flowering – ripening phases);
- **June 14 – June 26 – 23 mm** (17 – 29 mm average range). This is a phase of full ripeness and the farmers can start harvesting crop right after it.

Comparing the data of 2005 protection period with the 30 years average we can see that most of the protection period in 2005 was very dry at Behtery weather station. **The amount of rainfall during April 15 – June 15 was only 29,9 mm**. The similar situation at this station (April 10 – June 20) occurred only two times during 1973 – 2002 (years 2003-2004 have not been analyzed) in 1979 (28,1 mm) and in 1996 (33,1 mm).

The analysis of weather data shows that during 1973 – 2002 catastrophic droughts occurred in Behtery area only two times during April 10 – June 30 simulated protection period when the cumulative rainfall was lower than 35 mm (approximately 35% from 103 mm of multi-year average). Severe droughts were recorded seven times during April 10 – June 20 simulated protection period when the rainfall was lower than 50 mm (approximately 60% from 80 mm of multi-year average).

During the discussion in November 2005, the farmers proposed that the current index was not good for them. They claimed that the protection period was too long. Besides they proposed that in the future the index should be structured is a clever way to provide payouts in such situation as happened in 2005.

11. Major Obstacles for Weather Index Insurance Development in Ukraine

The main obstacles for weather index insurance in Ukraine are infrastructural ones. There is lack of weather stations. Although there are from 5 to 11 official weather stations per administrative region (oblast), the distance between stations is over 100 km. This represents a basis risk as for most producers the main risk is drought (rainfall level). The insurance companies might insure clients with the help of automatic registers though this cost should be borne either by the insurer of by the client.

The cost of weather data in Ukraine is prohibitive. No insurer is ready to invest 3000 USD and more for weather data when there is no indication of how big this market might be. According to the foreign colleagues the weather data costs from 600 EURO in EU for the database in electronic format ready for analysis.

The concept of weather index insurance is still new to Ukraine. The insurance companies prefer to experiment with traditional named and multi-peril insurance expecting government subsidies declared. Most insurers do not have quality analysis of the agricultural insurance program and the administrative costs are not in the scope of vision of the managers. It is expected that when the companies will assess the cost of traditional insurance programs administration, they will start looking for alternative programs. Besides, the weather index insurance products can be retail products so it is expected that in the future the insurers might turn they interest to index structures.

Ukraine lacks agricultural insurance actuaries. The premium rates are mostly directed by the reinsurers or identified by comparison of premium rates as offered by other insurers.

All in all, the level of agricultural insurance system development in Ukraine is currently low. The farmers are not used to insure their crops. The finance institutions prefer to over-collateral credit products but not to use insurance. The reputation of insurance sector is low however it is gradually improving.

12. Opportunities for Weather Index Insurance in Ukraine

Ukraine has good quality weather and crop yield data that is sufficient for design of weather structures. The country has sufficient scientific and practical expertise to design and support index structures.

The national legislation allows the use of weather instruments for agricultural applications. The insurance companies can comparatively easy register the rules of weather index insurance. It should be understood that the weather index concept is new to insurers and staff should be additionally trained to be able to sell contracts.

The current MPCI and yield index products do not meet the needs of producers. The products suffer from classical problems of traditional insurance including asymmetry of information (anti-selection, moral hazard, and the are costly to administrate.

The public support program in Ukraine is in the pilot phase and is ready to include weather indexes (the legislation foresees the introduction of weather indexes within the support program).

The agricultural sector is rapidly developing in Ukraine. The farmers start to produce more of high-value crops including vegetables, oil crops, fruits and grapes. Although these commodities promise good revenues to producers, they are susceptible to negative impact of adverse weather conditions. The most important risks to farmers growing high-value crops are low temperatures in winter, late spring frosts, drought, temperature stress and lack of heat during vegetation season. It is recognized that currently weather index products can offer quality insurance for grape producers (quality of berries) as there is no other insurance products available in Ukraine.

