

Weather Protection for European Horticulture and Crop Production

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Abstract

Ceiba species are widely cultivated in tropical regions due to their high ornamental value. However, it is still unknown what the genetic background of cultivated Ceiba plants. Based on SNPs derived from double-digest restriction-site associated DNA sequencing (ddRAD-seq), we identified SNPs associated with five horticultural traits and investigated the genetic relatedness of 153 accessions of Ceiba plants cultivated in Southern China in order to comprehend the genetic basis of key horticultural traits. These accessions belonged to one of three groups, as determined by clustering analysis: Groups of *C. speciosa*, *C. insignis*, and a hybrid SNPs related to petal color, number of striations in the petals, flowering time, trunk shape, and prickles on the trunk and branches were all found by the GWAS. Near the SNPs that were strongly associated with these traits, one or two candidate genes were discovered. This study laid the groundwork for phenotype-related marker selection and molecular breeding by revealing the genetic similarity of Ceiba plants grown in Southern China and presenting the first GWAS analysis for five of their horticultural traits.

Keywords: Agriculture; Management of risk; Danger posed by the weather; Insurance

Introduction

Agriculture is a dangerous industry. Crop yields can be reduced, costs can rise, and farmers' incomes can be at risk due to particularly adverse weather conditions like droughts, extreme temperatures, floods, and hail events. Since adverse weather events are getting more frequent and more severe as a result of climate change, yield volatility is expected to rise in many parts of the world [1]. Farmers in Europe are increasingly exposed to dangers posed by extreme weather, have seen significant declines in crop yields in recent years, and will face even greater yield volatility in the future. One important tool for reducing financial losses caused by bad weather is agricultural insurance. As a result, insurance can be a useful tool for adapting to the growing significance of extreme weather events as a result of ongoing climate change. These risk management strategies aim to improve farms' resilience. The agricultural industry, scientific community, and policymakers have shown an increasing interest in agricultural weather insurance. Insurance companies in Europe have increased the variety, depth, and regional scope of their weather insurance offerings in response to this growing demand. However, the scientific literature has not yet documented or evaluated this development.

An organized analysis of the various European insurance markets' agricultural weather insurance offerings for crop and horticulture production is provided in this paper [2]. The primary objectives are to provide an overview of the insurance products that are available and the weather risks that are covered, to compare this insurance supply to the scientific literature, to provide a summary of the most recent trends in the insurance product mix, innovation in the insurance industry, and political market interventions, and to emphasize the role that research plays in improving insurance products. In order to accomplish this, we evaluate the availability of agricultural weather insurance in a number of European nations, including Austria, France, Germany, Italy, Spain, and Switzerland.

Austria and Switzerland, which are not members of the European Union, have relatively small agricultural sectors that are characterized by a combination of grassland, arable production, and specialty crops. In terms of production value, France, Germany, Italy, and Spain are the largest agricultural producers in the European Union. Austria

and Switzerland are not members of the European Union. In terms of agricultural production, weather risk exposure, insurance market structures, and the types and depths of political market interventions, each of these nations exhibits diversity in their agricultural insurance markets (for instance, France offers a premium subsidy of 65%, while Germany does not currently offer premium subsidies at the national level). New insurance providers can enter the European insurance market, and voluntary insurance enrollment means that insurance supply must meet demand [3]. Risks like weather are covered by private or public-private insurance companies. Since commercial insurance providers account for the majority of insurance supply and risk transfer in Europe, our focus is on insurance supply. We use this to talk about smaller mutual funds and to talk about the mutual fund-based Income Stabilization Tool.

Background

Insurance solutions can be useful additions to other risk management options like diversification or irrigation in a farmer's weather risk management strategy. In the first part of this section, we'll talk about the different kinds of insurance, their challenges and opportunities. Different kinds of vegetables, crops, and fruits can be covered by these kinds of insurance [4]. Additionally, they can cover a variety of outcomes at stake. After that, we take a close look at the variety of political market interventions that have taken place in these markets and provide a summary of the roles that policies have played in the past and are still playing today. The assessments of the insurance markets in the countries being considered, as well as the identification of gaps, knowledge spill over effects, and future developments, require information on these dynamic developments.

