



INTERNATIONAL  
FOOD POLICY  
RESEARCH  
INSTITUTE

SFS4YOUTH WORKING PAPER #16

JUNE 2026

# Pre- and postharvest losses and their correlates in the Irish potato value chain in Kenya



Fantu Bachewe, Geoffrey Baragu, Josue Niyonsingiza, and Olufemi Popoola

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## EXECUTIVE SUMMARY

Food losses are a major constraint to agricultural productivity, farm incomes, and agrifood system efficiency in sub-Saharan Africa, yet comprehensive micro-level evidence across value chains remains limited. This study provides a detailed assessment of pre- and postharvest losses in the Irish potato value chain in Kenya, drawing on purposefully collected data from producers, aggregators and processors. Using a consistent, multidimensional measurement framework, the study captures both quantitative (physical) and qualitative (degradation) losses across production and postharvest stages.

The results indicate that potato losses are widespread and occur throughout the value chain, with the largest share concentrated at the producer level. Preharvest losses and on-farm postharvest losses account for a substantial proportion (23.5 percent) of total losses, reflecting the combined effects of pest and disease pressures, weather-related shocks, and suboptimal management practices. Nationally, producer-level potato losses could amount to KSh 14.5 billion annually, equivalent to the annual per capita income of about 50,000 Kenyans. While producer-level losses dominate, descriptive evidence shows that potato aggregators and processors also incur nonnegligible losses, particularly during storage, transportation, and handling. These losses are commonly associated with spillage, mechanical damage, inadequate storage conditions, and poor handling practices, highlighting inefficiencies beyond the farm gate.

Econometric results reveal that loss patterns vary across producers and production environments. Differences in demographic characteristics, farm size, labor availability, and market orientation contribute to heterogeneity in both the likelihood and intensity of losses. These results further demonstrate that asset ownership, management practices, and exposure to production risks are key determinants of loss outcomes. Greater household assets and labor availability are associated with reduced loss incidence and intensity, while exposure to biotic and abiotic stressors – captured through a composite index – significantly increases both the probability and severity of preharvest losses.

Input use and management practices also play an important role. The application of chemical fertilizers is associated with reduced loss intensity, consistent with improved crop vigor and resilience, while the use of pest control is positively correlated with loss occurrence, likely reflecting reactive application following infestation. The adoption of improved seed varieties increases the likelihood of losses but reduces the intensity of them, which is a nuanced finding that suggests both greater exposure and improved resilience conditional on damage. Access to training and third-party agricultural service is associated with lower losses, underscoring the importance of knowledge and advisory support. This area also presents opportunities for youth, particularly young women, to engage in agrifood-system service provision through activities such as advisory services, quality management, aggregation, and postharvest handling, which can simultaneously reduce losses and generate income. Importantly, the analysis reveals strong linkages between preharvest and postharvest losses. Higher preharvest losses are associated with both increased likelihood and greater severity of postharvest losses, indicating that damage incurred during production propagates along the value chain.

Overall, potato losses in Kenya are systemic but largely preventable through improved handling, storage, market infrastructure, and farmer capacity. Although youth sample sizes in this study are too small to quantify specific effects, the data highlight clear entry points for engaging youth, particularly young women, in reducing post-harvest losses. For instance, there are opportunities for involving youths in services offered at the production stage, which include sorting, curing, and transportation.

## MUHTASARI MKUU

Hasara au upotevu wa chakula bado ni kikwazo kikuu kwa tija ya kilimo, mapato ya wakulima, na ufanisi wa mfumo wa chakula na kilimo barani Afrika, Kusini mwa Jangwa la Sahara; hata hivyo ushahidi wa kina katika minyororo ya thamani ya chakula umesalia kuwa mdogo. Utafiti huu unatoa tathmini ya kina ya hasara kabla na baada ya mavuno katika mnyororo wa thamani wa viazi nchini Kenya, ukitumia data iliyokusanywa kwa mahususi kutoka kwa wakulima, wasambazaji na wasindikaji. Kwa kutumia mfumo thabiti wa kipimo chenye vipengele vingi, utafiti huu unabainisha hasara za kiasi (idadi) na za ubora (kulingana na thamani) katika hatua zote za uzalishaji na baada ya mavuno.

Matokeo yanaonyesha kwamba hasara za viazi zimeenea katika mnyororo wote wa thamani, huku sehemu kubwa zaidi ikijikita katika ngazi ya mkulima. Hasara kabla ya mavuno na upotevu wa baada ya mavuno shambani huchangia sehemu kubwa ya jumla ya hasara, zikionyesha athari za pamoja za wadudu na magonjwa, majanga yanayohusiana na hali ya hewa, na mbinu duni za usimamizi. Ingawa hasara katika ngazi ya mzalishaji ni kubwa zaidi, wasambazaji na wasindikaji wa viazi pia hupata hasara zisizo za kupuuzwa, hasa wakati wa kuhifadhi, kusafirisha, na kushughulikia. Hasara hizi mara nyingi huhusishwa na umwagikaji, uharibifu wa kimwili, hali duni za uhifadhi, na mazoea mabaya ya ushughulikiaji, jambo linaloonyesha upungufu wa ufanisi nje ya shamba.

Matokeo ya kiekonometri yanaonyesha kwamba mifumo ya upotevu inatofautiana kati ya wazalishaji na hali ya uzalishaji. Tofauti katika vipengele vya kidemografia, ukubwa wa shamba, upatikanaji wa ajira, na mwelekeo wa soko zinachangia kutofautiana kwa uwezekano na ukubwa wa upotevu au hasara. Matokeo haya yanaonyesha zaidi kwamba umiliki wa mali, mbinu za usimamizi, na mfiduo kwa hatari za uzalishaji ni vipengele muhimu vinavyochangia matokeo ya upotevu. Rasilimali nyingi za kaya na upatikanaji wa ajira zinahusishwa na kupungua kwa tukio na ukubwa wa upotevu, huku mfiduo kwa vipengele vya kibiolojia na visivyo vya kibiolojia – vilivyorekodiwa kupitia faharasa jumuishi – vinaongeza kwa kiasi kikubwa uwezekano na ukubwa wa hasara kabla ya kuvuna.

Matumizi ya pembejeo na mbinu za usimamizi pia yana jukumu muhimu. Matumizi ya mbolea za kemikali yanahusishwa na kupungua kwa ukubwa wa hasara, thibitisho la kuimarika kwa nguvu ya mazao na ustahimilivu, huku matumizi ya kemikali za kudhibiti wa wadudu yakihusishwa na kutokea kwa upotevu, pengine ikiakisi matumizi ya kudhibiti baada ya uvamizi. Kutumika kwa aina bora za mbegu kunaonyesha uhusiano wa kina, kuwa mbegu bora zinaongeza uwezekano lakini zinapunguza ukubwa wa hasara, basi ukiashiria mfiduo mkubwa na ustahimilivu bora endapo kuna uharibifu. Upatikanaji wa mafunzo na huduma za kilimo kutoka kwa wahusika wengine unahusishwa na upotevu mdogo, kusesitiza na kuonyesha umuhimu wa ujuzi na msaada wa ushauri. Huduma hizi pia zinatoa fursa kwa vijana, hususan wanawake vijana, kushiriki katika utoaji wa huduma ndani ya mfumo wa chakula na kilimo kupitia shughuli kama vile huduma za ushauri, usimamizi wa ubora, ukusanyaji wa mazao, na ushughulikiaji baada ya mavuno, ambazo zinaweza kwa wakati mmoja kupunguza upotevu na kuzalisha mapato.

Muhimu zaidi, uchambuzi unafichua uhusiano kati ya upotevu wa kabla na baada ya mavuno. Hasara kubwa kabla ya mavuno huhusishwa na ongezeko la uwezekano na ukubwa wa hasara za baada ya mavuno, ikionyesha kwamba uharibifu unaotokea wakati wa uzalishaji husambaa katika mnyororo wote wa thamani.

Kwa ujumla, hasara za viazi nchini Kenya ni za kimfumo lakini zinaweza kuzuilika kwa kiasi kikubwa kupitia kuimarisha ushughulikiaji, uhifadhi, miundombinu ya soko, na uwezo wa wakulima. Ingawa sampuli za vijana katika utafiti huu ni ndogo kuweza kupima athari mahususi, data inaangazia nafasi zilizo wazi za kuwashirikisha vijana, hasa wanawake vijana, katika kupunguza hasara za baada ya kuvuna. Kwa mfano, kuna fursa za kuwashirikisha vijana katika huduma zinazotolewa katika hatua ya uzalishaji, ambazo ni pamoja na kuchagua, kuandaa viazi kwa ajili ya uhifadhi, na usafirishaji.

# 1. INTRODUCTION

## 1.1 GENERAL BACKGROUND

Food losses are not a new phenomenon: evidence of food losses dates as far back as ancient Egypt (Baines and Malek 2000; Samuel 1999). Policy attention to food losses started gaining traction after the global food crisis of the mid-1970s, when the United Nations identified postharvest food loss reduction in developing countries as a priority (FAO 1981). Interest resurged following the food price crises of 2007/08, prompting renewed efforts by the United Nations Food and Agriculture Organization (FAO) to measure losses, promote mitigation technologies, strengthen institutional capacity, and launch initiatives such as the Global Initiative on Food Loss and Waste Reduction (Save Food) in 2015. Momentum further increased with the establishment of the African Postharvest Losses Information System (APHLIS) in 2009, the inclusion of postharvest loss targets in the Malabo Declaration under the Comprehensive African Agricultural Development Programme in 2014, and the adoption of food loss targets in the Sustainable Development Goals (SDGs) in 2015 (World Bank 2011; Affognon et al. 2015; Sheahan and Barrett 2017; Delgado et al. 2021).

However, studies that systematically measure the extent of food losses are relatively recent and remain scarce, with most focusing on losses during the postharvest stages of crop production (Adams 1977; APHLIS 2025a) rather than taking a value chain approach. In addition, studies dealing with the policy considerations of postharvest losses are a recent phenomenon.<sup>1</sup>

This study assesses pre- and postharvest losses along the Irish potato value chain in southwestern Kenya, focusing on producers, aggregators, and processors in the five counties of Kiambu, Nakuru, Narok, Nyandarua, and Nyeri. It contributes to the literature by combining micro-level measurement across multiple value chain nodes with econometric analysis of correlates of potato losses at preharvest and postharvest production.

Several factors are reinforcing efforts to reduce postharvest losses in sub-Saharan Africa (SSA). Rapid population growth requires a substantial increase in food production alongside significant reductions in food losses (AGRA 2022; IFPRI 2020). Loss reductions could also help address the rising prevalence of moderate or severe food insecurity experienced since 2014, which has been exacerbated by global crises that disrupted food supply chains, and support progress toward achieving SDG 2 (Zero Hunger) by 2030. At the same time, climate change and increasing extreme weather events are making food production and rural livelihoods precarious, affecting not only crop growth but also postharvest outcomes. Reducing food losses is therefore central not only to improving food availability but also to lowering the environmental costs associated with using land, water, energy, and other inputs to produce food that is ultimately not consumed (AGRA 2022; IFPRI 2020; Stathers et al. 2015; World Bank 2011). Loss reduction can further improve farm productivity, expand marketed supply, and improve the profitability and incomes of smallholder farmers who dominate food production in SSA.

Globally, food losses are estimated to be substantial (APHLIS 2013; FAO 2011; Lipinski et al. 2013). The FAO (2011) has estimated that roughly one-third of all food produced for human consumption – roughly 1.3 billion tons annually – is lost or wasted worldwide. Losses occur at different stages of value chains across countries: in higher-income countries, waste primarily occurs at the consumer level, while in low-income countries, losses are concentrated in early and intermediate stages of supply chains.

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<sup>1</sup> See section 2.1 for precise definitions of concepts and terms used in this study.

In SSA, food losses are estimated at about 100 million metric tons (MT) annually. Of this figure, grain losses are valued at about US\$4 billion (2007 prices), which exceeds the annual value of grain imports into Africa and the value of total food aid received in SSA over the 2008–2018 decade (African Union 2018). In 2017, APHLIS reported cereal postharvest losses of nearly 17 percent of total production (APHLIS 2025b). In the case of potatoes in Kenya, one of the country's key non-cereal staples, losses are estimated at approximately 19-23 percent of production, equivalent to roughly 400,000–500,000 metric tons annually. These losses carry a substantial economic cost of about USD 104 million (KES 12.9 billion) per year, highlighting the scale of inefficiencies in this key non-cereal staple value chain (Mbeche et al. 2025).

However, important evidence gaps remain in the measurement and assessment of food losses. Early estimates of food losses were derived from macro-level assessments with limited micro-level analyses and often relied on tenuous assumptions and outdated or inappropriate data (Affognon et al. 2015; Kaminski and Christiaensen 2014). Evidence remains lacking on the relative importance of quantitative and qualitative losses in production, postharvest production, and the downstream nodes of value chains. Given the diverse agroecologies, crop cultures, and production systems in SSA, more precise measurement of losses across production and postharvest stages are required.

Even today, studies that systematically measure the extent of food losses remain scarce, with most focusing on losses during postharvest stages of crop production (Adams 1977; APHLIS 2025a) rather than taking a value chain approach. Measuring and addressing food losses requires a broader value chain perspective that expands the focus from losses at a single stage. Most loss reduction interventions target storage losses, yet significant losses occur during production, in harvesting, drying, transportation, processing, and marketing (Delgado et al. 2021; Chatterjee 2018). Relatively few studies track losses comprehensively along the entire value chain in SSA. Moreover, loss-reduction strategies must account for the region's technological and institutional context, which is characterized by low input use, limited mechanization, weak service infrastructure, and underdeveloped markets and institutional support. These limitations reduce incentives for adopting improved practices (Chatterjee 2018). A more holistic, value-chain-oriented, and technology-sensitive approach is therefore needed for both research and policy. Recent empirical studies have begun filling these gaps, showing that mechanization of harvesting and threshing can significantly reduce losses (Daum 2023; Minten et al. 2021), while poor handling, delayed harvesting, and weak transport and market access contribute substantially to total losses (Delgado et al. 2017; 2021; Minten et al. 2021; Ssajjabbi et al. 2025).

This study contributes to addressing these evidence gaps by combining micro-level measurement across multiple value chain nodes with an econometric analysis of correlates of losses. The study describes Irish potato production, aggregation, and processing activities; the socioeconomic and demographic characteristics of value chain agents; and the relevant policy environment in Kenya. In doing so, it contributes micro-level evidence on food losses in SSA while providing a comprehensive view of the Irish potato value chain. Potatoes are a nutritionally rich and climate-resilient staple that play a critical role in Kenya and other SSA countries, making loss reduction in this value chain particularly important for food system resilience. The study also conducts econometric analyses to investigate the correlates of losses among producers during production and postharvest stages. By linking production and postharvest technologies and practices to observed loss levels along the value chain, the analysis helps address a key knowledge gap and provides evidence relevant for policy design.

The study examines food losses in the Irish potato value chain of Kenya as part of a broader research effort using purposefully collected data on food losses across three SSA countries – Kenya, Nigeria, and Rwanda – which differ in agroecological conditions, levels of economic and agricultural development,

and crop focus. The analysis employs a recently developed data collection and measurement methodology called the ‘attributes method’ (Delgado et al. 2021). The study aims to characterize food losses at different stages of the value chain and address the evidence gaps identified in the literature. Specifically, it measures quantitative and qualitative losses at multiple points along the potato value chain in the central highlands and Rift Valley regions of Kenya, identifying and measuring the relative importance of value chain nodes and post-harvest activities where losses occur.