13. The Current Situation in Ukraine

While the pilot project in 2005 did not get considerable results, several Ukrainian insurance companies are looking forward to introducing weather index products for insurance of high value crops. After hard winter in 2005-2006 and regular spring frosts the commercial farms are eager to insure some of their crops in 2007-2008. The insurers are planning to introduce the following products in the future:

- winter onion, orchards and vineyards – low temperatures in winter;
- vegetables, peaches and apricots – late frosts in April-May;
- non-irrigated field crops - lack of rainfall in May-June.

The abovementioned products can be offered with the optional cover against hail and storm for spring-summer periods. Additionally, the government and the insurers are discussing to opportunity to use weather instruments to substitute the currently practiced catastrophic ad-hoc payouts' system.

The weather index product should **cover preferably short periods** of crops vegetation. The problem of 2005 "lack of rainfall" structure might be overcome through calculation and **weighting of different periods corresponding to specific vegetation phases and plants water requirements**.

The weather index product can be **marketed through farmers' cooperatives and informal farming groups**. Such groups might purchase joint coverage for the community and allocate indemnity proportionally to the damage from insured risks. The farmers from Odessa and Cherkassy oblasts were interested to protect their high-value crops from **late spring frosts** in May. The similar proposal came from Mr.Rybalko, who purchased a pilot contract in 2005 in Kherson oblast. Such activities can be done jointly with other TA projects in Ukraine, like Agricultural Marketing Project (USAID), Farmers' Risk Management Project (EU), etc.

The **weather index product can be sold together with hail coverage**. Bundling of these products is capable to provide protection from major weather risks that the farmers are willing to insure.

Several **input suppliers and agribusiness companies might be interested to participate in the weather pilot**. Such agribusiness companies as Syngenta, Agrimatko, AMACO, breweries can become partners. Syngenta even informed that they could partially subsidize premiums in case good insurance solutions could be developed and presented (eg. excessive rainfall during summer time requiring additional chemical treatment against pests, weeds and deceases).

The weather index pilot project should be **promoted at several countries in CIS region** (Russia, Moldova, Ukraine, Kazakhstan, etc). This will allow to better allocate resources and to establish informational network within participants from different countries.

The weather index concept should be presented to **the national governments to consider weather index as a measurement of agricultural loss in case of weather unfavorable events or catastrophes**. By now, catastrophic payments in CIS countries have been done in ad hoc manner and are based mostly on subjective reasons.

Need for automatic weather stations

The weather registering system of Ukraine needs more weather stations installed closer to the farmers. The insurers should find the way how to minimize basis risk, and find practical solutions. Data from the automated stations could be used for higher density recording of the weather data. Some of the farming groups already think about financing weather stations which could be put on their farms.

Linkages with credit providers and agribusiness

The banks and other financial providers don't use crop insurance as means to guarantee repayment of their credits. They and the input suppliers can be interested in working with the weather indexes if the suitable models could be designed. These input suppliers need to get more information and training to understand better how weather indexes could help them to market such products as seeds, pesticides, even machinery. These would provide a natural linkage for a private insurer interested in expanding its product range.

Suggestion of CAT weather index products to reorganize current ad hoc assistance

A concept is that Ukrainian government could better allocate ad hoc support to farmers if such payments are reorganized from subjective allocation to using weather indexes as the measurement of actual disaster and damage volumes. The ministry of finance and the regulator would be interested in such program. The insurers were also interested in this suggestion as it could facilitate the access to weather data and a special facility to reinsure catastrophic risks could be established.

Annex 1. Product Designer Spreadsheet, structure for protecting field crops against temperature stress (higher than +30° C) – prepared by Jo Syroka for 2006 season

Critical Temperature Day or Event Product Designer Sheet:

Pick a Variable	Tmax	(Tave, Tmin, Tmax)				
Cold- or Warm-Side Protection	W	(C or W)				
Pick a Risk Period (max 130 days)	Starting:	25 April	inc	Ending:	20 June	inc
Select a Critical Day Temperature Trigger	30	deg C				
Select # of Consecutive Critical Days before Critical Event Occurs	4	Days, i.e. if entry is 3 on the 4th consecutive day a Critical Event occurs				
Select Trigger - # of Critical Days/Events where protection begins	2	Days/Events				
Select Limit - # of Critical Days/Events after Trigger where protection ends	5	Critical Days/Events in excess of Trigger (Must always be filled for either Type 1 or 2)				
Select Limit - Maximum Payout	1 000 грн.	(Must always be filled for either Type 1 or Type 2, i.e. it must be equal to C11*C14 or must equal to or less than the maximum payout in the Schedule below)				
Payout Type: 1 Tick; 2 Payout Schedule	2	Type 1 or 2				