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Types of insurance

The goal of agricultural insurance is to shield farm businesses from unanticipated losses resulting from exposure to weather risks. However, the insurability of weather risks is challenged by a number of factors. First, it must be possible to accurately assess the loss. Basis risk reduces an insurance product's risk-reduction potential and, as a result, its attractiveness. Basis risk is a mismatch between the pay out and weather-induced loss. Second, the insurance market may fail due to asymmetric information, which includes moral hazard and adverse selection. A farmer's unnoticed behavioral change that raises the likelihood of a pay-out is a moral hazard [5]. When farmers with above-average risk exposure take out insurance more frequently and total pay-outs exceed total premium volume, adverse selection occurs. Thirdly, the fundamental gamble openness should be assessable to infer expected pay-out's and actuarially fair expenses. In order to accomplish this, historical loss and risk exposure data must be accessible, comprehensive, and of sufficient quality. Fourthly, insurance providers must be cost-effective due to the fact that insurance supply costs are added to the actuarially fair premium, which makes insurance less appealing. Fifthly, the amount of resources required for loss assessments (such as labor resources) and pay outs (such as a financial buffer or re-insurance) increases with the severity of the weather risk—that is, the number of farmers affected simultaneously. The manifestations of these difficulties are contingent on the design and type of insurance (indemnity insurance or index insurance).

In indemnity insurance, experts use accounting data or damaged fields to estimate insured losses. The most widely used type of insurance in Europe is indemnity insurance, which can cover specific weather risks (such as hail only) or multiple weather risks at once (multi-peril insurance) [6]. The difficulty in separating insured weather impacts from management-related losses can lead to basis risk in indemnity insurance. Asymmetric information issues also arise, and solutions to them, like field inspections that necessitate a network of experienced loss adjusters, raise costs and make insurance solutions less appealing. Most importantly, during systemic weather risks that is, risks that affect multiple farms simultaneously this network of loss adjusters may reach a capacity limit. After a severe drought, for instance, it is impossible to adjust for multiple farms' losses simultaneously in a single nation ordeal drought, for instance, it is impossible. In contrast, farmers and insurance companies alike favour indemnity insurance due to its familiarity, ease of comprehension, and ability to cover multiple weather risks simultaneously.

An alternative type of data-driven insurance called index insurance is one in which the payout is solely contingent on the realization of an underlying index like cumulative precipitation. Since payouts and actuarially fair premiums are calculated using a transparent, non-manipulable index, index insurance can overcome asymmetric information issues. Additionally, pay-outs can be determined immediately following risk exposure thanks to automated insurance calibration and pay out determination, which reduce supply costs. Basis risk, which arises from inaccurate index loss estimation, presents a significant challenge for the design of index insurance. Area yield, vegetation health, and weather indices are the three distinct categories of indices. In most cases, indices for area-yield index insurance are the regional average yield realizations for a particular year, such as at the county level [7]. A normalized difference vegetation index (NDVI) in a specific region, for instance, is a vegetation-health indice. Variables that have an impact on yields, such as nutrient deficiency caused by insufficient fertilization or a variety of weather risks, can be reflected in vegetation-health indices. Weather indices, on the other hand, are more specific.

Private crop insurance markets in Europe

Private crop insurance markets in Europe have a long history of political market interventions. After the government, or the ducal chamber, stopped paying out compensation for hail damage, the world's first documented insurance markets emerged in Germany at the end of the 18th century [8]. Farmers responded by establishing mutual hail insurance, which offered pay-outs in the event of observed hail damage to their cereal production in addition to annual premium payments. As a result, the end of government support for damage caused by extreme weather was closely linked to the rise of private crop insurance, which began as mutual funds. Private insurance markets in Europe have developed since then. For instance, hail insurance currently accounts for 60% of the Swiss market. In addition, the development of legal frameworks and various forms of political market interventions like value-added tax deductions, premium subsidies, governmental loss participation, and public-private partnerships to design insurance and define (subsidized) premium rates accompanied this evolution in many nations.

In many nations, premium subsidies, in particular, have gained prominence. Premium subsidies are exempt from commitments to reduce political support in agriculture because they are classified as Green Box subsidies in the World Trade Organization's Agreement on Agriculture, which member states have agreed to and has become effective [9]. The Swiss agricultural policy and the European Union's Common Agricultural Policy, which itself provides the boundary conditions for the national policies of European Union member states, are also governed by the Agreement on Agriculture.

The Common Agricultural Policy explicitly allows premium subsidies for mutual funds, income stabilization tools, and animal and plant insurance with a maximum of 10%. Since then, the Common Agricultural Policy has permitted premium subsidies of up to 70%, resulting in various national levels of premium subsidies. Austria currently provides up to 55%, France and Italy up to 70%, and Spain around 40% in premium subsidies. While several Federal States, including Bavaria, Baden-Württemberg, and Rhineland-Palatinate, subsidize premiums by up to 50%, Switzerland has recently decided to introduce subsidized crop insurance for drought and frost. Although Germany does not currently offer national premium subsidies, it does offer a value-added tax deduction.

