Improving Resilience of Post-Harvest Losses through Parametric Insurance

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INTRODUCTION

Much attention is given to crop losses during cultivation and harvest but little to post-harvest losses. This article explores a possible parametric insurance solution to cover post-harvest losses during storage due to weather related causes, which are becoming prominent with climate change. The ultimate objective of offering such parametric insurance is to mitigate the risk of post-harvest losses at the storage stage leading to reduced food wastage, improved food security, and food supply chain stability.

Typically, post-harvest losses occur during handling, storage, processing (e.g., packaging), distribution, sales, or at households. Post-harvest crop losses are a perennial and costly challenge for farmers and the food industry. A significant part of post-harvest losses occurs at the storage stage. Excess rainfall, high humidity, poor ventilation, pests, diseases, and contamination can cause crop degradation/spoilage at the storage stage leading to economic losses for famers and reduce the food supply threatening food security for the society at large.

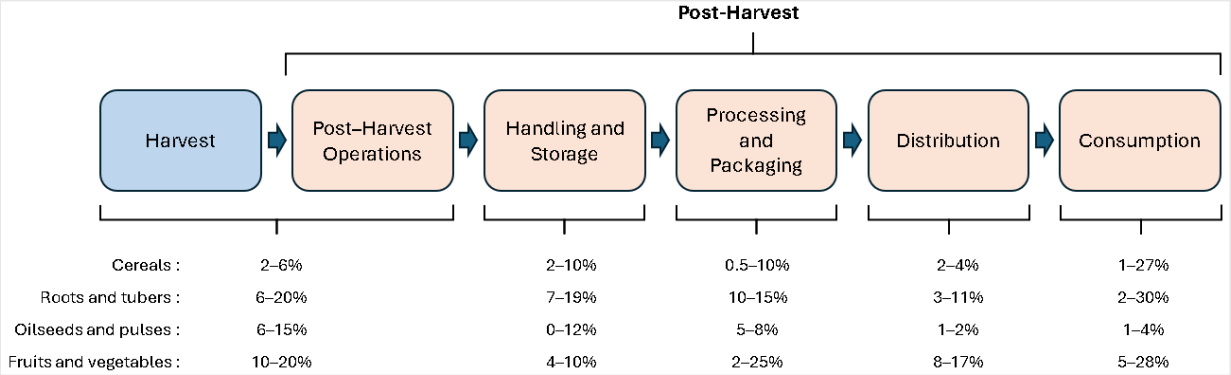
Post-Harvest Losses in Numbers

- The Food and Agriculture Organization (FAO) estimates that approximately 13% of all food produced globally is lost post-harvest [1].
- In developing nations, losses at storage and handling stages alone account for 7–10% of cereals and up to 19% of perishable crops [2].
- Small scale farmers are especially exposed due to limited access to modern storage infrastructure. For example, China reports grain losses of 7–13% at rural household storage facilities, compared with losses below 1% at the national reserve level [3].

The following diagram illustrates post-harvest losses at different stages from harvest to consumption. Percentages represent the proportion of losses of what enters each stage for different crop types.

Figure 1

LOSSES AT DIFFERENT STAGES FROM HARVEST TO CONSUMPTION



Cereals :	2–6%	2–10%	0.5–10%	2–4%	1–27%
Roots and tubers :	6–20%	7–19%	10–15%	3–11%	2–30%
Oilseeds and pulses :	6–15%	0–12%	5–8%	1–2%	1–4%
Fruits and vegetables :	10–20%	4–10%	2–25%	8–17%	5–28%

Based on data from [1] [2]

Traditional indemnity-based insurance products rarely address the risk of post-harvest losses particularly at the storage stage as claims assessment for spoilage can be slow, subjective, and costly particularly for small scale farmers. However, parametric insurance offers an efficient and cost-effective alternative as explored in this article to achieve the ultimate objective of risk mitigation of post-harvest losses at the storage stage by the following means.

- Financial security provided by coverage can help farmers to continue their livelihoods.
- Financial security can also help to invest in better infrastructure for storage facilities.
- As part of product support, provide training and awareness to farmers about best practices for storage facilities.
- Encourage farmers to adopt modern affordable technologies and practices which can lead to improved storage conditions.

CURRENT MARKET LANDSCAPE FOR POST-HARVEST LOSSES

Currently, only a handful of well-known schemes are available in the market for post-harvest loss protection. Pradhan Mantri Fasal Bima Yojana (PMFBY) [4] in India is a government scheme covering post-harvest losses, sowing failures, and other disasters. It provides coverage for up to two weeks post-harvest for crops that require drying in a cut-and-spread condition in the field, against hailstorms, cyclones, cyclonic rains, and unseasonal rains. The scheme has a parametric element to ensure timely payout of weather-induced losses.

PARAMETRIC PRODUCT DESIGN

Parametric insurance solutions are emerging as a pragmatic alternative to traditional insurance for several reasons:

- Highly customizable to specific coverage needs.
- Allow faster and simpler claim payments. Payouts can be made within a short timeframe after a weather event triggering a pre-determined threshold.
- Triggers can be based on third-party verifiable weather data improving transparency.
- Provide cost efficiency by eliminating costly spoilage inspections particularly in disperse rural areas.
- Provide scalability with the possibility to roll out to large farmer networks or cooperatives.

- Potential to compensate for quality degradation such as crop downgrading even when total losses do not occur.
- Emergence of specialized parametric service providers in recent years provides more options in terms of service providers.