The detailed assessment of pre- and postharvest losses along the potato value chain in this report was conducted as part of the Strengthening Food Systems to Promote Increased Value Chain Employment Opportunities for Youth project, a collaboration of IFPRI, the Mastercard Foundation, and its implementing partner. The project’s overall objective is to create innovative, digitally savvy, and dignified and fulfilling livelihood opportunities for youth, especially young women, while reducing postharvest losses across agrifood systems. Consistent with this objective, IFPRI and partners are conducting a series of studies to measure pre- and postharvest losses among producers, aggregators, and processors.

## 1.2 IMPORTANCE OF IRISH POTATOES<sup>2</sup> IN KENYA

Irish potato is Kenya’s second most important food value chain after maize, in terms of both production volume and consumption volume (Kenya MoALFC 2021). The crop thus plays an important role in the country’s agricultural economy and food security. Irish potato’s relatively short growing season – typically 90–120 days, depending on variety and location – allows for multiple harvests per year in some regions, providing a reliable source of food and income for farming households.

The value chain also contributes significantly to rural employment and livelihoods, and to the nutritional security of millions of Kenyans. Table 1.1 summarizes trends in potato production among potato-producing counties in Kenya between 2020 and 2024. With annual production reaching 2.15 million MT in 2024 and cultivation spanning approximately 225,000 hectares (ha), the potato value chain is a vital component of Kenya’s agricultural landscape (AFA 2025). It is also substantial in terms of value, generating revenue exceeding 50 billion Kenyan shillings (more than US\$371 million)<sup>3</sup> annually and providing direct employment to more than 800,000 small-scale farmers, while indirectly supporting an additional 3.5 million individuals across the value chain (Kenya MoALFC 2021). The potato value chain is positioned as a critical driver of rural economic development, particularly in the highland regions of Kenya where potato cultivation is concentrated.

The production landscape of potatoes has transformed in Kenya over the past few decades, driven by the introduction of improved varieties and expanded cultivation zones. Historically, potato cultivation was confined to altitudes between 1,500 and 3,000 meters above sea level. The introduction of improved potato varieties and increased economic importance of potato production has expanded this range to now include regions that are 1,200-1,500 meters above sea level (Kenya MoALFC 2021). Major potato-producing counties at higher altitudes include Nyandarua, Elgeyo Marakwet, Meru, Narok, Uasin Gishu, and West Pokot, while Nakuru, Kiambu, Nyeri, Bungoma, Bomet, Trans Nzoia, and Taita-Taveta dominate production at lower elevations.

In Kenya, approximately 90 percent of potato cultivation is carried out by smallholder farmers, who typically manage land parcels averaging less than 2 ha, mainly in the highlands of the Central, Upper Eastern, and Rift Valley regions (Naziri et al. 2024). These small farms dominate the agricultural landscape,

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<sup>2</sup> This study examines food losses in the Irish potato (*Solanum tuberosum*) value chain. Throughout the report, Irish potato is alternatively referred to simply as potato. Sweet potato (*Ipomoea batatas*), a botanically distinct crop, is not covered in this study.

<sup>3</sup> This is calculated at the 2024 average annual exchange rate of 134.74 Kenyan shilling per US\$1.

particularly in potato-growing regions, where data on officially registered farmers shows that only farmers in Narok manage parcels of more than 1.2 ha on average (KALRO 2024). Potato farmers in Elgeyo Marakwet, Kajiado, Migori, West Pokot, Nakuru, Baringo, Trans Nzoia, Nyandarua, Uasin Gishu, and Laikipia counties cultivate about 0.4 ha of land on average.

Despite its importance to food security and rural livelihoods, Kenya's potato value chain faces substantial challenges related to pre- and postharvest losses that undermine its potential contribution. These inefficiencies translate into an estimated annual loss of approximately 815,000 tons of potatoes (Kaguongo, Maingi, and Giencke 2014), which is equivalent to about 37 percent of the production. A more recent study estimates that about 19-23 percent of Kenya's potato production is lost annually (Mbeche et al., 2025), representing a critical food security challenge. FAO estimates that 5.4 million Kenyans faced acute food insecurity in 2023 (IPC 2023), making the reduction of pre- and postharvest losses a vital strategy for enhancing food availability and accessibility.

**Table 1.1.** Area cultivated and quantity produced in major potato producing counties in Kenya, 2020-2024

County	2020		2021		2022		2023		2024	
	Area	Production	Area	Production	Area	Production	Area	Production	Area	Production
Nakuru (1)	29.9	372.1	40.3	422.2	46.7	523.3	50.0	657.1	48.5	476.9
Nyandarua (1)	38.8	428.3	37.6	384.3	19.6	101.1	43.6	437.7	35.0	394.3
Elgeyo Marakwet	32.0	374.4	31.4	426.0	28.7	276.7	25.1	259.3	24.0	279.3
Meru	21.0	141.9	17.4	224.7	20.5	185.7	24.6	236.4	24.7	263.6
Narok (1)	15.2	150.5	14.6	135.2	12.7	88.0	15.0	140.6	17.9	157.3
Kiambu (1)	16.4	112.7	19.0	123.9	19.2	97.5	19.2	102.6	21.3	126.7
Nyeri (1)	16.4	96.0	16.5	94.4	14.7	97.7	16.4	98.0	12.7	89.6
Bungoma	1.9	19.7	1.9	24.9	9.4	100.7	2.2	27.2	7.5	73.1
Uasin Gishu	7.2	54.4	7.2	56.7	6.9	50.9	7.7	55.6	5.4	70.1
Baringo	3.6	39.2	3.4	45.2	3.5	30.0	3.6	37.2	3.8	42.9
Murang'a	6.5	22.5	6.3	32.7	14.9	66.3	7.5	26.0	7.2	35.8
Bomet	3.5	35.5	3.5	36.3	6.7	78.1	3.9	37.4	2.0	29.3
West Pokot	1.8	17.5	2.5	24.4	1.9	16.1	8.0	96.1	2.5	28.0
Trans Nzoia	1.7	9.8	1.8	9.9	2.8	33.2	1.6	13.2	2.6	26.7
Laikipia	5.1	36.9	8.5	40.3	19.3	53.8	6.1	47.9	6.9	25.9
Kajiado	1.4	6.8	1.1	4.4	1.5	14.1	1.7	10.9	1.3	11.5
<b>Total</b>	<b>204.5</b>	<b>1,939.7</b>	<b>215.7</b>	<b>2,109.6</b>	<b>231.5</b>	<b>1,831.8</b>	<b>239.3</b>	<b>2,309.8</b>	<b>226.0</b>	<b>2,150.0</b>

Source: Kenya AFA Yearbooks of Statistics (2025).

Note: (a) Counties selected for the study are indicated by (1); area is given in '000 hectares; production is in '000 metric tons.

Potato cultivation in Kenya between 2020 and 2024 (Table 1.1) reveals a resilient but volatile production landscape, heavily driven by a few dominant agricultural hotspots and prone to yield shocks. While the total cultivated land steadily expanded from 204.5 thousand hectares in 2020 to a peak of 239.3 thousand hectares in 2023 before contracting slightly in 2024, national production did not follow a linear path; instead, it experienced a massive collapse in 2022 to 1,831.8 thousand metric tons despite an increased land footprint, before bouncing back to its peak of 2,309.8 thousand metric tons in 2023. This production volatility is localized primarily within Kenya's "potato basket" counties – Nakuru and Nyandarua – which collectively dictate national market outcomes. For instance, the macro-drop in 2022 pinpoints a severe crisis localized in Nyandarua, where production plummeted by 80 percent despite only losing 58 percent land area, revealing a devastating drop in yield that largely dragged down the country's output the most.

Nakuru established itself as the most consistent and rapidly growing powerhouse, overtaking Nyandarua by steadily expanding its area and scaling production to a peak of 657.1 thousand metric tons in 2023. Meru county demonstrates a highly positive trajectory, nearly doubling its output from 141.9 thousand metric tons (2020) to 263.6 thousand metric tons (2024) through moderate land expansion (from 21-24.7 ha) and vastly improved crop management.

In general, the potato value chain in Kenya is also characterized by pronounced seasonal price fluctuations, largely driven by the crop's high perishability and limited storage capacity. Because potatoes deteriorate rapidly and only a small share of farmers store their produce, most are forced to sell immediately after harvest, creating seasonal supply gluts followed by off-season shortages (Ateka and Mbeche 2022). This dynamic results in substantial price volatility, with wholesale prices ranging from below KES 20/kg during peak harvest periods to over KES 150/kg in the off-season (KIPPRA 2024). Compared to more storable staples such as maize, which benefit from public buffer stock systems like the Strategic Grain Reserve, potatoes exhibit structurally higher seasonal price variability due to their short shelf life and weak storage infrastructure (KIPPRA 2024; Nzuma et al. 2013). Because smallholder farmers often lack the resources to store their produce and wait for favorable market conditions, they are disproportionately affected. Further compounding these challenges is uneven infrastructure development. While some areas benefit from improved storage and road networks, many others lack essential facilities, hindering postharvest handling, transportation, and market access, ultimately creating disparities in value chain efficiency and farmer profitability.

The role of women and youth in Kenya's potato value chain reflects broader patterns of differentiated participation across value chain nodes. Women tend to occupy vulnerable, informal, and labor-intensive roles and are often absent from the most lucrative parts of the value chain (FAO 2023). They are heavily involved in on-farm production, postharvest handling, and retail trade (FAO 2023). In contrast, men tend to be concentrated in wholesale aggregation, long-distance trade, and input supply, and in segments characterized by higher transaction volumes and stronger market bargaining power. As a result, women's participation, while numerically substantial, is concentrated in lower-margin activities: women are engaged in agrifood sales earning approximately US\$1,035 per month on average, compared to US\$3,087 for men, a gap that reflects differences in the scale and node of value chain engagement (FAO 2023). Youth participation in the potato value chain is constrained primarily by limited access to land, which distinguishes young people from other smallholder groups that face capital and input challenges but are not systematically excluded from land in the same way. These challenges are recognized in the Kenya Youth Agribusiness Strategy 2018–2022, which calls for targeted interventions to strengthen youth engagement across agricultural value chains (Kenya MoALF 2018). The Kenyan government has rolled out policy frameworks aimed at modernizing the value chain and ensuring food security. Box 1 details the evolution of this policy environment for one of the nation's most vital food crops.

### **Box 1: Kenya's agricultural policy environment for food loss and the potato sector**

Kenya's policy framework for the potato sector has evolved through successive strategic interventions. The Agriculture Sector Transformation and Growth Strategy (ASTGS 2019–2029) established the foundational strategic direction, providing a 10-year roadmap for transforming Kenya's agricultural sector into a commercially oriented, food-secure system. It identifies potato as one of 13 priority value chains for agricultural transformation and inclusive growth and mandates the establishment of six agro-processing hubs countrywide. By locating processing capacity closer to production zones, the ASTGS sought to reduce perishability-related losses associated with transportation delays and inadequate on-farm handling.

Enacted the same year, the Crops (Irish Potato) Regulations of 2019 – issued under the Crops Act – introduced mandatory grading, standardized packaging at a maximum of 50 kilograms per unit, labeling requirements indicating variety, county of origin, and date of harvest, and compulsory registration of growers, traders, processors, and collection centers with the Agriculture and Food Authority and county governments. Previously, the packing of potatoes in unregulated 110–180kg bags was a direct driver of postharvest loss. It exposed farmers to systematic underpayment and contributed to physical damage and spoilage during handling. While these regulations created a legal framework for market integrity and loss reduction, implementation remains constrained by uneven enforcement, limited infrastructure, and inconsistent county-level compliance.

Building on the ASTGS, the National Potato Strategy (NPS 2021–2025) provided the first sector-specific multi-year roadmap for the potato value chain. The Strategy articulates nine strategic objectives spanning the full value chain, including strengthening the institutional and regulatory framework, enhancing research and seed systems, increasing on-farm productivity, and improving postharvest management, value addition, and marketing. It explicitly targets loss reduction through improved storage, cold chain development, and enforcement of the 2019 Regulations. The NPS aligns with Vision 2030 and the current government's Bottom-Up Economic Transformation Agenda, which designates potato as one of five priority value chains for inclusive rural growth.

The most recent and directly relevant policy development is the Kenya Postharvest Management Strategy for Food Loss and Waste Reduction (2024–2028). This is the first national strategy to adopt a holistic, multisectoral food systems approach to postharvest food loss and waste, spanning production through retail and consumption. The Strategy acknowledges that concerted upstream investments in production have not been matched by equivalent attention to preserving the harvest, resulting in an estimated 30 percent of food produced being lost or wasted along the supply chain annually. To address this, the Strategy establishes a National Committee on Food Loss and Waste Management to coordinate its strategic pillars including strengthening postharvest infrastructure, improving cold chain systems and storage, building the capacity of value chain actors, and enhancing policy coherence and regulatory enforcement. Potato is among the priority value chains earmarked for targeted interventions under the Strategy's implementation matrix. Aligned with SDG Target 12.3 and the 2014 Malabo Declaration commitments on halving food losses, the 2024–2028 Strategy represents Kenya's most institutionally grounded response to date to the food loss challenge.

The rest of this study is organized as follows: Section 2 defines key concepts and discusses the study's conceptual framework. Section 3 describes the methodology used to measure losses in the potato value

chain and the econometric methods used to investigate correlates of losses at production and postharvest stages, with a subsection focused on the baseline survey data. Section 4 characterizes value chain agents and activities. Section 5 presents the frequency, magnitude, and causes of losses. Section 6 presents the results of the econometric analyses on correlates of losses during potato production and postharvest production. Section 7 presents the conclusions and policy recommendations.

## 2. CONCEPTUAL FRAMEWORK AND DEFINITIONS

This section defines key concepts used in the study and presents the conceptual framework guiding the analysis. The framework situates food losses along the potato value chain, from production through aggregation and processing, and links loss points to the survey modules and empirical analysis.

### 2.1 DEFINITIONS AND CONCEPTS

This section defines concepts related to food losses in crop value chains. Given the FAO's leadership in measuring food loss and waste, these definitions are largely derived from its methodological publications or affiliated institutions and authors.

Value chains comprise “a full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services); delivery to final customers; and final disposal after use” (Kaplinsky and Morris 2002, 4). More specifically, agricultural value chains comprise “the input supply, production, postharvest, storage, processing, marketing and distribution, food service and consumption functions along the “farm-to-fork” continuum for a given product” (FAO 2018, 9).

Agricultural value chains primarily produce food, which the FAO and the World Health Organization (2023, 7) define as “any substance, whether processed, semi-processed, or raw, which is intended for human consumption, and includes drink, chewing gum and any substance which has been used in the manufacture, preparation or treatment of ‘food’ but does not include cosmetics or tobacco or substances used only as drugs.” The production of food in agriculture involves joint production of edible and inedible components of food. The edible part refers to what is traditionally consumed by a specific cultural or economic population (Fabi and English 2019). On the other hand, the inedible portions of the crop, such as stalks, hulls, and leaves, are not food. Crops consumed by animals are not considered food (FAO 2018).

Food value chains involve several stages. Kaplinsky and Morris (2002) define the preharvest stage of crop production as “the time frame between maturity and harvesting.” However, in the context of crop losses, we define the preharvest production stage more broadly to cover the full production cycle – from land preparation through harvest – to capture all factors and processes that contribute to losses. Harvesting is defined as “the deliberate act of separating the food material from the site of immediate growth or production, for instance reaping of cereals, picking of fruits, etc.” (FAO 2018, 13). Postharvest is the period after separation from the site of immediate growth or production. Moreover, the stage of production that comprises harvest and postharvest operations is defined as postproduction (FAO 2018).

