coffee & climate
enabling effective response

Agricultural Insurance Mechanisms against adverse climatic events in the municipalities of Perdões and Lambari

Case Study Background		
Tool Category: Adaptation beyond the farm **Variety:** Arabica – Mundo Novo **Climatic Hazard:** • Hail • Drought **Expected Outcome:** • Effective climatic risk management		**Detail:** Density (plants/ha): 3.333 - 3.572 (Perdões) 2.777 - 2.976 (Lambari) Soil type: Red latosol Shade regime: No shade Farming system: Intense Monoculture Yield Range (kg green dried coffee /ha): 13,1 – 43,2 (Perdões) 13,5 – 41,7 (Lambari) ⦸ rain (mm/ano): 1.530 (Perdões) 1.642 (Lambari)
Implementation Date: 01.01.14 – 31.03.14	**Altitude:** 948 m (Perdões) 987 m (Lambari) **GPS**: 21º05'27"S 45º05'27"W (Perdões) 21º58'33"S 45º21'00"W (Lambari)	**Slope of plots**: Small inclination ⦸ **Age of trees**: simulated life cycle of 20 years
No. farmers: medium profile based in 44 farmers in Perdões and 60 in Lambari	⦸ **Area under coffee**: 3 ha/farmer (Perdões) 5 ha/farmer (Lambari)	Tested with smallholders

Results

This study's objective was to explore (through a cost benefit analysis using simulated scenarios) the effects of adopting agricultural insurance alternatives, which are currently available to the smallholder family coffee farmers in Minas Gerais, over the financial performance of their enterprises. The results showed the important role that the insurance mechanisms can have as management tools of climatic hazards in the coffee production activity at smallholder level.

Pros & Advantages + Learnings	**Cons & Disadvantages + Things to take into account**
• Effective climatic risk management. • Affordable cost to farmers.	Main barriers for broad adoption: • Lack of understanding on how the mechanisms work and what are its real benefits. • Lack of knowledge about how to access it.

Acceptability	Low	**Effectivity**	High
Accessibility	High	**Urgency**	High

Appendix

Implementation Mark

The climate variability, exacerbated in a climate-changing environment, is the main factor responsible for the oscillations and frustrations in the Brazilian coffee crops (Camargo, 2010). The agricultural insurance mechanisms provide an important risk management tool, to protect smallholder producers from the variability in the production caused by adverse climatic events.

By using a set of simulated scenarios, this study's objective was to explore the effects of adopting currently available alternatives of agricultural insurance by smallholder coffee producers over the financial performance of their enterprises. It considered different levels of productivity losses caused by climatic adversities in two municipalities of Minas Gerais, Perdões and Lambari.

The currently available agricultural insurance products to smallholder coffee producers are two kinds: the Family Agriculture Insurance (SEAF), a multi-risk insurance program subsidized by the government, linked to agricultural credit operations of the National Family Agriculture Strengthening Program (PRONAF), and the insurance products offered by the market (also part-subsidized by the government), with coverage for specific risks such as hail or freeze.

Case Study Methodology

The case study was implemented via simulations. Starting with a scenario for the coffee production under normal climatic conditions in each one of the two municipalities, a series of possible scenarios with productivity breaks due to adverse climate were simulated, considering the following assumptions:

- The initial scenario was built based on production cost and coffee productivity per hectare data from the last three years, extracted from the database of Coffee and Climate participating smallholders of the two municipalities (44 farms in Perdões and 60 in Lambari). These properties were qualified according to their investment level (coffee production costs per hectare) as: low level (less than R$3500/ha), intermediate level (R$3500 to R$6000/ha) and high level (R$6001 to R$10000/ha). Production costs and average productivities per hectare in each level were derived from this information, as shown in table 1.
- In the simulations a representative coffee sale price of R$329 per 60 kg of green dried coffee bag was considered (average price payed by the Cooxupé Cooperative to the farmers during the last 20 years, adjusted by the inflation). Alternatively, a 10 % decrease was considered in this average sale price, aiming to also evaluate the effect of adopting agricultural insurance mechanisms in a low prices scenario.