However, there are some limitations:

- Unlike traditional indemnity-based insurance, there can be exposure to basis risk[1] where spoilage occurs despite trigger thresholds not being met.
- Farmers may lose trust in the system if spoilage occurs, but trigger thresholds are not met.

COVERAGE AND TARGET SEGMENTS

The coverage objective is to protect the loss of value of harvest at the storage stage against degradation/spoilage from adverse weather conditions such as high humidity and excessive rainfall. This generic solution can be adopted for a specific crop type.

Target user segments can include individual farmers with on-farm storage facilities such as granaries and cold rooms, farmer cooperatives with shared storage facilities, and agribusiness aggregators purchasing directly from farmers.

TRIGGER INDEX

A trigger should be relatively easy to measure, verifiable, transparent, and strongly correlated with degradation/spoilage to reduce basis risk. Possible indices include:

- Daily Average Relative Humidity[2] that can be measured at weather stations closer to farms or via satellite-derived atmospheric moisture data. Alternatively, low-cost measurement tools such as Hygrometers can be installed at farm storage facilities to monitor and report relative humidity levels.
- Relative humidity meeting an agreed value over a specified period can be considered for the trigger (e.g., a daily average over 85% for five consecutive days).
- Cumulative Rainfall over an agreed period. (e.g., 100 mm cumulative rain over five consecutive days).

In fact, to address basis risk, a two-factor index that includes both relative humidity and cumulative rainfall can be considered.

Trigger index thresholds can be tailored to a target region and its crops, based on their specific spoilage patterns. Moreover, different threshold options can be considered for different storage types (e.g., climate-controlled vs. traditional).

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[1] The difference between pay-out from parametric insurance and underlying loss. For more detail see https://www.interactivebrokers.com/campus/glossary-terms/basis-risk/

[2] *Relative Humidity*, ScienceDirect Topics, Elsevier, accessed February 13, 2026, https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/relative-humidity

CONSIDERATIONS FOR UNDERWRITING

The following are a few preconditions for consideration to be eligible for coverage.

- A minimum acceptable level of storage facilities to mitigate the risk of losses conforming to the ultimate objective of waste reduction and food security improvement.
- For example, consider low-cost evaporative cooling arrangements as a precondition for small scale farmers.
- Another example is to consider the use of hermetic storage bags instead of traditional jute bags as a precondition. Hermetic bags reduce spoilage risk during storage [5].
- Reporting of yield within a given timeframe post-harvest to determine the market value of harvest.
- However, as an alternative historical yield data can be considered particularly for crops that require only a short storage period. For example, consider the average yield for past seven years excluding two years of declared disasters.

Accumulation risk is likely to be a concern. Limiting the coverage to a specific area, and the selection of triggers and payout structures can help to manage accumulation risk in a more predictable manner.

The duration of coverage depends on the type of crops being protected. Perishable harvest such as fruits and vegetables can have a short coverage period whereas the coverage for grains can be longer.

PAYOUT STRUCTURE

The payout structure specifies how claims are settled in case the parametric cover is triggered. If a two-factor index is adopted, a possible payout structure can look like the following aligning payouts with likely severity of spoilage and loss in market value.

Table 1
A SAMPLE PAYOUT STRUCTURE

Two-Factor Index	Payout as a Percentage of Market Value of Harvest
RH >= 85% and < 90% cumulative rainfall >= 100mm and < 150mm for five consecutive days	30%
RH >= 90% and < 95% and cumulative rainfall >= 150mm and < 200mm for five consecutive days	60%
RH > 95% and cumulative rainfall > 200mm for five consecutive days	100%

For example, if daily average relative humidity is between 85% and 90% and cumulative rainfall is between 100mm and 150mm for five consecutive days, based on the payout structure, the insured can claim 30% of the market value of the harvest.

PRICING

Typically, the pricing of parametric insurance is mainly driven by the probability of occurrence of a trigger event. Historical rainfall and relative humidity data spanning over a sizeable period are likely to be readily available from credible third-party sources gathering such information. Moreover, compared to a

traditional indemnity-based coverage, a simple index-based trigger can make pricing more competitive, particularly when affordability is a key concern for small scale farmers.

DISTRIBUTION

Based on target segments, parametric insurance has the scalability to reach out to a large section of the farmer community through different distribution channels. The following are several for consideration:

- Policies can be sold through cooperatives and agribusiness aggregators and financed though cooperatives or other funds.
- For small scale farmers, policies can be bundled with microfinance or other loans taken for their post-harvest needs.
- As part of food security initiatives, Governments and development agencies can distribute parametric coverages and subsidize premiums particularly for small scale farmers.
- Digital channels: with the ubiquitous prevalence of mobile phones, mobile apps and SMS platforms can be used for policy issuance, trigger notifications, and payout alerts.
- If farmers are already on a parametric or other scheme for the protection of their harvest, post-harvest protection can be offered as an add-on coverage.

CONCLUSION

Post-harvest crop losses are a perennial and costly challenge threatening livelihood of farmers and food security for the society at large. Post-harvest losses can occur at different stages of the food supply chain and losses at the storage stage can be significant. Traditional indemnity-based insurance products rarely address the risk of post-harvest losses particularly at the storage stage. Flexibility, transparency, simple and faster claim settlement, cost efficiency, and scalability associated with parametric insurance make it ideal to address losses from degradation/spoilage at the storage stage due to weather related causes such as high humidity and excessive rainfall. Such parametric insurance solutions not only protect livelihood of farmers but also can contribute to food security, waste reduction, and food supply chain stability.

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