Food loss is defined as “all the crop and livestock human-edible commodity quantities that, directly or indirectly, completely exit the postharvest production/supply chain by being discarded, incinerated or otherwise, and do not re-enter in any other utilization (such as animal feed, industrial use, etc.), up to, and excluding, the retail level. Losses that occur during storage, transportation and processing, also of imported quantities, are therefore all included. Losses include the commodity as a whole with its non-edible

parts” (Fabi and English 2019, 6). The FAO (2018) qualifies this definition of food losses as the measurable decrease of food produced, which may be quantitative or qualitative and something that causes any change in the availability of food and in the edibility, wholesomeness, or quality of food that reduces its value to humans. Specifically, losses may be characterized as direct, indirect, quantitative, qualitative, and economic.

Quantitative loss is the decrease in the physical substance of food that would have been eaten had it remained in the food chain. This type of loss is usually quantifiable and assessed through direct measurement. Quantitative loss is closely related to direct loss, defined as the disappearance of food by spillage or consumption attributed to insects, rodents, birds, mold, fungi, or other causes. However, quantitative loss more broadly refers to a reduction in the physical substance of food (by weight or volume) and reflects direct losses as well as other factors such as moisture loss, contamination, and spoilage (Shahbazi et al. 2025; FAO 2018; Aulakh et al. 2013).

Qualitative loss refers to the deterioration of food quality attributes, which may reduce a food's nutritional value, appearance, or other characteristics that make it less desirable for consumption or processing. Qualitative losses could result from food damage, which refers to changes in the appearance and structure of food, such as crushing or breaking produce, which makes it less usable but not necessarily unfit for consumption. This is different from food loss, where food is rendered inedible. Qualitative losses and food damage could result in nutritional loss, which is loss in nutritional value or reduction in nutrients to the human population. This happens because damage and quality degradation mostly affect the food's nutrient content, as pests often target the most nutritious parts (Shahbazi et al. 2025; FAO 2018; FAO 2014; Aulakh et al. 2013).

Qualitative losses also cause reduced marketability and higher rejection rates of food that is less attractive to consumers. Value chain agents bear increased costs of handling, storing, and transporting food that has been damaged or has a shorter shelf life. Lower-quality food fetches lower prices, which directly affects the incomes of value chain agents, particularly producers. These lower prices and incomes translate into economic losses (Shahbazi et al. 2025). In this study, we collect price data to measure the value of both qualitative and quantitative losses.

Food losses usually involve an unintentional reduction in food quantity or quality before consumption. Such losses mostly occur in the earlier stages of the food value chain, including during preharvest, harvest, and postharvest. Preharvest losses occur before the harvest begins and may be the result of attacks by insects, rodents, birds, weeds, or diseases afflicting crops. Harvest losses occur during harvesting and may be the result of shattering, mechanical damage, and shedding of the grain from the ears to the ground (FAO 2018). Losses can also occur during wholesale and retail.

In this study, we define postharvest losses as losses that occur after the crop is harvested, which excludes harvesting losses from postharvest losses. This definition is consistent with Delgado and colleagues (2021, 2), who argue that “PHL (post-harvest losses) is an element of food losses and excludes losses at the production level, although losses during harvest are sometimes misleadingly included in the concept.” In this study, losses during harvesting are included within preharvest production losses (and excluded from postharvest losses), while a third category – left in the field – accounts for losses due to unharvested crop and is included as a component of food losses.

A concept related to food losses is food waste, which is most common toward the end of the value chain at the retail and household level. Food waste refers to “food that is of good quality and fit for human consumption but that does not get consumed because it is discarded – either before or after it spoils. Food waste typically, but not exclusively, occurs at the retail and consumption stages in the food value

chain and is the result of negligence or a conscious decision to throw food away” (Lipinski et al. 2013, 4). As mentioned earlier, food waste is largely concentrated in high-income countries, accounting for 60 to 70 percent of total food loss and waste in these countries, or 25 to 35 percent of food available for human consumption (United Nations Environment Programme 2021; FAO 2011). Food losses are more common in low-income countries and negatively affect food security. Specifically, food losses affect food availability, which is an important dimension of food security, because food losses reduce the total quantity or quality of food produced, brought through market mechanisms, held by traders and in government reserves, and supplied by the government and/or aid agencies (FAO 2018; Kör et al. 2022).

## 2.2 CONCEPTUAL FRAMEWORK

Figure 2.1 illustrates the conceptual framework guiding this study. This framework situates food losses within the structure of the potato value chain, spanning from production to processing. The data collected in this study trace the flow of potato from its production on the farm to its final transformation. Accordingly, the conceptual framework captures how the activities undertaken at each stage generate distinct types of quantitative and qualitative losses and how these losses accumulate to determine the total volume and value of potato lost across the value chain.

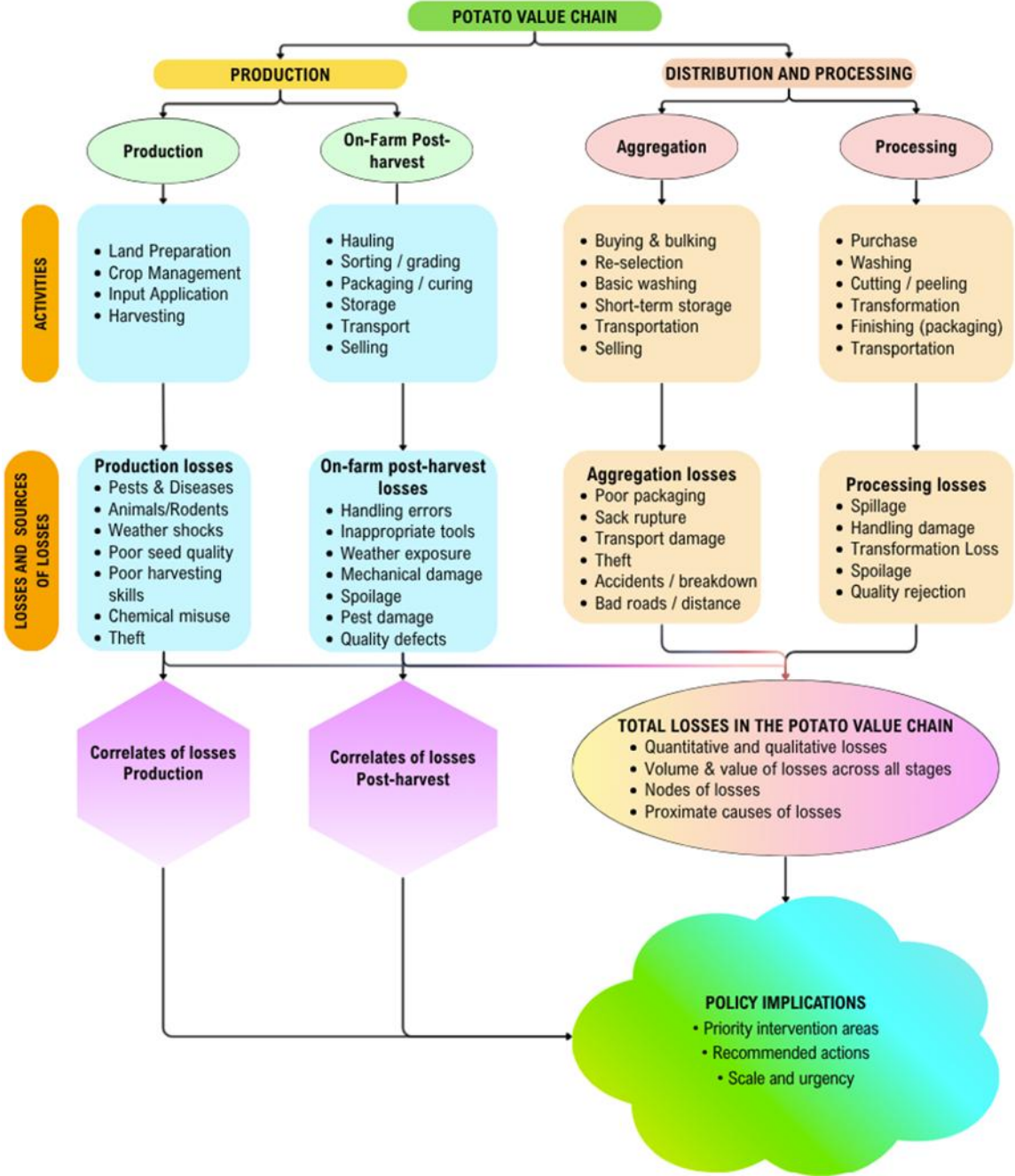
The conceptual framework shows how the data collected are used in different sections and subsections of the paper. The four major columns of the conceptual framework depict the different components of the potato value chain covered in this study – beginning with potato production and on-farm postharvest handling activities performed by producers, and followed by aggregation and processing activities performed by the respective value chain agents. Section 4 of the study characterizes producers, aggregators, and processors across demographic and spatial variables (section 4.1) before describing the activities in the four nodes of production, on-farm postharvest, aggregation, and processing.

At the initial stage of the value chain, producers undertake core production activities, starting with land preparation and ending with harvesting. Following harvest, potato producers perform a sequence of on-farm postharvest operations that start with hauling harvested potato from the field, storing it, and/or selling it. Aggregators’ activities involve the purchasing, bulking, grading, occasional processing, transporting, and selling of potato. Potato processors engage in purchasing, washing, peeling, and processing potato into different products.

Each of these activities expose the potato to numerous loss-inducing factors. The third level of the conceptual framework, which is indicated as *Losses and Sources of Losses*, corresponds to section 5 of the study, where we measure losses, indicate where losses occur, and describe the sources of these losses. Losses at the production stage are likely to arise for multiple reasons, including pests and diseases, animal and rodent attacks, weather shocks such as drought or flooding, chemical misuse, and suboptimal harvesting techniques. Losses during postharvest production activities result from handling errors, mechanical or physical injury to potato tubers caused by force or friction, and weather exposure leading to spoilage, greening, sprouting, or rotting, among other causes.

This study treats losses at preharvest and postharvest as analytically distinct. However, both nodes of production are identified as the basis for assessing the correlates of losses, which the study examines through econometric analyses. At the aggregation stage, losses could result from poor packaging, such as sack overfilling and compression, sack rupture, or theft. Processor-level losses could result from spillage, handling damage, spoilage, transformation inefficiencies, or spoilage.

**Figure 2.1.** Conceptual framework of the potato value chain



Source: Authors' illustration.

Losses occurring at all four nodes collectively determine total losses within the potato value chain, which comprise both quantitative losses (physical tuber loss) and qualitative losses (deterioration of tuber quality). The framework also emphasizes that the study measures both volume and value losses, thereby capturing their full economic implications. The study also measures the relative importance of each node of the value chain as part of the total value and volume of losses, while also describing the prevalence of proximate causes of losses (biotic and abiotic stressors) across the value chain.

The econometric analysis component of the study aims to identify factors that contribute to potato losses during production and postharvest production. These analyses thereby point to important policy implications to reduce losses at this important stage of the value chain, which would likely have positive impacts on subsequent value chain nodes as well as spillover benefits for downstream nodes.

The framework demonstrates that the analyses in this study provide a basis for identifying actionable policy pathways. By mapping where and how losses occur, the study highlights priority intervention points along the value chain; the types of technical, behavioral, or institutional responses required; and the scale and urgency of potential interventions. These insights aim to support evidence-based policymaking targeted at reducing potato losses, improving value chain efficiency, and strengthening food system resilience.

## 3. EMPIRICAL FRAMEWORK

This section first describes the methodologies used for our food loss and econometric analysis. In the second subsection, the study's pre- and postharvest loss data are described, specifically the data collected in the baseline survey of the Irish potato value chain in Kenya.

### 3.1 ESTIMATION METHODS

#### 3.1.1 *Measurement of losses*

This study follows the food loss measurement methodology of Delgado and colleagues (2021), which implements three alternative methodologies for measuring food losses, in addition to the traditionally used method of aggregate self-reported loss. The three alternative methodologies measure losses at different stages of the value chain and are comparable across crops and regions/countries. These methodologies are implemented using data collected through representative surveys. In this study, we use data collected along Kenya's Irish potato value chain through a survey of producers, aggregators, and processors (described in section 3.2). These surveys allow us to characterize the input use and practices of each agent during the production, postharvest, aggregation, and processing stages and to estimate the quantity, quality, and value of outputs, as well as losses as the product travels along the value chain.

This study specifically uses the "attribute method," which involves evaluating a crop according to inferior visual, tactile, and olfactory product characteristics. This method improves on existing methodologies by (1) following a sampling procedure that captures food losses in areas with considerable importance in each value chain; (2) accounting for losses across multiple stages of the value chain (preharvest and postharvest production through the product distribution and processing stages); and (3) measuring quantitative food losses while also accounting for losses resulting from qualitative deterioration

The attribute-based methodology estimates total losses as the sum of the amount of food entirely lost (quantitative loss/degradation) and losses due to food affected by quality deterioration (qualitative loss/degradation), as distinct from quantitative loss/degradation. These losses are measured at the three broad nodes of the potato value chain in Kenya for which data were collected using detailed survey questionnaires.

We estimate quantitative and qualitative losses during potato production and on-farm postharvest handling using data collected in the potato producer baseline survey, which pertains to the harvest and immediate postharvest period of the major potato season of 2024. Data collected from the aggregators' and processors' surveys are used to estimate food losses that occurred from potato purchases to sale during

a one-month period prior to the survey. Due to the heterogeneity of transformation processes at later stages in the value chain, only the aggregate self-reported measurement method is used at the processor level.

In the attributes method, product attributes are identified prior to survey implementation in collaboration with commodity experts, local experts, and value chain actors. In addition, an extensive pilot was conducted to validate the attributes. The number of attributes varies between 10 and 14, according to the commodity and country. In the survey, the producer evaluates their production and establishes the share of output that was damaged or affected by inferior attributes, both during production (immediately after harvest) and after postharvest production activities. Aggregators evaluate their product from the previous month at both purchase and sale. The producer and the aggregators declare how much of their respective produce is considered inferior and whether their buyers penalize them for these product attributes by paying a lower price. The attribute-specific price penalty is used to estimate value losses.

Total potato lost at the producer level is captured by the sum of quantity and quality degradation in volume/weight (*Weight loss<sub>p</sub>*) and in value (*Value loss<sub>p</sub>*) for each producer *p*, as given by equations 1 and 2, respectively:

$$Weight\ loss_p = Q_{Prod,p} - Q_{PH,p} + \sum_{j=1}^J a_{j,p} * Q_{PH,p} \quad (1)$$

$$Value\ loss_p = V_{Prod,p} - V_{PH,p} + \sum_{j=1}^J \bar{P}a_{j,p} * Q_{PH,p} \quad (2)$$

where  $Q_{Prod,p}$  and  $Q_{PH,p}$  are the quantity of all produce after production and after postharvest, respectively, for producer *p*, while  $a_{j,p}$  is the share of product affected by damage attribute *j*. Similarly,  $V_{Prod,p}$  and  $V_{PH,p}$  are the value of all produce after production and after postharvest, respectively. The respective values are obtained as multiples of  $Q_{Prod,p}$  by  $\bar{P}_{ideal}$  and  $Q_{PH,p}$  by the ideal price  $\bar{P}_{ideal}$  by  $\bar{P}_{ideal}$ , whereby the ideal price,  $\bar{P}_{ideal}$ , is the average sales price for an ideal product.  $\bar{P}a_{j,p}$ , is the average price punishment for an inferior product with damage attribute *j*. This is obtained as a difference between the ideal producer price for the product at the producer level and the lower producer-level price associated with the inferior product of damage attribute *j*. While the first terms of equations 1 and 2 provide the total quantity or value lost (quantity degradation) during preharvest production and postharvest production activities, the second terms capture the quantity affected by quality loss/degradation during the same nodes of the value chain.