Table 1. Costs distribution for coffee production in Lambari and Perdões per cost category

Activity	Cost category in Lambari (R$/Ha)			Cost category in Perdões (R$/Ha)		
	< 3.500	3.500 a 6.000	6.001 a 10.000	< 3.500	3.500 a 6.000	6.001 a 10.000
Average area with coffee(Ha)	5	5	5	3	3	3
Average density (pitss/Ha)	2.777	2.777	2.976	3.333	3.572	3.572
Average productivity (60kg bag/Ha)	13,5	27,2	41,7	13,1	25,8	43,2
Average Production Cost (R$/Ha)	2.503	4.665	7.551	2.779	4.815	7.503
Costs distribution (%):						
Fertilizing	27,7	27,6	20,9	31,0	34,7	29,6
Hoeing	8,6	5,1	3,9	11,5	7,0	5,8
Pulverizations	2,8	1,5	1,5	6,7	6,6	4,4
Squaring*	2,9	2,7	2,5	3,4	2,6	2,3
spreading**	0,5	0,6	0,6	1,5	0,2	0,3
Prining	0,5	0,4	0,3	0,7	0,4	0,1
Harvest	40,8	45,6	53,0	33,9	36,2	43,9
Post-harvest	12,3	12,8	14,0	5,8	6,2	7,6
Soil treatment	1,7	1,6	1,3	3,7	4,5	4,8
Other operational costs	2,2	2,1	1,9	1,9	1,5	1,2

* soil cleaning around the coffee plants before harvesting

** Redistribution in the coffee plants' base organic matter accrued in the soil during the harvest

- In the simulations it was assumed that the costing loans from PRONAF, received by the farmers, would cover an average of 40% of the annual production costs of the coffee cultivation. The annual interest rate for these credits currently varies according to the financed amount (1,5% for credits up to R$10000 per farmer and 3% for credits above this value). It was also assumed that the credits are settled each year after the coffee sale.
- The private agricultural insurance modality considered was the basic coverage against damages by hail in coffee plants offered by the insurance group called BB-Mapfre. The maximum indenisation limit under this basic coverage is R$6,000/ha. In the premium fees and indenisation calculations it was assumed a 15% insurance deductible for crops up to two years of life and 10% from the third year on. The premium fees calculation also had as base the production costs per hectare
- The premium fees calculation also had as a base the production costs per hectare, the plants density per hectare, the coffee plantations age and the climatic hazard in each municipality. This insurance modality is available for coffee plantations up to 15 years old. Thus, the last five years of the coffee cycle (lasting a total of 20 years) were covered by this mechanism in the simulations.

- In the simulations it was assumed that the whole area with coffee in the property was planted at the same time and that the plantation cycle covers a 20 year period, with the productivity starting at the third year, reaching its maximum in the sixth year and with a cyclic production starting at the eight year, alternating years of high and low productivity, aiming to represent the biennial effect in the coffee plant productivity, typical from Arabica coffee types.

Simulated scenarios:

- Scenario 1: simulated productivity losses variables in the years five and six to represent the hail damages effect in coffee plantations for a given year (year five), with effect also in the next year's harvest (year six); and a 30% fixed productivity loss at year 12 due to drought conditions. This scenario assumes a high sales price for produced coffee (R$329/ 60 kg bag). The following pairs of coffee productivity loss for years five and six were respectively considered: 0-0, 30-10 e 50-20 (expressed as a productivity reduction percentage in comparison to a normal climatic situation). It was assumed that the required management for the coffee plants damaged due to hail events in the year five consisted in "pruning", "framing" and "decode" (special pruning in the superior half of the plant), applied to 20%, 40% and 40% of the damaged coffee plants, respectively. It was also assumed that the productivity reductions for coffee plants subjected to these three management practices during year five were 100%, 100% and 35%, respectively. The extra cost with these pruning techniques was also considered in the cash flows built under this scenario.
- Scenario 2: the same as scenario 1, but under a low sales price situation for coffee produced (R$296/ 60 kg bag).
- Scenario 3: consists in "uprooting" and posterior replanting of 0%, 10%, 30%, 50% and 70% of all the coffee plants in the first year of the plantation due to variable levels of hail damage; fixed productivity losses of 0-0%, 30-10% and 50-20% in the years five and six, respectively, due to drought conditions. This scenario assumes a high sales price for coffee produced (R$329/ 60 kg bag). The extra replanting costs are considered in this scenario's cash flows.
- Scenario 4: the same as scenario 3, but under a low sales price for coffee produced (R$296/60 kg bag).

Based on the information and assumptions above, cash flows were created for each simulated scenario in each of the three investment levels, in both municipalities. To determine the economic feasibility of agricultural insurance mechanisms adopted under the different proposed scenarios, a cost-benefit analysis was made. The analysis considered two feasibility measures:

- Current Net Value (CNV): represents the monetary return over investment discounting the money value in time at a predetermined discount rate (5% in this case study). When CNV>0, the project is economically feasible.
- Intern Return Rate (IRR): is the internal discount rate generated by the project that makes the CNV = 0. When IRR is bigger than the predetermined discount rate, the Project is economically feasible.
- Discounted Payback Period (DPP): is defined as the recovery time of the capital invested evaluating the discounted cash flows, so it considers the money value over time. The least the recovery period, the bigger the liquidity of the project.
- Cost Benefit Ratio (CB): is the ratio between benefits converted in a common equivalent monetary unit (Current Value), to a determined discount rate (interest rate). If CB ≥ 1, the Project is recognized as economically acceptable to the applied estimates and discount rates.

How does the Familiar Agriculture Insurance (SEAF) works:

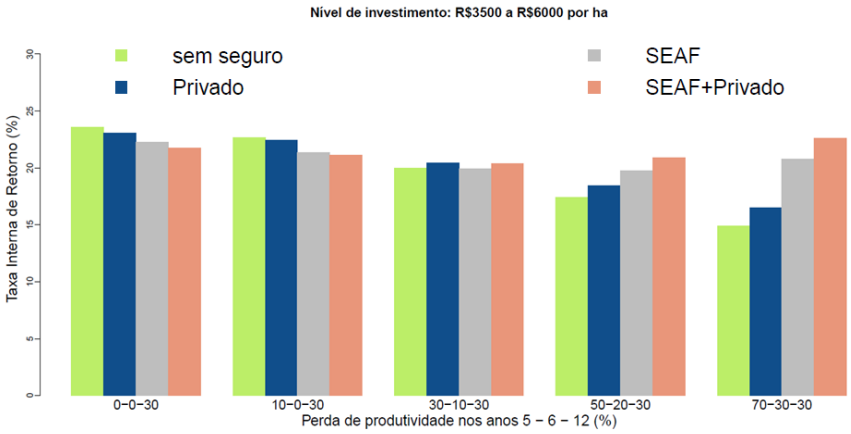
Nr.	Step	Picture
1	The SEAF adhesion is automatic in the act of hiring PRONAF's costing credit. Familiar farmers that access the PRONAF's investment credits can adhere to SEAF voluntarily.	Steps to access Pronaf's credits 1º passo: Solicitar a emissão da DAP no Escritório Local da EMATER ou no Sindicato de Trabalhadores Rurais do Município. 2º passo: Elaboração do projeto técnico conjuntamente entre família agricultora e técnicos da EMATER. 3º passo: Encaminhar a DAP e o projeto técnico ao agente financeiro para análise da viabilidade cadastral, econômica e financeira da proposta.
2	In case of casualty the farmer should inform the bank, so it can perform the inspection in the crop to verify the amount and causes of the damages.	