The Common Agricultural Policy is still evolving and serves as the legal foundation for subsidizing insurance premiums, which can be incorporated into the national support strategies of member states. This regulation now explicitly allows supporting index-based insurance, in addition to standard single and multi-peril insurance plans. This policy modification is in line with the most recent developments in the insurance market, as our findings will demonstrate.

However, not every European Union nation relies solely on subsidies for insurance support. Spain, for instance, has expanded its public-private partnership. More specifically, the State Agency of Agricultural Insurance coordinates the creation of insurance products with the participation of farmers, private insurance companies, and the public administration. Agroseguro is a coinsurance pool managing entity for the grouped insurance providers on behalf of the private insurance providers who sell these insurance products. Loss assessments, claim management, and risk transfer to reinsurers are all the responsibility of Agroseguro [10]. In addition, the State Agency of Agricultural Insurance's insurance products receive a base premium from it. The base premiums can be individually loaded by insurance companies to

cover their own internal costs. Premium subsidies are provided by the central government of Spain in addition to premium subsidies provided by regional governments in addition to a predetermined sum. At the moment, the average percentage of the total premium subsidy is around 40%.

In addition, France has decided to include a government loss participation program for severe losses in addition to premium subsidies. More specifically, this loss participation was put into place and covers 90% of losses above 30% of the maximum loss for horticultural production and 90% of losses above 50% of the maximum loss for wine production, field crops, and vegetables.

Methods and Materials

By screening online commercial insurance documents, we systematically gathered information on existing insurance products for horticulture (fruits, vegetables, wine) and field crop production for the structural assessment of agricultural weather insurance [11]. We chose these nations because of the diverse production conditions, market structures, and levels of political market intervention in their insurance markets. Furthermore, Austria's agricultural sectors are relatively small, with a lot of specialty horticulture and field crops, whereas France, Germany, Italy, Spain, and France have the highest value of agricultural production in the European Union. We gathered data on covered weather risks to determine insurance protection gaps and provide a market-specific overview of insurable weather risks. In addition, in order to demonstrate the variety of insurance options available, we gathered data regarding the insurance type (indemnity or index insurance) utilized to cover these weather risks. We also documented the kind of underlying index used to provide an overview and indicate innovation efforts in insurance designs for index-based insurance schemes.

In order to produce a comprehensive dataset, three pillars were used to collect data on insurance solutions currently available on the market. As a starting point, Swiss Hail Insurance provided a list of 34 commercial insurance companies that operate in these markets. Second, by conducting a web search, we added fourteen additional insurance companies to this list. Thirdly, we conducted systematic expert interviews to confirm the accuracy of the information gathered about offered insurance products and make any necessary additions. The structured questionnaire that was used for the expert interviews (see Supplementary Online Material) encouraged knowledge transfer without introducing potential biases.

Result and Discussion

In the analyzed agricultural insurance markets in Austria, France, Germany, Italy, Spain, and Switzerland, 48 insurance companies offered 107 distinct agricultural insurance products. The country-by-country distribution of insurance providers and products. Germany has the most products available [12]. Spain has the most insurance companies, and these companies are all part of the Agroseguero coinsurance pool. In terms of the number of insurance companies offering self-designed products, the German market has the most competitors. Additionally, we observe a monopoly in Austria and a duopoly in Switzerland.

This segment extends the expressive outcomes displayed in area 5 by giving a top to bottom conversation in view of writing and directed organizing interviews. All the more explicitly, this part grows the present status-of-the-workmanship with conceivable future roads with regards to protection item blend, advancement, political mediations and cooperation between examination, back up plans and policymakers.

Conclusion

This paper methodically surveyed farming climate protections for crop and green creation in the European protection markets in Austria, France, Germany, Italy, Spain and Switzerland. We recognized 48 protection suppliers offering 107 particular protection items in these 6 nations and find extraordinary varieties in market fixations, weather conditions gambles covered, and protection types utilized. All the more explicitly, there exists a reach from (nearly) monopolistic market structures to business sectors with solid rivalry. Protection suppliers for the most part offer repayment protection, yet in addition weather conditions file protection is as of now generally accessible. While the accessible items permit ranchers to cover many financially pertinent weather conditions gambles, a couple of protection security holes remain. For instance, flood occasions in Germany are at present not insurable, and dry spell and intensity occasions are overall underrepresented given their financial importance. Weather conditions file protection supplements repayment protection and covers particularly foundational gambles, yet there are likewise items that cover less fundamental dangers. There are various degrees of political market mediations and particularly premium sponsorships will remain or acquire in significance.

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Conflict of Interest

None

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