At the aggregator level, the quantity and quality degradation in weight (*Weight loss<sub>m</sub>*) and in value (*Value loss<sub>m</sub>*) for aggregator *m* are given by equations 3 and 4, respectively:

$$Weight\ loss_m = Vol\ quantitative\ losses_m + \sum_{aj=1}^J (Q_{Purchase,aj,m} - Q_{Sale,aj,m}) \quad (3)$$

$$Value\ loss_m = Value\ quantitative\ losses_m + \sum_{aj=1}^J (V_{Purchase,aj,m} - V_{Sale,aj,m}) \quad (4)$$

where *Vol quantitative losses<sub>m</sub>* and *Value quantitative losses<sub>m</sub>* are the volume and value of quantitatively lost produce, respectively, at the aggregator level.  $Q_{Purchase,aj,m}$  and  $Q_{Sale,aj,m}$  are the quantities of potato purchased and sold, respectively, by aggregators with qualitative damage attributes of *aj* by aggregator *m*.  $V_{Purchase,aj,m}$  and  $V_{Sale,aj,m}$  are the values at purchase and sale of qualitatively damaged harvest with attribute *aj*. The respective values are obtained as multiples of the quantities affected by

qualitative damages ( $Q_{Purchase,aj,m}$  and  $Q_{Sale,aj,m}$ ) by the corresponding average price penalty at purchase and sale. These, in turn, are obtained as a difference between aggregator-level ideal market price and the lower price associated with inferior product of damage attribute  $aj$  that aggregators receive from processors or consumers.

For processors, we only consider quantitative losses, taking the aggregate self-reported quantitative losses as measures of food losses at this stage of the value chain. This is captured by the first terms of equations (3) and (4) above.

### 3.1.2 Correlates of incidence and severity of food losses

We conducted econometric analyses to determine the associates of preharvest and postharvest food losses among potato producers in Kenya. We specifically use the term *correlates* since some of the variables used as explanatory (righthand side) variables in these analyses could simultaneously be jointly determined by producers and hence could fail the criteria to be considered *determinants*. For instance, producers' labor and herbicide use decisions may be made jointly with the occurrence and extent of losses expected pre-production. Similarly, producers' decision to use specific postharvest methods and storage infrastructure may be determined together with their expectations of occurrence and severity of postharvest losses.

To examine both the likelihood and severity of potato losses among sampled producers, we estimate a two-equation framework combining a Probit model for the incidence of damage and a Tobit model for the intensity/percentage of damage. First, let  $D_p \in \{0,1\}$  denote whether producer  $p$  experienced any crop damage, and let  $X_p$  be a vector of explanatory variables capturing household characteristics, production and marketing practices, agro-ecological conditions, and other spatial characteristics. The probability of observing crop damage at preharvest and postharvest production is modeled using a standard Probit specification:

$$\Pr(D_p = 1 | X_p) = \Phi(X_p' \beta) \quad (5)$$

where  $\Phi(\cdot)$  is the standard normal cumulative distribution function and  $\beta$  is the parameter vector to be estimated. The log likelihood equation associated with (5) is given as:

$$l(\beta) = \sum_p D_p \cdot \ln \Phi(X_p' \beta) + (1 - D_p) \cdot \ln (1 - \Phi(X_p' \beta)) \quad (6)$$

We model the severity of preharvest and postharvest production potato losses using the observed percentage of loss  $P_p \in [0, 100]$ . The boundaries (0 and 100) naturally limit food losses that producers can experience, which dictates that we implement a two-sided Tobit model:

$$P_p^* = X_p' \gamma + u_p, \quad u_p \sim N(0, \sigma^2), \quad (7)$$

$$P_p = \begin{cases} 0, & P_p^* \leq 0, \\ P_p^* & 0 < P_p^* < 100, \\ 100 & P_p^* \geq 100, \end{cases} \quad (8)$$

where  $P_p^*$  is a latent continuous damage propensity. Parameters  $\gamma$  and  $\sigma$  are estimated by maximum likelihood method using the standard Tobit log-likelihood with lower and upper bounds at 0 and 100. Because Tobit coefficients do not directly represent effects on the observed outcome, we compute average mar-

ginal effects on the unconditional expected percentage damage,  $E[P_p|X_p]$ , using the standard decomposition of the Tobit model into effects on the probability of being uncensored and the expected severity among uncensored observations.

In the equations above,  $X_p$  is a vector of variables pertaining to producer  $p$ , including demographic variables (age, gender, education, household size, household wealth, and experience growing potato). We also use variables related to potato production and marketing such as area under potato, share of potato output sold, potato price gap between abundant and lean seasons, membership in agricultural cooperatives, and types of inputs used in potato production. The third group of variables include those that are specifically related to problems encountered during potato production, such as insect infestations and disease, weeds, drought, and others that represent proximate causes or biotic and abiotic stressors that directly and indirectly affect the likelihood and severity of losses during production. Finally, we include spatial variables, such as rainfall and temperature during production season, dummy variables representing states, and whether the area receives Mastercard Foundation's partner interventions

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The corresponding likelihood/Probit equation of the postharvest production activities add two types of variables. First, we include the share of preharvest losses in the likelihood and severity equations of postharvest losses. This is justified given that the extent of preharvest qualitative losses affect the extent of total (qualitative and quantitative) losses at postharvest. The second type/group of variables pertain to the postharvest methods of production and equipment that producers use, which can clearly affect the extent and severity of postharvest losses. We also use weather variables that pertain to the postharvest period of potato production.

In estimating both Probit and Tobit equations we also cluster the variance-covariance matrix across wards, the smaller administrative units in Kenya, to adjust for within-ward correlation in the regression error terms.

## **3.2 DATA: BASELINE SURVEY OF FOOD LOSSES IN KENYA'S POTATO VALUE CHAIN**

This study uses primary data collected in the baseline survey of food losses in Kenya's potato value chain. This section discusses the study area covered in the surveys, the sample design and size, fieldwork, questionnaires, and limitations of the surveys.

Data were collected by interviewing the main agents in the potato value chain (namely potato producers, aggregators, and processors) through well-structured questionnaires. This involved collecting quantitative and qualitative information from participants along the potato value chain through in-person interviews. Three distinct questionnaires were prepared and administered to these value chain agents.

In the producers' survey, information was obtained from producers who cultivated potato, completed harvest, and sold all or part of their harvest during the 2023 planting season. The data collected in this part of the survey included information on farmer and household demographics and characteristics, volume and value of potato produced, pest infestation and disease and management strategies, preharvest losses, and harvest/postharvest handling practices.

Potato aggregators are those who purchased potato from producers for resale in larger markets or processors during the 2023 production season. The data collected in the potato aggregators' survey pertains to the last 30 days of aggregators' activities and included information on business enterprise activities, quantity and value of potato purchased from producers and other intermediaries during the 2023 planting season, price fluctuations, quality of purchased potato and associated costs, quantity and quality of potato sold and related price adjustments, and sources of damage during aggregation.

The potato processors' survey included processors that acquired potato either from the aggregators or directly from producers during the 2023 planting season. Data collected in this component of the survey pertained to the last 30 days of processors' activities and included information on the type and ownership (structure) of the business; quantity and cost of potato purchased; quality of potato acquired and price penalties associated with quality degradation; sources of qualitative losses; and quality depreciation or quantity of losses at various processing stages.

### **3.2.1 Study area**

IFPRI conducted the potato losses baseline survey from February to April 2024 in collaboration with Innovations for Poverty Action Kenya. This study focused on five purposively selected major potato-producing counties in southwestern Kenya (Figure 3.1). Three counties – Nyandarua, Nakuru, and Narok – were chosen from the treatment<sup>4</sup> group, where Mastercard Foundation's implementing partner promotes technologies and practices to reduce postharvest losses. Two counties – Nyeri and Kiambu – were selected as the control group from areas without these interventions. The selection aimed to include counties with similar characteristics, particularly in terms of potato production and market access. These five counties were among the ten most important potato-producing counties on average between 2020 and 2024 (Table 1.1).

### **3.2.2 Sampling strategy**

Within each of these selected counties, the recruitment of eligible potato producers followed the organization of administrative units in Kenya, which is divided into 47 counties. Counties are subdivided into subcounties, which are further subdivided into the respective lower administrative units of wards, sublocations, and villages. A stratified random sampling method with proportional allocation was used to select potato producers from the five counties using the 2023 short-rain-season data for each selected ward. Additionally, chain-referral sampling was employed to select aggregators and processors by asking producers to identify their buyers. The sample size at the ward level was determined based on the proportion of Irish-potato-producer data from the Kenya Census of Agriculture 2023. This ward-level sample size was then used to determine the required samples at the sublocation and village levels.

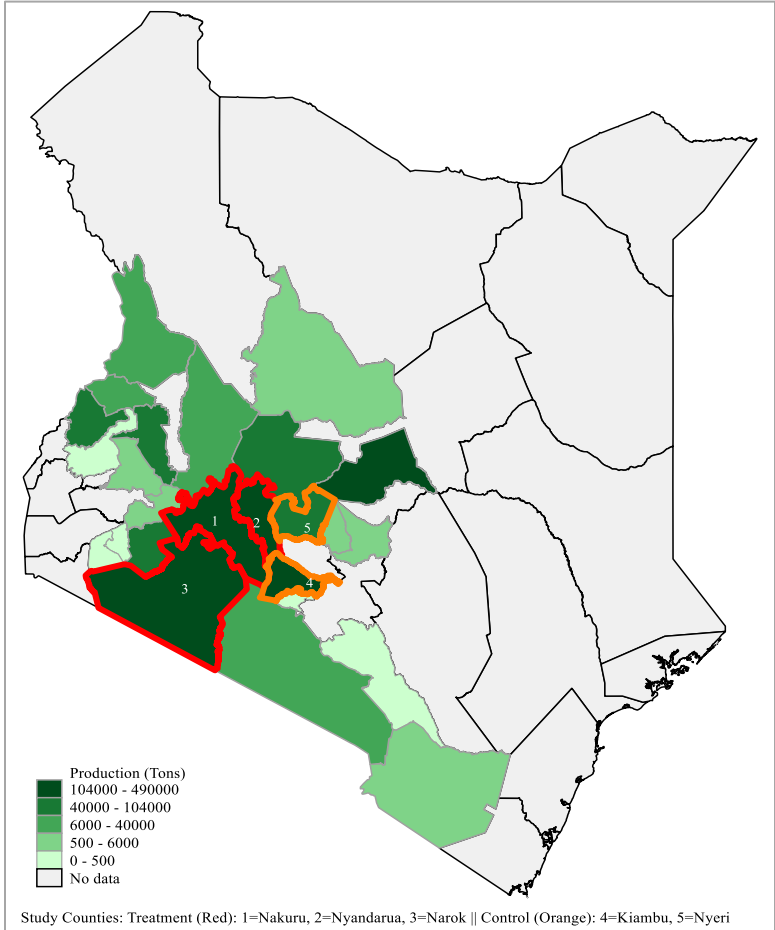
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<sup>4</sup> The terms "treatment" and "control" refer to the programmatic classification of the study areas within the baseline design. These comparisons are descriptive and are intended to highlight differences across the sampled contexts; they should not be interpreted as causal treatment effects at baseline.

To select the treatment counties, we generated a list of counties at the ward level where other projects were either already operating or expected to operate.<sup>5</sup> From this list, we chose Nyandarua, Nakuru, and Narok (ranked 1<sup>st</sup>, 2<sup>nd</sup>, and 6<sup>th</sup>, respectively) as the treatment counties and selected Kiambu and Nyeri (ranked 7<sup>th</sup> and 8<sup>th</sup>, respectively) to match the treatment group. Meru and Elgeyo Marakwet counties (ranked 5<sup>th</sup> and 4<sup>th</sup>) were not selected because they did not receive any postharvest-loss interventions.

We selected subcounties for the treatment group based on the number of producers in each county, which is an important indicator of the importance of the crop. For each county, we selected the three sub-counties with the highest number of producers, providing a preselected list of treatment wards. All wards within these selected subcounties were included in the treatment group sample.

**Figure 3.1.** Map of study area indicating focus counties



**Source:** Authors' elaboration based on the Kenya Irish potato losses baseline survey (2024)

To randomly select control wards, we used the calculated average travel time to the road for treatment wards as a threshold. As a result, all wards in the control group that had a travel time equal to or less than the average for the treatment wards were deemed eligible, provided they were also accessible in terms of proximity to the main road. From this final list of treatment and control wards, we selected pairs for comparison following a specific procedure.

<sup>5</sup> The interventions of the other Mastercard Foundation–funded projects in the Irish potato value chain in Kenya include providing trained harvest service providers, training farmers on synchronized harvest to access the market, and harvesting a mature crop. See the [Regional Initiative to Strengthen Food Systems and Bolster Livelihoods of Smallholder Farmers and Young People](#) for more details.

This process involved a methodology based on raster analysis, adapted from Maruyama and colleagues (2018). First, we projected global geographic data on water, roads, railroads, topography, and natural barriers – publicly available from DIVA-GIS – and land-cover-type data from the National Aeronautics and Space Administration and the United States Geological Survey for Kenya. Second, we divided the country into equal-sized grids of 100 m<sup>2</sup> and calculated travel time estimates to account for the specific topologies of each grid. Third, we estimated optimized travel time from the center of each village to the nearest primary or secondary road and the closest city.

This methodology enabled the effective selection of comparable treatment and control wards, by matching them on travel time as a proxy for accessibility and market access. Travel time is a standard measure of spatial accessibility in transport geography and is widely used to capture the ease with which populations can reach economic opportunities and services. By ensuring similarity in accessibility conditions between wards, the approach reduces location-based confounding and enables a more robust and credible comparison of outcomes (Rodrigue, 2020; Benassai-Dalmau et al., 2025).

### **Sampling of producers**

We decided to select a target sample size of 600 potato producers distributed across the five counties, given budgetary considerations. To account for potential non-responses or participant unavailability during data collection, we implemented sampling with replacement. The 600 producers were divided into two groups, with ward-level data from the Kenya Census of Agriculture serving as the sampling frame.

Wards were selected from a predefined list organized by subcounty and county, which included potential control wards. The primary selection criterion was accessibility, measured by travel time to primary or secondary roads, with treatment ward travel times serving as the threshold for comparison. Both treatment and control wards were sampled accordingly. Table 3.1 presents the distribution of control wards by accessibility category. To strengthen comparability and minimize variability between groups, treatment and control wards were systematically paired and matched, thereby enhancing the statistical power to detect meaningful effects.

The final sample size of 609 producers reflects a slight oversampling of the planned 600 to ensure balance across treatment groups. Ward-level targets, such as the 10 producers in Kiptagich, were set proportionally based on actual producer populations rather than fixed quotas to preserve the statistical validity of the distribution.

To identify producers, we conducted a listing exercise in selected villages, inviting farmers who met specific criteria. To be considered for selection, potato producers had to meet specific criteria. First, they had to have cultivated potatoes during the 2023 short season, which covered the September–November 2023 period. Second, they had to farm potatoes individually for the harvest season in question. Finally, a significant portion of their harvest had to be sold, with the majority of their crop being sold primarily for commercial purposes.