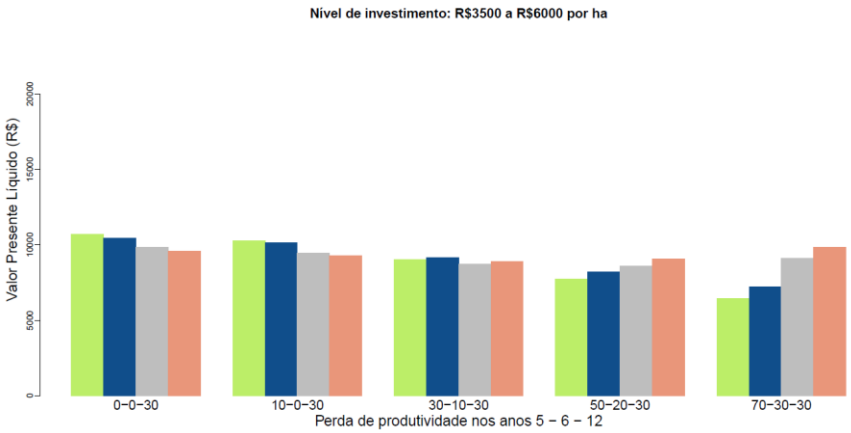
3	In order to receive indemnities foreseen in SEAF the farmer must have at least 30% loss in the expected gross revenue with proven cause by adverse event covered by SEAF (drought, freeze, hail, excessive rain, strong winds, excessive temperature variation, fungal diseases or plagues without technical controls possibility or economically infeasible).	
4	It is necessary to keep the first copy of inputs purchase invoices, because these shall be presented to the banks in case of losses coverage.	

Main results of the Case Study

Generally, the economic feasibility measures evaluated had the same behaviour under scenarios 1 and 2 (Picture 1). According to the results, productivity breaks in year five due to hail damages should be at least 30% to any of the insurance mechanisms evaluated (or a combination of them) to be more profitable than the scenario without insurance. When the loss was 30%, the private insurance was the best option. However, for bigger productivity breaks in year five (50% or more), the combination SEAF plus private hail insurance had a synergic effect, reaching the best financial performance, followed by the scenarios that had only SEAF. When the investment level and the sales price for coffee were low, and the productivity losses due to hail in year five were high (50% or more), the scenarios without private insurance were not economically feasible.

According to the economic feasibility measures, the adoption of a private insurance mechanism under scenarios 3 and 4 constituted a more profitable option than the situation without insurance, for any of the simulated hail damage levels to the coffee plants during the first year (figure 2) and for any of the three investment levels. The difference in the value of the measures in alternatives with and without private insurance has also increased along with the intensity of the hail damage in these scenarios. The private insurance was superior to other mechanisms when productivity losses due to adverse climate in other years of the coffee plantation cycle were not registered. But when additional productivity losses in the years five and six occurred, due to drought conditions, the compensations payed by SEAF led to a combination of SEAF + private insurance reaching the best financial performance, especially when these additional losses were high (50% and 20% in years five and six, respectively).