1. Simple & Quick Linear Tick Payout Structure

Select Tick per Critical Day/Event	200 грн.	per Day/Event

2. Manual Entry Payout Schedule

Select Payout Schedule: To add more payout steps just inset rows, to remove delete entries in column C

	#	Payout
1 Critical Day/Event in excess of Trigger	1	200 грн.
2 Critical Day/Events in excess of Trigger	2	400 грн.
3 Critical Day/Events in excess of Trigger	3	600 грн.
4 Critical Day/Events in excess of Trigger	4	800 грн.
5 Critical Day/Events in excess of Trigger	5	1 000 грн.
6 Critical Day/Events in excess of Trigger		
7 Critical Day/Events in excess of Trigger		
8 Critical Day/Events in excess of Trigger		
9 Critical Day/Events in excess of Trigger		
10 Critical Day/Events in excess of Trigger		

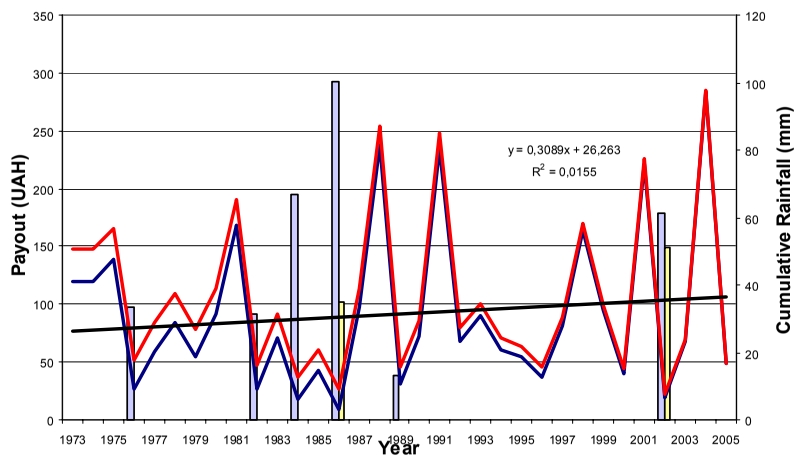
Raw Premium Estimate	82 грн.	RoVAR	7,5%	Conservative market loading estimates, do not change
Detrended Premium Estimate	88 грн.	CC	2,5%	Conservative market loading estimates, do not change

Annex 2. Drought index spreadsheet for premium calculation (prepared by Jo Syroka for 2006 season)

Behtery Station

Trigger (mm)	15	15	15	15
Sum Insured (UAH) per Hectare (at 0mm)	500	750	1000	1500
Tick (UAH/mm)	30	45	60	90
Loading	7,5%	7,5%	7,5%	7,5%
All Data No Detrending				
Expected Loss	45,0	67,5	90,0	135,0
Value-at-Risk (Worst Case)	360,0	540,0	720,0	1080,0
Premium	**68,6**	**102,9**	**137,3**	**205,9**
Rate-on-Line	**14%**	**14%**	**14%**	**14%**
All Data Linear Detrend				
Expected Loss	14,7	22,1	29,5	44,2
Value-at-Risk (Worst Case)	227,2	340,8	454,4	681,6
Premium	**30,7**	**46,0**	**61,4**	**92,0**
Rate-on-Line	**6%**	**6%**	**6%**	**6%**
All Data Daily Simulation Model				
Expected Loss	32,3	48,22	64,04	95,71
Value-at-Risk (99%)	392,3	594,64	777,16	1190,43
Premium	**59,3**	**89,2**	**117,5**	**177,8**
Rate-on-Line	**12%**	**12%**	**12%**	**12%**

Historical Payouts of Cumulative Rainfall Contract, 1973-2005



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