### **Sampling of aggregators and processors**

Aggregators and processors represent critical but often overlooked segments of the potato value chain. Unlike producers, who can be identified through agricultural census data and farmer registries, these actors frequently operate through informal channels, lack fixed business premises, and are absent from official directories. Consequently, no comprehensive sampling frame existed for either group at the outset of this study.

**Table 3.1.** Sampling distribution of potato producers in Nakuru, Narok, Nyandarua, Kiambu, and Nyeri counties, Kenya

County	Subcounty	Ward	Sublocation	Village	Treatment status	Final sample size at village level	Design sample size at ward level	Final sample size at ward level	
Nakuru	Kuresoi North (1)	Kiptororo	Chemare	Seretiot	Treatment	27	27	27	
		Nyota	Solliat	Arimi	Treatment	46	49	46	
		Sirikwa	Sirikwa	Gacharage A	Treatment	18	18	18	
	Kuresoi South (2)	Amalo	Amalo	Chesoan East	Treatment	8	8	8	
		Keringet	Milimet	Chebitoik	Treatment	32	32	32	
		Kiptagich	Kiptagich	Mlango	Treatment	10	5	10	
	Molo (3)	Elburgon	Elburgon	Sokoro	Treatment	15	15	15	
Molo		Molo Town	Maishani	Treatment	8	13	14		
			New Location	Treatment	6				
Narok	Narok East (1)	Ildamat	Enkorika	Jacob Sinkwa	Treatment	3	10	10	
				Parmois Lempaka	Treatment	7			
	Narok North (2)	Olokurto	Entiyani	Shura	Treatment	14	14	14	
		Olorropil	Topoti	Oltiani	Treatment	24	24	24	
	Narok South (3)	Sogoo	Sogoo	Marinwak	Treatment	5	7	12	
				Sogoo Centre	Treatment	7			
Nyandarua	Kinangop (1)	Engineer	Kahuru	Kifuno	Treatment	30	30	30	
	Kipipiri (3)	Githioro	Mawingu	Lower Gakorofa	Treatment	19	17	19	
		Wanjohi	Rironi	Jiret B	Treatment	31	32	31	
Kiambu	Gatundu South (3)	Kiamwangi	Karembu	Gikurweini	Control	1	10	10	
				Githioro	Control	1			
			Kigongo	Kahunyo	Control	1			
				Kiangai A	Control	2			
				Kiangai B	Control	3			
				Kuguthi	Control	1			
		Kiganjo	Gatitu	Gatitu	Control	2	10	13	
				Gaturimaru	Control	2			
				Muhuhu	Control	6			
				Shora	Control	3			
		Ndarugo	Gacharage	Cununiki	Control	2	5	5	
				Thiririka	Control	3			
	Ngenda	Gatundu South (3)	Gatundu South (3)	Githuya	Gathei township	Control	3	25	24
					Githuya	Control	1		
					Kareru	Control	2		
					Marigi	Control	3		
					Mucharage	Control	3		
					Muthiga	Control	1		
					Mutundu	Control	1		
					Handege	Karirau	Control		
Kimunyu	Kivedera	Control	1						
	Therereka A	Control	1						
	Therereka C	Control	2						
Mutomo	Kiahwai	Control	3						
Lari (1)	Kamburu	Matimbei	Raini	Control	8	9	8		

County	Subcounty	Ward	Sublocation	Village	Treatment status	Final sample size at village level	Design sample size at ward level	Final sample size at ward level
		Kijabe	Kambaa	Mung'ere B	Control	20	20	20
		Kinale	Kirasha	Gathwariga	Control	19	47	45
				Ha thing'a	Control	11		
				Junction B	Control	15		
		Lari	Ibonia	Gathabai	Control	2	19	19
				Gatharo	Control	8		
	Kabunge			Control	9			
	Nyanduma	Nduriri	Feya	Control	6	6	6	
	Limuru (2)	Bibirioni	Ngarariga	Mburu Marenga A	Control	2	13	13
				Mburu Marenga B	Control	11		
		Limuru Central	Kimirithu	Giaitunda	Control	8	13	13
				Ngenia	Control	5		
		Limuru East	Karanjee	Karanjee	Control	2	2	2
		Ndeiya	Kiriri	Kiriri	Control	5	20	20
				Nguirubi A	Control	10		
				Nguirubi B	Control	5		
Ngecha/Tigoni	Ithanji	Tigoni	Control	3	5	5		
		Tumaini	Control	2				
Nyeri	Kieni East (1)	Thegu River	Gatei	Ngatha	Control	3	14	14
				Richardson	Control	11		
	Kieni West (2)	Endarasha/Mwiyogo	Kinyaiti	Wa Karuga	Control	52	52	52
		Mugunda	Karemeno	Ndemu	Control	11	11	11
		Mweiga	Bondeni	Gachichi	Control	19	19	19

**Source:** Authors' elaboration based on the baseline survey of food losses in the Irish potato value chain in Kenya (2024).

**Note:** Several specific considerations influenced our data and sampling methodology. Numbers in parentheses indicate the subcounty's ranking within its county based on producer count. For Nyeri county, census information was only available for producers from two subcounties. Furthermore, Melili ward (Narok North subcounty, Narok county) was excluded from sampling due to unavailable census data. Lastly, in Nyandarua county, the Mastercard Foundation project's list only included producers from Kinangop (1) and Kipipiri (3), even though Kinangop (1), Mirangine (2), and Kipipiri (3) were the three principal subcounties by producer count.

To address this challenge, we employed chain referral sampling, also known as snowball sampling, for both populations. This non-probability technique is particularly suited for hard-to-reach groups, as it leverages existing social and commercial relationships to identify potential respondents. Information gathered during producer interviews served as the entry point for both referral chains, with producers asked to identify individuals or businesses involved in purchasing, bulking, or processing Irish potatoes in their areas.

### Aggregators

Aggregators function as intermediaries who purchase potatoes from multiple farmers, consolidate these purchases, and sell onward to traders, processors, or retailers. Their operations are typically mobile and transactional, often conducted at farm gates, local collection points, or informal market spaces rather than permanent business locations. This fluidity makes them particularly difficult to capture through conventional enumeration.

Initial referrals from producers enabled the survey team to identify local buyers and brokers actively engaged in potato trading. These first-wave respondents – usually one or two per location – were interviewed and subsequently asked to refer enumerators to other aggregators within their trading circles (Table 3.2).

**Table 3.2.** Sampling distribution of potato aggregators in Nakuru, Narok, Nyandarua, Kiambu, and Nyeri counties, Kenya

County	Subcounty	Ward	Aggregators' sample size
Nakuru	Kuresoi North	Kiptororo	10
	Kuresoi South	Keringet	15
	Molo	Elburgon	7
		Molo	-
Narok	Narok East	Ildamat	12
	Narok North	Melili	3
		Olokurto	1
		Olorropil	9
	Narok South	Melelo	2
		Sogoo	12
Nyandarua	Kinangop	Engineer	15
	Kipipiri	Geta	1
		Githioro	13
		Wanjohi	1
Nyeri	Kieni East	Naromoru/Kiamathaga	5
		Thegu River	10
	Kieni West	Mugunda	7
		Mweiga	8
Kiambu	Limuru	Bibirioni	3
		Limuru Central	4
		Nachu	3
	Lari	Kijabe	3
		Kinale	5
		Lari	2
	Gatundu South	Ngenda	10
			<b>Total</b>

**Source:** Based on the baseline survey of food losses in potato value chain of Kenya (2024).

## Processors

In contrast to aggregators, processors are engaged in transforming raw potatoes into value-added products such as chips, crisps, and other processed foods. This group exhibits considerable heterogeneity, ranging from vendors frying chips for local consumers to medium-scale enterprises supplying packaged products to supermarkets and distributors.

Building on the referral framework established during aggregator sampling, the team extended its inquiries to capture actors involved in processing activities. Producers and aggregators alike were asked to identify businesses or individuals to whom potatoes were sold for processing purposes. This dual-source approach enriched the initial pool of processor contacts. The first wave of processor respondents were interviewed and asked to refer enumerators to others within their supply networks. This strategy was particularly crucial for reaching processors operating informally (Table 3.3).

**Table 3.3.** Sampling distribution of potato processors in Nyandarua, Nakuru, and Narok counties, Kenya

County	Subcounty	Ward	Processors sample size
Nakuru	Kuresoi North	Kiptororo	3
	Kuresoi South	Keringet	6
	Molo	Elburgon	3
		Molo	1
Narok	Narok East	Ildamat	4
	Narok North	Melili	2
		Olokurto	-
		Olorropil	3
	Narok South	Melelo	1
		Sogoo	3
Nyandarua	Kinangop	Engineer	5
	Kipipiri	Geta	-
		Githioro	5
		Wanjohi	-
Nyeri	Kieni East	Naromoru/Kiamathaga	-
		Thegu River	5
	Kieni West	Mugunda	3
		Mweiga	2
Kiambu	Limuru	Bibirioni	1
		Limuru Central	1
		Nachu	1
	Lari	Kijabe	2
		Kinale	2
		Lari	-
	Gatundu South	Ngenda	3
		<b>Total</b>	<b>56</b>

**Source:** Based on the baseline survey of food losses in potato value chain of Kenya (2024).

### 3.2.3 Survey instruments, key modules, and questions

We developed three comprehensive survey tools covering various aspects of the potato value chain. Specifically, each of the tools were used in the producer, aggregator, and processor surveys. The survey tools serve the purpose of quantifying food loss throughout the value chain, using standardized approaches that can be used to compare data collected across different commodities and regions. Additionally, they allow us to characterize the nature of food loss, particularly to identify the production and postharvest stages and specific processes during which losses occur.

The producer survey questionnaire consists of several modules, each serving a unique purpose (Figure 3.2):

**Roster and producer identification (Module 1):** Used to identify and register the producer. This module provides information on age, sex, and education, as well as household and locational/geographic characteristics.

**Asset and production characteristics (Modules 2 and 3):** Data related to assets and production characteristics (such as input use, technology adoption, and outputs).

**Preharvest losses (Module 4):** Measurement of the quantity of potato lost during the preharvest stage and identification of the sources of these losses, as well as value losses due to qualitative degradation, thereby capturing producers’ incentives to improve the quantity and quality of production.

**Potato left in the field (Module 5):** Record of the quantity of good quality potato that remains in the field after harvest and the reasons it was left behind.

**Harvest and quality assessment (Module 6):** Data on the total production harvested, as well as the qualities, attributes, and prices associated with the harvest.

**Harvest and postharvest losses (Module 7):** Information on the quantity affected by quality degradation<sup>6</sup> and the total quantity lost<sup>7</sup> during postharvest activities, such as winnowing, threshing, grading, transporting, and packaging. This module also captures postharvest handling and storage techniques that contribute to food losses and measures the value lost due to qualitative degradation and quantitative losses, gauging producers’ incentives to improve the quantity and quality of production.

**Product destination and sale attributes (Module 8):** Product’s destination, specifically whether it is for consumption, sale, donation, or other purposes. This module also records attributes related to the quantity intended for sale.

**Figure 3.2.** Producer survey questionnaire modules

<p><b>Roster and Producer Identification</b> <i>(Module 1)</i></p> <ul style="list-style-type: none"> <li>• Producer identification (name, age, telephone)</li> <li>• Education and household members</li> <li>• Location</li> </ul>	<p><b>Productive Assets</b> <i>(Module 2)</i></p> <ul style="list-style-type: none"> <li>• List of specific assets</li> <li>• Quantity and price (value)</li> </ul>	<p><b>Production Characteristics</b> <i>(Module 3)</i></p> <ul style="list-style-type: none"> <li>• Area, technology, labor</li> <li>• Fertilizer use (type, times, quantity, costs)</li> <li>• Production issues (insects, diseases, weeds)</li> <li>• Pesticides and fungicides (type, times, quantity, costs)</li> </ul>	<p><b>Pre-harvest Losses</b> <i>(Module 4)</i></p> <ul style="list-style-type: none"> <li>• Reasons for loss</li> <li>• Quantity of affected product and value</li> <li>• Quantity of totally lost product and value</li> </ul>
<p><b>Beans Left in the Field</b> <i>(Module 5)</i></p> <ul style="list-style-type: none"> <li>• Reasons for left in the field</li> <li>• Area</li> <li>• Quantity</li> <li>• Value</li> </ul>	<p><b>Harvest and Quality Assessment</b> <i>(Module 6)</i></p> <ul style="list-style-type: none"> <li>• Quantity produced</li> <li>• Quantity damaged by attributes</li> </ul>	<p><b>Harvest and Post-harvest Losses</b> <i>(Module 7)</i></p> <ul style="list-style-type: none"> <li>• Specific activities</li> <li>• Quantity of affected product and value</li> <li>• Quantity of totally lost product and value</li> <li>• Reasons for losses</li> </ul>	<p><b>Product Destination and Sale Attributes</b> <i>(Module 8)</i></p> <ul style="list-style-type: none"> <li>• For each use: quantity and value, quantity of affected and lost product</li> <li>• For sale: quantity damaged by attributes, penalization by attributes</li> <li>• Price in scarcity and in abundance time</li> </ul>

**Source:** Baseline survey of food losses in potato value chain of Kenya (2024).

<sup>6</sup> Affected product: Product that lowers quality but can still be used.

<sup>7</sup> Totally lost: Product that is completely lost and cannot be used.

The aggregators' survey questionnaire comprises four distinct modules (Figure 3.3):

**Roster and aggregator identification (Module 1):** Identification and registration of the aggregator. This module collects information on age, sex, and education, as well as geographical location.

**Purchase details (Module 2):** Information about the quantity, quality, value, and attributes of the total product purchased during a specified period.

**Postharvest losses (Module 3):** Quantification of the quantity and value of affected product and the total loss and value incurred during postharvest processing activities for potato.

**Sales information (Module 4):** Quantity, quality, attributes, and value of the total product sold within a defined period, tailored to the context of Kenya.

**Figure 3.3.** Aggregator survey questionnaire modules

Roster and Aggregator Identification <i>(Module 1)</i>	Purchase Details <i>(Module 2)</i>	Post-harvest Losses <i>(Module 3)</i>	Sales Information <i>(Module 4)</i>
<ul style="list-style-type: none"> <li>• Intermediary identification (name, age, telephone)</li> <li>• Location</li> <li>• Type of business</li> </ul>	<ul style="list-style-type: none"> <li>• Total quantity purchases from producers and other intermediaries and values</li> <li>• Average quantity purchase in one day and the value</li> <li>• Quality constraint's reaction</li> <li>• If penalize it, how much per attribute</li> <li>• Quality attributes of the product at purchase</li> </ul>	<ul style="list-style-type: none"> <li>• For each activity:               <ul style="list-style-type: none"> <li>• Quantity of affected product and value</li> <li>• Quantity of totally lost product and value</li> <li>• Reasons for losses</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Total quantity sale</li> <li>• Average quantity sale in one day and the value</li> <li>• Quality constraint's reaction</li> <li>• If penalize it, how much per attribute</li> <li>• Quality attributes of the product at sale</li> </ul>

Source: Baseline survey of food losses in potato value chain of Kenya (2024).

The processor survey consists of three key modules (Figure 3.4):

**Roster and processor identification (Module 1):** Identification and registration of the processor.

**Purchase details (Module 2):** Information regarding the quantity, quality, and attributes of the total product purchased during a specified period, which may vary depending on country context.