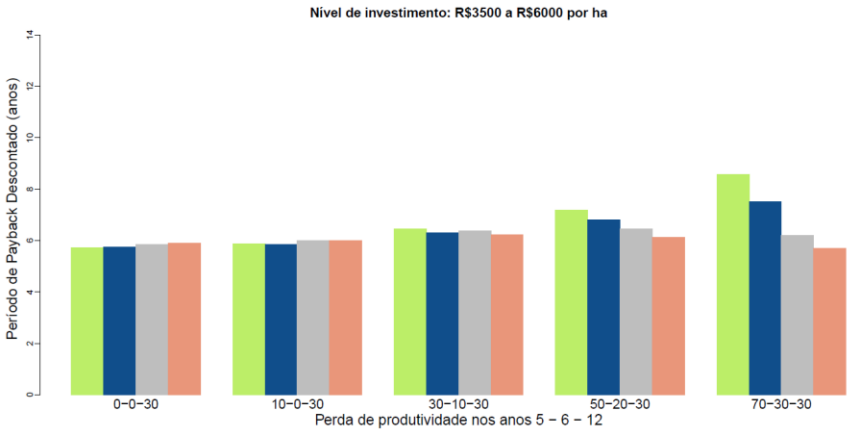
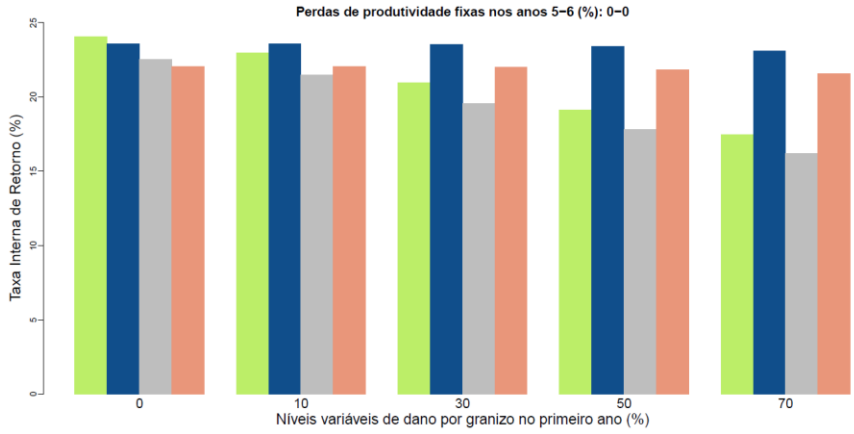


Figure 1. Intern return rate (%), net present value (R$) and discounted payback period (years) for the coffee production in Perdões (MG) with an intermediate investment level under scenario 1: high coffee sales price (R$329/ 60 kg bag), variable coffee productivity losses in years 5 and 6 due to hail damages in the coffee plants and fixed productivity losses of 30% in year 12, due to drought conditions.