**Processing steps (Module 3):** Information about the steps involved in transforming the acquired product into the final product intended for consumption, including losses and value at each step.

**Figure 3.4.** Processor survey questionnaire modules

Roster and Processor Identification <i>(Module 1)</i>	Purchase Details <i>(Module 2)</i>	Processing Steps <i>(Module 3)</i>
<ul style="list-style-type: none"> <li>• Processor identification (name, age, telephone)</li> <li>• Location</li> <li>• Type of business</li> </ul>	<ul style="list-style-type: none"> <li>• Total purchases from producers and aggregators</li> <li>• Average quantity purchase in one day and the value</li> <li>• If penalized, how much per attribute</li> <li>• Attributes at purchase</li> </ul>	<ul style="list-style-type: none"> <li>• For each activity:               <ul style="list-style-type: none"> <li>• Quantity of affected product and the value</li> <li>• Quantity of totally lost product and the value</li> <li>• Reasons for losses</li> </ul> </li> </ul>

Source: Baseline survey of food losses in potato value chain of Kenya (2024).

In the attributes section of each survey, producers, aggregators, and processors were asked to evaluate the physical or chemical characteristics of the crops. These characteristics, specific to potato in Kenya, were identified in collaboration with value chain actors and potato experts. In our surveys, crop damage is determined by factors such as the presence of pest and diseases, animals or rodents, handling impacts, theft, and chemical misuse, among others. We further validate this through expert consultations and the price punishment that each type of crop damage entails in the different market locations.

## 4. DESCRIPTIVE STATISTICS

This section first describes value chain agents (that is, producers, aggregators, and processors) in the potato value chain in Kenya. The second subsection describes the different activities engaged in by these value chain agents across the respective nodes of the value chain. Comparisons across different spatial groups (counties and treatment status) and demographic groups (gender and age) refer only to statistically significant differences.

### 4.1 CHARACTERISTICS OF VALUE CHAIN AGENTS

Tables 4.1 and 4.2 show the demographic and socioeconomic operational characteristics of the three key value chain actors across spatial disaggregates. Annex Table 1 provides a similar summary across gender and age categories.

The data reveal distinctive gender patterns across the value chain. Women dominate potato production (61 percent), aggregation (79 percent), and processing (71 percent), which also holds across all spatial subgroups. Youth (15–35 years old) value chain agents account for a smaller share (18 percent) of producers relative to mature producers. The relatively low participation of youth as potato producers does not necessarily imply a limited role in addressing post-harvest losses. Youth may contribute through value chain functions such as aggregation, transportation, storage management, mechanization services, and digital market innovations, which have been identified as important pathways for improving post-harvest management and market coordination (Cruickshank et al. 2022; Flores Rojas 2024). Average producer age is 49 years, with statistically significantly younger producers in treatment areas (45.5 years of age), as compared to control areas (52.6 years of age) (Tables 4.1 and 4.2). Female and male producers are similar ages, at approximately 48.5 and 49.3 years, respectively, while young and mature producers averaged 31 and nearly 53 years of age (Annex Table 1). The average age of aggregators is nearly 43 years, while processors are markedly younger, averaging nearly 34 years. The relatively younger profile of processors may reflect lower entry barriers for processing compared to production, particularly regarding land access, which disproportionately constrains youth, especially young women, from entering primary production. This observation implies that potato processing may provide a gateway for youth engagement and thereby contribute to agrifood system transformation in Kenya, an implication consistent with that of other studies (Bachewe et al. 2025; Abay et al. 2025). These patterns suggest that aggregation, storage management, quality grading, transportation, and market information systems represent promising entry points for reducing potato losses while simultaneously creating dignified and fulfilling employment opportunities for youth, particularly young women. Unlike primary production, many of these activities are less constrained by land access and may therefore provide more accessible pathways into agrifood systems for younger workers (Kabir et al. 2026; Dolislager et al. 2021; Christiaensen et al. 2021). Beyond gender, the relatively low physical infrastructure requirements of several post harvest activities including grading, quality monitoring, record-keeping, and certain processing tasks suggest that targeted ergonomic and organizational adaptations could open meaningful entry points for youth with disabilities,

a group whose inclusion in agrifood value chains remains limited despite demonstrated potential (FAO, 2024; IFAD, 2025; AUDA-NEPAD, 2024). Most of Kenya's producers are literate, with approximately 4 percent of potato producers being illiterate (Table 4.1). Although this rate is considerably less than the illiteracy rate elsewhere in SSA, where adult (15 and older) illiteracy is more than 30 percent (World Bank 2026), methodological differences in defining literacy may contribute to the divergence. About half of producers completed primary school (51 percent), followed by junior secondary (19 percent) and senior secondary school (16 percent). About 10 percent pursued college or polytechnic education, and just over 1 percent hold a university degree. Producers in control areas have a statistically significant higher share of senior secondary education (22 percent) compared to the treatment group (11 percent). Narok county records the highest illiteracy rate (17 percent), while Nyeri county has the highest share of senior secondary graduates (35 percent). Overall, producers had 5.6 years of formal education on average, with only slight variation across treatment and control groups.

**Table 4.1. Characteristics of potato producers, spatial distribution**

Variable	Total		Treatment		Control		Sig. test	Kiambu		Nakuru		Narok		Nyandarua		Nyeri	
	Mean	SD	Mean	SD	Mean	SD		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<b>Observations (number)</b>	609		310		299			203		170		60		80		96	
<b>Gender of producer (=1 if female)</b>	60.8	48.9	59.4	49.2	62.2	48.6		63.1	48.4	64.1	48.1	33.3	47.5	68.8	46.6	60.4	49.2
<b>Age (years)</b>	49.0	13.1	45.5	12.9	52.6	12.3	***	53.7	12.7	44.6	13.1	41.1	9.6	50.8	12.9	50.3	11.2
<b>Experience in years</b>	14.4	11.3	12.3	9.7	16.5	12.5	***	18.8	12.7	11.0	8.8	10.9	7.4	16.3	11.9	11.7	10.5
<b>Household size (no. of members)</b>	4.6	2.3	5.3	2.5	4.0	1.9	***	4.0	2.0	5.4	2.1	7.0	3.0	3.8	2.0	3.8	1.6
<b>Education (%)</b>																	
Illiterate	3.9	19.5	4.5	20.8	3.3	18.0		3.9	19.5	1.8	13.2	16.7	37.6	1.3	11.2	2.1	14.4
Primary school	50.7	50.0	52.9	50.0	48.5	50.1		51.2	50.1	52.9	50.1	50.0	50.4	55.0	50.1	42.7	49.7
Junior secondary school	18.7	39.0	21.0	40.8	16.4	37.1		16.8	37.4	25.9	43.9	16.7	37.6	13.8	34.7	15.6	36.5
Senior secondary school	16.4	37.1	11.3	31.7	21.7	41.3	***	15.3	36.1	8.8	28.5	5.0	22.0	21.3	41.2	35.4	48.1
College/polytechnic	9.0	28.7	9.7	29.6	8.4	27.7		10.3	30.5	10.6	30.9	10.0	30.3	7.5	26.5	4.2	20.1
University degree	1.2	10.7	0.7	8.0	1.7	12.8		2.5	15.5	0.0	0.0	1.7	12.9	1.3	11.2	0.0	0.0
<b>Education in years</b>	5.6	2.6	5.5	2.5	5.7	2.7		5.8	2.8	5.1	2.3	5.4	2.0	6.5	3.0	5.5	2.2
<b>Household assets (000 KSh)</b>	48.1	47.3	45.9	46.6	50.4	48.0		49.0	46.2	41.5	43.9	78.6	55.8	30.5	30.8	53.3	51.9
<b>Main occupation is farming (%)</b>	93.6	24.5	93.2	25.2	94.0	23.8		94.1	23.6	95.9	19.9	83.3	37.6	95.0	21.9	93.8	24.3
<b>Main occupation is non-farming (%)</b>	6.4		6.8		6.0			5.9		4.1		16.7		5.0		6.3	

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

Value chain experience averaged 14.4 years among producers, 12.7 years among aggregators, and 4.9 years among processors, reflecting the relatively younger and emerging nature of this segment. Producers in control areas are more experienced (16.5 years) than those in treatment areas (12.3 years). Farmers in Kiambu county are more experienced and are the oldest, while those in Narok are the least experienced and on average the youngest. Kiambu county aggregators reported the longest experience (13.9 years), while Narok aggregators reported the shortest (7.7 years). Socioeconomic indicators show that producers maintain moderate-sized households averaging 4.6 members, with treatment households larger (5.3) than control households (4.0). The total current value of household assets averages 48,070

**Table 4.2.** Characteristics of aggregators and processors of potato, by county

Variable	Total		Kiambu		Nakuru		Narok		Nyandarua		Nyeri	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<b>Aggregators</b>												
Observations (number)	161		32		39		30		30		30	
Gender of aggregator (=1 if female)	78.9	40.9	90.6	29.6	74.4	44.2	83.3	37.9	63.3	49.0	83.3	37.9
Age (years)	42.8	12.0	42.9	11.0	39.2	10.9	41.8	14.6	42.9	11.0	48.0	11.4
Experience (years)	12.7	8.3	18.8	12.7	11.0	8.8	10.9	7.4	16.3	11.9	11.7	10.5
<b>Business type (%)</b>												
Has no store	67.1	47.1	71.9	45.7	64.1	48.6	80.0	40.7	66.7	48.0	53.3	50.7
Has store	32.9	47.1	28.1	45.7	35.9	48.6	20.0	40.7	33.3	48.0	46.7	50.7
<b>Role in business (%)</b>												
Owner	98.8	11.1	100.0	0.0	97.4	16.0	100.0	0.0	96.7	18.3	100.0	0.0
Boss/Manager	1.2	11.1	0.0	0.0	2.6	16.0	0.0	0.0	3.3	18.3	0.0	0.0
Share of formal business (%)	6.8	25.3	15.6	36.9	5.1	22.4	0.0	0.0	6.7	25.4	6.7	25.4
<b>Processors</b>												
Observations (number)	56		13		13		10		10		10	
Gender of aggregator (=1 if female)	71.4	45.6	61.5	50.6	92.3	27.7	80.0	42.2	60.0	51.6	60.0	51.6
Age (years)	33.9	8.9	35.8	11.1	28.7	5.2	36.6	9.7	35.1	9.2	34.3	7.3
Experience (years)	4.9	4.5	3.5	1.4	3.7	2.2	8.3	8.6	5.7	4.1	3.8	1.9
Share of formal business (%)	42.9	49.9	30.8	48.0	7.7	27.7	80.0	42.2	60.0	51.6	50.0	52.7
<b>Role in business (%)</b>												
Head/Owner	92.9	26.0	100.0	0.0	100.0	0.0	90.0	31.6	100.0	0.0	70.0	48.3
Employee	3.6	18.7	0.0	0.0	0.0	0.0	10.0	31.6	0.0	0.0	10.0	31.6
Assistant	3.6	18.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.0	42.2

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

Kenyan Shillings (KSh), which is approximately US\$360.<sup>8</sup> Significant county-level variation exists, with Narok producers recording significantly higher asset values (78,627.8 KSh or US\$589) compared to Nyandarua (30,487 KSh or US\$228) and Nakuru (41,530 KSh or US\$311). The average value of assets owned by youth is higher than that of mature producers, probably due to the lower sample, presence of youth-targeted programs, and involvement in off-farm activities. Significant differences are also found across gender categories (Annex Table 1). These disparities suggest important regional and demographic economic differences that may influence value chain dynamics.

We collected data on the major occupation of producers, as well as on types of business activities and roles in the businesses of aggregators and processors. Farming constitutes the primary occupation for approximately 94 percent of producers, with similar proportions in four counties (94 to 96 percent) yet a considerably lower rate in Narok (83 percent). Analysis of business structure reveals distinct patterns across the value chain. Only about 7 percent of aggregators operate as formal businesses, with notable county-level variation. Kiambu records the highest share of formal aggregators (about 16 percent), while in Narok, all aggregators operate informal businesses. Annex Table 1 shows that formal aggregator business operations remain consistently low across both gender and age groups. A relatively higher share of processors (43 percent) operate formal businesses although there is a wide variation in the share across counties – from as low as less than 8 percent in Nakuru to as high as 80 percent in Narok. The share of men with formal processing businesses (about 69 percent) is more than twice the share of women (32.5 percent).

An overwhelming majority of aggregators, nearly 99 percent, are business owners, with Kiambu and Narok recording full owner-operation. No statistically significant differences exist across gender and age in terms of store ownership among aggregators.

## 4.2 POTATO VALUE CHAIN ACTIVITIES

In this section, we describe the input use and production activities of producers, aggregators, and processors. Table 4.3a summarizes producers' preharvest activities, disaggregated spatially, and Table 4.3b summarizes them across counties. Table 4.4a summarizes postharvest activities of producers by treatment status, and Table 4.4b does so across counties. Annex Tables 2 and 3 provide corresponding summaries across gender and age categories. Table 4.5a and 4.5b provide spatially disaggregated summaries of the activities of aggregators, and Table 4.6 provides a corresponding summary for processors. Annex Table 4 summarizes processors' activities across demographic groups.

### 4.2.1 Potato preharvest production activities

#### Outputs and yields

Potato production averaged 2 MT per producer, and average potato yields were 6.2 MT/ha (Table 4.3). Producers in treatment areas had considerably higher potato yields (7.1 MT/ha) than those in control areas (5.3 MT/ha), while the difference in output levels was even greater in treatment areas, where average output was three times the output in control areas. Producers in Narok county had the highest average output (6.0 MT) and the highest average yield (8.4 MT/ha), while those in Kiambu recorded lower output (0.9 MT) and yield (4.8 MT/ha) levels. Male producers achieved notably higher average output (2.7 MT) and yields (7.0 MT/ha) than female producers (1.5 MT) and (5.7 MT/ha), respectively. Youth

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<sup>8</sup> The exchange rate between the Kenyan Shilling and the US dollar (US\$) at the time of the survey was 1 KSh to 0.00748 US\$.

producers (15–35 years) recorded higher yields (7.4 MT/ha) than mature producers (6.0 MT/ha) (Annex Table 2).

### **Land use and management**

The average producer operated 0.5 ha of land, which suggests that Kenyan farmers cultivate some of the smallest farms in SSA, where the average farm size is around 1 ha. In Nigeria and Rwanda, the other two countries where this project studies food loss, average landholding is nearly 3 ha and 0.4 ha, respectively. Out of the 0.5 ha operated in Kenya, 0.3 ha is rented. Producers on average used 0.3 ha of the land to cultivate potato, underscoring the smallholder nature of potato farming in the counties surveyed. Producers in treatment areas operated and rented-in more land relative to those in control areas. Narok county producers operated the largest average area (1 ha) and allocated most of the land to cultivate potato (0.7 ha) (Table 4.3). Farmers in Kiambu and Nyeri allocated a small area (0.2 ha) to potato cultivation. Male producers rented-in significantly larger amounts of land than women (Annex Table 2), which may reflect access rights and gendered differences in ability to rent lands in Kenya. The case in Nigeria is different, however, where women rented twice as much land as men (Bachewe et al. 2026; Kabir et al. 2026).

Use of mechanical equipment was reported by 30 percent of producers overall. The share of producers in treatment areas that adopted mechanical equipment was considerably higher than those in the control areas. Adoption was also more prevalent in Narok (70 percent) than Kiambu (10 percent). Adoption of mechanical equipment was higher among men than women (Annex Table 2).