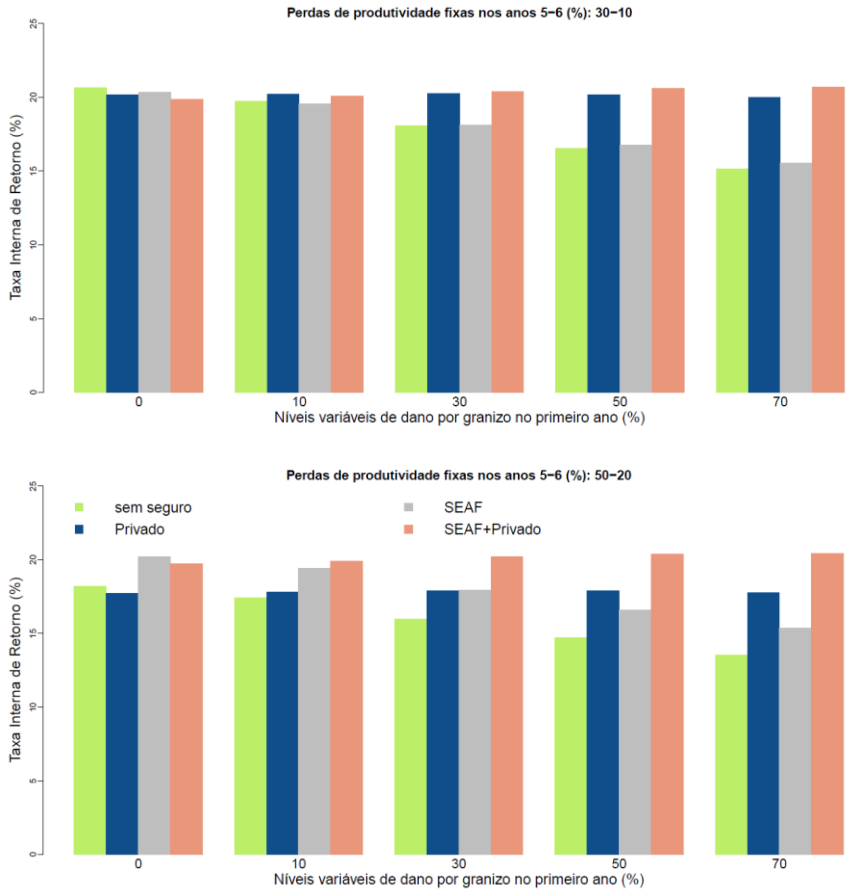


Figure 2. Internal return rate (%) for coffee production in Perdões (MG) for an intermediate investment level (R$3.500 - R$6.000 per hectare) under scenario 3: high sales price (R$329/60kg bag), variable hail damage levels on the coffee plants during first year and 0-0%, 30-10% and 50-20% fixed productivity losses in years 5 and 6, respectively, due to drought conditions.

Acceptance					
Main question: how easy did farmers accept this tool as being something useful for implementation and applied it as planned?					
HIgh		**Low**	X	**Don't Know**	
High: Farmers accepted this tool easily and continue to implement it as planned.			**Low:** The farmers, generally, did not accept this tool or it has found resistance later, although the farmers have accepted it in the beginning.		
Please comment:					
If there was resistance to adopting this tool, why?			-		

If the farmers have not continued to implement the tool during the process, although it was initially accepted, what was the reason?	-
Did this tool have any external problem or impact (positive or negative) that has influenced its acceptance? (Community, value chain)?	-
Any other comment:	Farmers, generally, do not see insurance as a risk management tool, but as an additional production cost.

Accessibility					
Main question: Are the tool's costs accessible to the farmers, considering the initial investment, maintenance costs and input availability?					
High	X	**Low**		**Don't Know**	
High: the initial investment and the maintenance cost of this tool are accessible to the farmers within their regular operations; the time it takes to recover the investment is reasonable to the farmers. Inputs (ex: labor, electricity, etc.) are available when needed, so there will be no additional costs for accessing these resources opportunely.			**Low:** The initial investment or the maintenance cost of this tool goes beyond what is affordable to the farmers within their regular operations. The amount of time it takes to recover the investment is not reasonable for the farmers.		
Please comment:					
Are there any external costs? (for society or the environment?)			No		
If the costs are high due to the absence of any input, which input is it? And why?			-		
Any other comment:			Both SEAF and the private insurance are partially subsidized by the government, making these accessible for the smallholders.		

Efficiency					
Main question: Does the tool provide the expected benefit to the farmers?					
High	X	**Low**		**Don't know**	
High: the objective of this tool has been reached by the farmers.			**Low:** the tool did not fulfil its objective entirely.		
Please comment:					
Which benefits did the farmers expect from this tool?			-		
If the objective has not been reached, why?			-		
Were there significant external questions that have influenced (positively or negatively) the efficiency of this tool? Please, exemplify.			-		
Any other comment:			There is still a lack of knowledge by the farmers about the operation and the real benefits of the available agricultural insurance mechanisms. However, the simulations under local conditions showed their efficiency as risk management tools when implemented along the coffee crop cycle of life.		

Urgency					
Main question: is the time this tool takes to be applied (since the beginning of its execution until the benefits occur) reasonable for the farmers?					
High	X	**Low**		**Don't know**	
High: the time for the tool's implementation is reasonable (considering the productive cycle of the coffee, the necessary inputs, the preparation time and the execution time); and the expected effects of the tool occur within a reasonable period of time.			**Low:** It takes too long to execute this tool (considering the productive cycle of the coffee, the necessary inputs, the preparation time and the execution time); or it simply takes too long for the benefits to occur.		
Please comment:					
If the execution takes too long, why?			-		
Any other comment:			The hiring/renovation of these insurance mechanisms do not demand much time and in the SEAF case, it is automatic (at the PRONAF costing credit contract moment).		