Manual soil preparation was the dominant tilling method, used by 76 percent of producers. It was significantly more common among producers in control areas (89 percent) than in treatment areas (63 percent) and substantially higher in Kiambu (94 percent) and lowest in Narok (18 percent). Mechanized soil preparation was used by only 2 percent of potato farmers, while animal traction was rare among potato producers in Kenya. Multiple soil preparation methods (manual and mechanized) were used by 19 percent of the producers, but this method was used by a considerably higher share (75 percent) in Narok county and by less than 10 percent of producers in Nyeri county. Multiple soil preparation methods were used by 32 percent of potato producers in treatment areas.

### **Variable input use**

#### **Seeds**

Potato seed application rates averaged 1,290.8 kg/ha and were higher in treatment areas and in Nakuru and Narok counties than in other counties (Table 4.3). Application rates were also higher among male and youth producers (Annex Table 2). Nearly 29 percent of producers in the overall sample adopted improved seed varieties. Uptake of improved seeds was significantly higher among producers in treatment areas (37 percent) than in control areas (21 percent), with Nakuru county recording the highest adoption rate at 46 percent. Adoption of improved seeds was considerably lower in Nyandrua (12.5 percent) and lowest in Nyeri (6.3 percent).

#### **Fertilizer and crop protection**

Organic fertilizer was used by 47 percent of producers, with significantly higher adoption rates among producers in control areas (79 percent) than treatment areas (17 percent), and substantially higher rates in Kiambu (91 percent) than in Nakuru (14 percent). Overall, 89 percent of producers applied chemical fertilizer, with adoption more prevalent among producers in treatment areas (97 percent) compared to control areas (82 percent). Almost all farmers in Nyandrua county applied chemical fertilizers, while slightly more than three-quarters in Nyeri applied chemical fertilizer. Frequency of fertilizer application

averaged 1.3 times per season, with no significant difference across groups. Rate of fertilizer application averaged 519 kg/ha overall, but with considerable spatial variation. Producers in control areas applied considerably more fertilizer per ha (748 kg/ha) than producers in treatment areas (299 kg/ha). Kiambu county recorded the highest fertilizer application rates at 799.6 kg/ha, while Nakuru recorded the lowest. Male and mature producers applied fertilizer at higher rates than female and youth producers, respectively (Annex Table 2).

**Table 4.3a.** Potato preharvest production and input use, treatment vs. control areas

Variable	Measure	Total		Treatment		Control		Sig. test
		Mean	SD	Mean	SD	Mean	SD	
<b>Outputs</b>								
Total output harvested (000)	kgs	2.0	2.9	3.0	3.6	0.9	1.3	***
Yield (000)	kgs/ha	6.2	4.5	7.1	4.9	5.3	3.9	***
<b>Land</b>								
Total area operated	Ha	0.5	0.5	0.6	0.5	0.5	0.4	*
Area rented/sharecropped	Ha	0.3	0.4	0.3	0.4	0.2	0.3	***
Total potato area	Ha	0.3	0.3	0.4	0.4	0.2	0.2	***
<b>Used mechanical equipment</b>	%	0.3	0.4	0.3	0.5	0.2	0.4	***
<b>Tilling type used</b>								
Manual	%	75.7	42.9	63.2	48.3	88.6	31.8	***
Animal	%	0.3	5.7	0.7	8.0	0.0	0.0	
Mechanized	%	4.9	21.7	4.2	20.1	5.7	23.2	
More than one method	%	19.1	39.3	31.9	46.7	5.7	23.2	***
<b>Variable inputs</b>								
Seed use (000)	kgs/ha	1.3	0.7	1.5	0.7	1.1	0.6	***
Improved seed used	%	29.1	45.4	36.5	48.2	21.4	41.1	***
Applied organic fertilizer	%	47.1	50.0	16.5	37.1	78.9	40.9	***
Applied chemical fertilizer	%	89.3	30.9	96.5	18.5	81.9	38.5	***
Chem. fertilizer application frequency	Number	1.3	0.6	1.3	0.6	1.3	0.6	
Rate of fertilizer application	kgs/ha	519.4	772.7	299.2	356.3	747.7	991.8	***
<b>Crop protection</b>								
Chemical insecticide	%	62.2	48.5	66.1	47.4	58.2	49.4	*
Biological insecticides	%	0.3	5.7	0.3	5.7	0.3	5.8	
Herbicides	%	17.2	37.8	26.1	44.0	8.0	27.2	***
Fungicides	%	70.1	45.8	83.6	37.1	56.2	49.7	***
Biological pest control	%	0.8	9.0	1.0	9.8	0.7	8.2	
Integrated pest management	%	0.0	0.0	0.0	0.0	0.0	0.0	
Value of modern inputs applied (000)	KSh./ha	42.1	27.8	37.2	21.2	47.2	32.5	***
<b>Received training in harvesting</b>	%	6.9	25.4	3.9	19.3	10.0	30.1	**
<b>Harvesting</b>	%	100.0	0.0	100.0	0.0	100.0	0.0	
<b>Harvesting method</b>								
Manual	%	100.0	0.0	100.0	0.0	100.0	0.0	
<b>Other inputs</b>								
Used hired labor	%	77.0	42.1	79.4	40.5	74.6	43.6	
Used irrigation	%	5.4	22.7	2.9	16.8	8.0	27.2	**
Used formal credit	%	39.6	48.9	32.9	47.1	46.5	50.0	***
Used informal credit	%	1.2	10.7	1.6	12.6	0.7	8.2	
Member of agricultural coops.	%	12.8	33.5	14.5	35.3	11.0	31.4	
Used agricultural services	%	3.6	18.7	6.5	24.6	0.7	8.2	***
<b>Barriers toward</b>								
Accessing input/service markets	%	41.9	49.4	45.2	49.9	38.5	48.7	
Reaching markets/buyers	%	17.9	38.4	19.0	39.3	16.7	37.4	

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

**Note:** Significance test estimates with \*\*\*, \*\*, and \* are significant at 1 %, 5 %, and 10 %, respectively.

**Table 4.3b.** Potato preharvest production and input use, across counties

Variable	Meas- ure	Kiambu		Nakuru		Narok		Nyandarua		Nyeri	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<b>Outputs</b>											
Total output harvested (000)	kgs	0.9	1.5	2.6	3.1	6.0	4.7	1.5	2.4	1.1	0.7
Yield (000)	kgs/ha	4.8	3.8	7.5	4.8	8.4	5.6	5.2	4.2	6.4	4.0
<b>Land</b>											
Total area operated	Ha	0.5	0.4	0.5	0.5	1.0	0.7	0.4	0.4	0.5	0.5
Area rented/sharecropped	Ha	0.2	0.3	0.3	0.4	0.5	0.5	0.3	0.4	0.2	0.3
Total potato area	Ha	0.2	0.2	0.4	0.3	0.7	0.4	0.3	0.3	0.2	0.2
Used mechanical equipment	%	0.1	0.3	0.2	0.4	0.7	0.5	0.5	0.5	0.4	0.5
<b>Tilling type used</b>											
Manual	%	94.1	23.6	82.4	38.2	18.3	39.0	56.3	49.9	77.1	42.3
Animal	%	0.0	0.0	1.2	10.8	0.0	0.0	0.0	0.0	0.0	0.0
Mechanized	%	2.0	13.9	1.8	13.2	6.7	25.2	7.5	26.5	13.5	34.4
More than one method	%	3.9	19.5	14.7	35.5	75.0	43.7	36.3	48.4	9.4	29.3
<b>Variable inputs</b>											
Seed use (000)	kgs/ha	1.0	0.7	1.7	0.6	1.7	7.7	1.1	0.4	1.1	0.6
Improved seed used	%	28.6	45.3	45.9	50.0	41.7	49.7	12.5	33.3	6.3	24.3
Applied organic fertilizer	%	91.1	28.5	13.5	34.3	16.7	37.6	22.5	42.0	53.1	50.2
Applied chemical fertilizer	%	83.3	37.4	97.1	17.0	91.7	27.9	98.8	11.2	79.2	40.8
Chem. fertilizer application frequency	Number	1.2	0.5	1.3	0.5	1.5	0.6	1.4	0.6	1.4	0.7
Rate of fertilizer application	kgs/ha	799.6	1015.7	292.6	338.4	295.7	302.2	315.9	427.7	638.1	935.0
<b>Crop protection</b>											
Chemical insecticide	%	54.2	50.0	67.7	46.9	93.3	25.2	42.5	49.8	66.7	47.4
Biological insecticides	%	0.5	7.0	0.0	0.0	0.0	0.0	1.3	11.2	0.0	0.0
Herbicides	%	8.9	28.5	19.4	39.7	45.0	50.2	26.3	44.3	6.3	24.3
Fungicides	%	40.4	49.2	81.8	38.7	80.0	40.3	90.0	30.2	89.6	30.7
Biological pest control	%	0.0	0.0	1.2	10.8	0.0	0.0	1.3	11.2	2.1	14.4
Integrated pest management	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Value of modern inputs applied (000)	KSh./ha	49.5	34.6	34.7	21.2	41.1	20.3	39.8	21.5	42.2	27.0
<b>Received training in harvesting</b>											
Harvesting	%	100.0	0.0	100.0	0.0	100.0	100.0	0.0	100.0	0.0	100.0
<b>Harvesting Method</b>											
Manual	%	100.0	0.0	100.0	0.0	100.0	100.0	0.0	100.0	0.0	100.0
<b>Other inputs</b>											
Used hired labor	%	69.0	46.4	74.7	43.6	88.3	32.4	82.5	38.2	86.5	34.4
Used irrigation	%	6.9	25.4	0.0	0.0	13.3	34.3	1.3	11.2	10.4	30.7
Used formal credit	%	47.8	50.1	31.2	46.5	31.7	46.9	37.5	48.7	43.8	49.9
Used informal credit	%	0.5	7.0	0.0	0.0	1.7	12.9	5.0	21.9	1.0	10.2
Member of agricultural coops.	%	11.8	32.4	16.5	37.2	5.0	22.0	17.5	38.2	9.4	29.3
Used agricultural services	%	1.0	9.9	11.8	32.3	0.0	0.0	0.0	0.0	0.0	0.0
<b>Barriers toward</b>											
Accessing input/service markets	%	43.8	49.7	43.5	49.7	56.7	50.0	40.0	49.3	27.1	44.7
Reaching markets/buyers	%	12.8	33.5	17.7	38.2	20.0	40.3	21.3	41.2	25.0	43.5

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

Chemical insecticides were used by 62 percent of producers, while biological insecticides were used by less than 1 percent. Herbicides were used by 17 percent of producers, fungicides by 70 percent, and biological pest control by 1 percent. No producer reported using integrated pest management. Fungicide was used by considerably more producers in treatment areas (84 percent) compared to control areas (56 percent). Similarly, the share of young producers that applied fungicides was higher than the share of mature producers. The share of treatment-area and male producers that used herbicides was higher.

The value of modern inputs applied averaged 42,100 KSh/ha, with higher expenditures by farmers in control areas than those in treatment areas. Kiambu county recorded the highest average at 49,500 KSh/ha.

### Potato harvesting

All producers (100 percent) harvested potato, an activity conducted entirely manually across all counties and treatment groups (Table 4.3). Training to enhance harvesting skills was received by only 7 percent of farmers overall, with a significantly higher proportion of farmers in control areas having received such training (10 percent) compared to treatment areas (4 percent).

### Other inputs/services

A substantial share of producers (77 percent) used hired labor. Irrigation was used by a low share of producers (5 percent). A relatively higher proportion of potato producers in control areas used irrigation; irrigation was used predominantly in Narok (13 percent) and Nyeri (10 percent). Formal credit was accessed by 40 percent of producers, with a higher share of producers in control areas (47 percent) accessing credit than those in treatment areas (33 percent). Informal credit was used by only 1 percent of producers in the overall sample. Cooperative membership was 13 percent. Agricultural services were used by only 3.6 percent of producers, with a significantly higher share in treatment areas (7 percent), driven particularly by higher services utilization in Nakuru county (12 percent), while it was considerably lower in control areas.

About 42 percent of producers reported barriers to accessing input and service markets, with no statistically significant differences across different groups. Reaching output markets was identified as a barrier by 18 percent of producers, with no statistically significant differences across groups.

## 4.2.2 *Potato postharvest production activities*

### Potato transportation, hauling, and grading

The transfer of harvested potato from the field involves two distinct activities: transportation and hauling. Transportation (moving potato over longer distances) was practiced by 15 percent of producers, while hauling (initial movement from field to nearby collection points or local markets) was considerably more widespread at 87 percent (Table 4.4a). Hauling was nearly universal in Nyandarua (99 percent) and Nyeri (94 percent), while transportation was most common in Narok (27 percent) and Kiambu (18 percent) (Table 4.4b). Manual hauling dominated at 73 percent, with mechanical hauling adopted by only 6 percent of producers, though combined methods were significantly higher in treatment areas (7 percent) than control areas (2 percent). The substantially lower prevalence of transportation compared to hauling indicates that most producers store their harvest at or near the point of production and move to local markets rather than transporting it to distant facilities. Grading of the potato harvest was practiced by 92 percent of producers, overwhelmingly using manual methods (86 percent). Differences in grading practice across treatment and control groups were not statistically significant. No statistically significant differences in transportation or grading exist across gender and age categories (Annex Table 3).

### Potato storage and related activities

Storage facilities and pre-storage activities are important factors that influence the extent of damage during storage. About 88 percent of producers stored some part of their potato harvest; the storage period averages 41 days. Producers in treatment areas stored for longer relative to those in control areas. Nyandarua county producers stored for the longest period (52 days), while Kiambu county producers stored for the shortest period (32 days). The maximum quantity stored averaged 701 MT, with treatment-area

farmers storing significantly higher quantities than control-area farmers (Table 4.4). Female producers stored for longer periods than male producers, while youth stored quantities similar to those of mature farmers (Annex Table 3).

**Table 4.4a.** Postharvest activities of potato producers, treatment vs. control areas

Variable	Measure	Total		Treatment		Control		Sig. test
		Mean	SD	Mean	SD	Mean	SD	
<b>Observations</b>		609		310		209		
<b>Transportation</b>	%	14.8	35.5	14.5	35.3	15.1	35.8	
Manual	%	7.1	25.6	8.1	27.3	6.0	23.8	
Mechanical	%	4.9	21.7	2.9	16.8	7.0	25.6	*
Both	%	1.0	9.9	1.0	9.8	1.0	10.0	
<b>Hauling</b>	%	87.2	33.5	89.4	30.9	85.0	35.8	
Manual	%	73.2	44.3	74.8	43.5	71.6	45.2	
Mechanical	%	5.6	23.0	6.1	24.0	5.0	21.9	
Both	%	4.6	21.0	7.1	25.7	2.0	14.1	**
<b>Grading</b>	%	92.1	27.0	91.3	28.2	93.0	25.6	
Manual	%	85.7	35.0	85.2	35.6	86.3	34.5	
Mechanical	%	0.3	5.7	0.0	0.0	0.7	8.2	
Both	%	6.1	23.9	6.1	24.0	6.0	23.8	
<b>Potato storage</b>								
Stored potato	%	88.3	32.1	86.1	34.6	90.6	29.2	
Average storage period	Days	41.2	24.1	45.5	23.1	36.9	24.4	***
Maximum quantity stored (000)	MT	701.4	1426.7	982.3	1864.0	424.7	685.8	***
<b>Storage location</b>								
Home	%	71.2	45.3	68.9	46.4	73.4	44.3	
Farm	%	2.4	15.4	2.3	14.9	2.6	15.9	
Community warehouse	%	0.2	4.3	0.4	6.1	0.0	0.0	
<b>Storage method</b>								
Sacks	%	33.1	47.1	40.0	49.1	26.1	44.0	***
On a platform covered	%	24.0	42.7	15.5	36.2	32.8	47.0	***
On bare floor uncovered	%	14.8	35.5	13.2	33.9	16.4	37.1	
On a platform uncovered	%	7.9	27.0	9.7	29.6	6.0	23.8	*
All other storage methods	%	8.5	28.0	7.7	26.8	9.3	29.2	
<b>Pre-storage activities</b>								
Cleaning storage site	%	83.6	37.0	85.4	35.4	81.9	38.6	
Cleaning storage sacks/bags	%	30.4	46.1	41.2	49.3	19.9	40.0	***
Preparing site (ventilation)	%	46.8	50.0	46.8	50.0	46.9	50.0	
Curing	%	2.8	16.5	1.5	12.2	4.1	19.8	*
Fumigation of storage site	%	2.0	14.2	0.8	8.6	3.3	18.0	*

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

**Note:** Significance test estimates with \*\*\*, \*\*, and \* are significant at 1 %, 5 %, and 10 %, respectively.

Homes were used for storage by 71 percent of producers, followed by farms (2.4 percent). A small share (0.2 percent) used community warehouses. Various storage methods were used: sacks by 33 percent, a covered platform by 24 percent, and bare or uncovered floors by 15 percent. Treatment-area producers were more likely to use sacks than those in control areas, while control-area producers more commonly stored on covered platforms (Table 4.4a). The use of storage methods varied across counties. More than 43 percent of farmers in Narok and 52.5 percent of farmers in Nyandrua used sacks, 55.2 percent in Nyeri used a covered platform, a third of the farmers in Nakuru used sacks, and 17 percent used a

covered platform in Nakuru. In Kiambu, 27.6 percent used sacks, 22 percent used covered platforms, and 22 percent used an uncovered/bare floor, showing the diversity of methods in Kiambu (Table 4.4b). Differences in storage techniques by gender and age were not statistically significant (Annex Table 3).

Most producers (84 percent) cleaned their storage sites. In contrast, only 30.4 percent of producers reported cleaning storage sacks or bags. A significantly higher proportion of producers in treatment areas (41 percent) reported cleaning their storage bags relative to control areas (20 percent). Ventilating the site before storage was undertaken by 47 percent of producers, with no statistically significant differences across groups. Curing of storage sites was reported by a small share of producers (3 percent), with a higher share of producers in control areas practicing curing than those in treatment areas. Similarly, fumigation of storage sites was practiced by only 2 percent of producers; fumigation was also more prevalent in control areas.

**Table 4.4b.** Postharvest activities of potato producers, across counties

Variable	Measure	Kiambu		Nakuru		Narok		Nyandarua		Nyeri	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<b>Observations</b>		203		170		60		80		96	
<b>Transportation</b>	%	18.2	38.7	11.8	32.3	26.7	44.6	11.3	31.8	8.3	27.8
Manual	%	7.9	27.0	7.7	26.7	6.7	25.2	10.0	30.2	2.1	14.4
Mechanical	%	8.4	27.8	2.4	15.2	8.3	27.9	0.0	0.0	4.2	20.1
Both	%	1.0	9.9	1.2	10.8	1.7	12.9	0.0	0.0	1.0	10.2
<b>Hauling</b>	%	80.8	39.5	88.8	31.6	78.3	41.6	98.8	11.2	93.8	24.3
Manual	%	68.0	46.8	71.8	45.2	60.0	49.4	92.5	26.5	79.2	40.8
Mechanical	%	5.9	23.6	10.0	30.1	1.7	12.9	1.3	11.2	3.1	17.5
Both	%	2.5	15.5	5.9	23.6	16.7	37.6	2.5	15.7	1.0	10.2
<b>Grading</b>	%	89.7	30.5	86.5	34.3	100.0	0.0	95.0	21.9	100.0	0.0
Mechanical	%	79.8	40.3	79.4	40.6	91.7	27.9	92.5	26.5	100.0	0.0
Manual	%	1.0	9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Both	%	8.9	28.5	7.1	25.7	8.3	27.9	2.5	15.7	0.0	0.0
Storage	%	91.6	27.8	79.4	40.6	91.7	27.9	96.3	19.1	88.5	32.0
Average storage period	Days	32.1	19.5	42.4	19.8	44.2	19.5	51.8	29.1	47.3	30.3
Maximum quantity stored (000)	kgs	428.0	741.8	855.0	1698.3	1817.2	2561.7	609.1	1318.7	417.3	547.6
<b>Storage location</b>											
Home	%	62.9	48.4	65.9	47.6	58.2	49.8	81.8	38.8	96.5	18.6
Farm	%	1.6	12.6	0.0	0.0	5.5	22.9	3.9	19.5	4.7	21.3
Community warehouse	%	0.0	0.0	0.7	8.6	0.0	0.0	0.0	0.0	0.0	0.0
<b>Storage method</b>											
Sacks	%	27.6	44.8	32.9	47.1	43.3	50.0	52.5	50.3	22.9	42.3
On a platform covered	%	22.2	41.6	17.1	37.7	6.7	25.2	18.8	39.3	55.2	50.0
On bare floor uncovered	%	21.7	41.3	11.2	31.6	21.7	41.5	11.3	31.8	5.2	22.3
On a platform uncovered	%	7.9	27.0	10.6	30.9	16.7	37.6	2.5	15.7	2.1	14.4
All other storage methods	%	12.3	32.9	7.6	26.7	3.3	18.1	11.3	31.8	3.1	17.5
<b>Pre-storage activities</b>											
Cleaning storage site	%	85.5	35.3	80.7	39.6	90.0	29.0	89.6	30.7	74.1	44.1
Cleaning storage sacks/bags	%	28.0	45.0	44.4	49.9	50.9	50.5	28.6	45.5	2.4	15.2
Preparing site (ventilation)	%	43.0	49.6	49.6	50.2	45.5	50.3	42.9	49.8	55.3	50.0
Curing	%	5.9	23.7	2.2	14.8	1.8	13.5	0.0	0.0	0.0	0.0
Fumigation of storage site	%	3.2	17.7	0.7	8.6	0.0	0.0	1.3	11.4	3.5	18.6

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

### 4.2.3 Potato aggregation

#### Potato purchases

Aggregators sourced potato from an average of 13.2 producers and 7.2 other intermediary sellers (Table 4.5a). The number of producers and intermediaries from whom aggregators sourced potato differed widely across counties (Table 4.5b). An average aggregator purchased 4.8 MT of potato directly from producers and an additional 1.6 MT from intermediary sellers (Table 4.5a). The value of potato purchased directly from producers averaged 211,201 KSh (USD 1,522.5)<sup>9</sup>, while purchases from intermediaries averaged 69,698 KSh (USD 502.4). On a typical day, aggregators purchased 268.5 kg of potato, valued at approximately 10,600 KSh (USD 76.4). While there were no statistically significant differences across age groups, these values varied widely across counties.

#### Activities of potato aggregators

Most aggregators (82.3 percent) stored their potato purchases before selling them, reflecting an essential component of the intermediary role they play in the value chain. Aggregators stored potato for an average of 5.4 days before selling. Storage time varied considerably across counties, from 2.7 days in Kiambu to 11.7 days in Nyandarua. Sacks were the predominant storage method, used by 82.3 percent of the aggregators. About 50 percent of aggregators engaged in cleaning and packaging, 19 percent in distribution and transportation, and 16 percent in drying. Differences in intermediary activities across age groups were not statistically significant (Table 4.5a).

#### Potato sales and prices

Aggregators sold an average of 3,100 kg in the last 30 days, generating total sales revenue of approximately 150,500 KSh (USD 1,084.9). Youth and mature aggregators sold similar quantities and earned similar total revenue. The average price received for potato was 52.3 KSh/kg (USD 0.37/kg) by producers in the overall sample, with Nyeri county aggregators receiving the highest prices (60.1 KSh/kg-USD 0.4/kg) and Narok and Nyandarua aggregators receiving the lowest (47.7 KSh/kg each- USD 0.3/kg).

Aggregators reported that they sold potato to individual consumers (87 percent) and processors (47 percent), followed by other aggregators (30 percent) and stores (15 percent). Mature aggregators were more likely to sell to individual consumers (91 percent) compared to youth aggregators (77 percent). Kiambu county aggregators reported the most diversified buyer base, with more than 69 percent selling to processors and 44 percent selling to other aggregators.

The data indicate that seasonal purchase price fluctuations characterize potato markets in Kenya. During the abundant crop season/year, potato prices paid by aggregators averaged 23.3 KSh/kg (USD 0.2/kg). Purchase prices rose sharply to 52.9 KSh/kg (USD 0.38/kg) during the scarce season. Youth aggregators paid slightly higher abundant season purchase prices relative to mature aggregators, a statistically significant difference (Table 4.5). Abundant season sales prices averaged 30.5 KSh/kg (USD 0.2/kg), rising to 63.9 KSh/kg (USD 0.5/kg) during the scarce season. This implies a price markup of 31 percent over purchase prices in the abundant season and 21 percent during the scarce season.

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<sup>9</sup> USD 1= 137.72 Ksh as at March 2024 (the period of data collection)

**Table 4.5a** Activities of potato aggregators, by age

Variable	Measure	Total		Youth (15-35 years)		Mature (>35 years)		Sig. test
		Mean	SD	Mean	SD	Mean	SD	
<b>Observations</b>	Number	161		44		117		
<b>Potato purchases: volumes and values</b>								
Producers sourced from	Number	13.2	15.5	13.6	15.5	13.1	15.5	
Aggregators sourced from	Number	7.2	9.5	8.0	10.0	6.9	9.3	
Purchased from producers ('000)	Kgs	4.8	10.1	3.9	8.9	5.0	10.5	
Purchased from aggregators ('000)	Kgs	1.6	2.3	1.8	2.6	1.6	2.2	
Purchased from producers ('000,000)	KSh	0.2	0.5	0.2	0.3	0.2	0.5	
Purchased from aggregators('000,000)	KSh	0.1	0.1	0.1	0.1	0.1	0.1	
Quantity purchased (typical day)	Kgs	268.5	452.4	251.6	463.1	274.8	450.1	
Value purchased (typical day) ('000)	KSh	10.6	17.3	9.8	16.7	10.9	17.5	
<b>Potato buyers</b>								
Aggregators	%	29.8	45.9	25.0	43.8	31.6	46.7	
Stores	%	14.9	35.7	6.8	25.5	18.0	38.5	
Processors	%	46.6	50.0	34.1	48.0	51.3	50.2	
Individual consumers	%	87.0	33.8	77.3	42.4	90.6	29.3	*
<b>Activity and sells</b>								
<b>Intermediary activities</b>								
Drying	%	15.5	36.3	20.5	40.8	13.7	34.5	
Cleaning and packaging	%	50.3	50.2	54.6	50.4	48.7	50.2	
Storage	%	82.0	38.6	75.0	43.8	84.6	36.2	
Distribution and transportation	%	18.6	39.1	18.2	39.0	18.8	39.2	
Other activities	%	0.0	0.0	0.0	0.0	0.0	0.0	
<b>Storage practices</b>								
Days stored before selling	Number	5.4	5.8	5.2	5.8	5.5	5.8	
<b>Main storage methods</b>								
Sacks	%	82.3	38.3	78.8	41.5	83.5	37.3	
Others	%	15.4	36.2	15.2	36.4	15.5	36.3	
<b>Potato sales</b>								
<b>Sales volume and price (last 30 days)</b>								
Quantity of potato sold ('000)	Kgs	3.1	6.1	3.2	6.5	3.1	6.0	
Quantity sold to Aggregators ('000)	Kgs	2.6	2.7	6.7	2.5	6.2	2.7	
Quantity sold to Processors ('000)	Kgs	1.0	1.0	1.5	1.0	1.4	1.0	
Quantity sold to Consumers ('000)	Kgs	1.5	1.5	2.0	1.5	1.8	1.5	
Total sales revenue ('000)	KSh	150.5	289.1	148.2	289.1	151.4	290.4	
Average price of potato	KSh/Kg	52.3	15.7	51.6	15.5	52.5	15.8	
<b>Potato sales: destinations</b>								
Intermediaries	%	36.0	48.2	34.1	48.0	36.8	48.4	
Processors	%	52.2	50.1	52.3	50.5	52.1	50.2	
Individual consumers	%	92.6	26.4	93.2	25.5	92.3	26.8	
<b>Potato price benchmarking</b>								
Purchase price in abundant season	KSh/Kg	23.3	8.3	25.6	9.1	22.5	7.9	*
Purchase price in scarce season	KSh/Kg	52.9	11.5	53.5	10.5	52.7	11.8	
Selling price in abundant season	KSh/Kg	30.5	10.9	31.8	11.3	30.0	10.7	
Selling price in scarce season	KSh/Kg	63.9	19.6	66.4	18.6	62.9	20.0	

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

**Note:** Significance test estimates with \*\*\*, \*\*, and \* are significant at 1 %, 5 %, and 10 %, respectively.

**Table 4.5b** Activities of potato aggregators, by county

Variable	Measure	Kiambu		Nakuru		Narok		Nyandarua		Nyeri	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<b>Observations</b>	Number	32		39		30		30		30	
<b>Potato purchases: vol. and values</b>											
Producers sourced from	Number	24.1	22.4	16.2	16.7	6.2	4.6	11.2	7.7	4.9	2.6
Aggregators sourced from	Number	12.9	15.6	9.5	9.3	3.0	1.7	3.5	4.9	4.3	3.7
Purchased from producers ('000)	Kgs	4.7	9.3	8.5	14.1	0.5	0.5	2.2	1.6	9.1	14.6
Purchased from aggregators ('000)	Kgs	1.9	2.9	2.4	2.7	0.3	0.4	1.8	2.2	1.0	1.2
Purchased from producers ('000,000)	KSh	0.3	0.5	0.3	0.6	0.0	0.0	0.1	0.0	0.4	0.7
Purchased from aggregators ('mil)	KSh	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.1
Quantity purchased (typical day)	Kgs	239.0	514.5	273.6	485.1	96.5	117.3	477.8	481.2	256.0	463.8
Value purchased (typical day) ('000)	KSh	9.5	19.5	11.3	19.1	2.7	2.2	18.9	17.4	10.6	17.7
<b>Potato buyers</b>											
Aggregators	%	40.6	49.9	41.0	49.8	6.7	25.4	33.3	48.0	23.3	43.0
Stores	%	34.4	48.3	0.0	0.0	0.0	0.0	16.7	37.9	26.7	45.0
Processors	%	68.8	47.1	20.5	40.9	23.3	43.0	76.7	43.0	50.0	50.9
Individual consumers	%	93.8	24.6	53.9	50.5	100.0	0.0	100.0	0.0	96.7	18.3
<b>Activity and sells</b>											
<b>Intermediary activities</b>											
Drying	%	0.0	0.0	53.9	50.5	3.3	18.3	10.0	30.5	0.0	0.0
Cleaning and packaging	%	43.8	50.4	82.1	38.9	40.0	49.8	33.3	48.0	43.3	50.4
Storage	%	96.9	17.7	89.7	30.7	43.3	50.4	80.0	40.7	96.7	18.3
Distribution and transportation	%	9.4	29.6	35.9	48.6	0.0	0.0	6.7	25.4	36.7	49.0
Other activities	%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Storage practices</b>											
Days stored before selling	Number	2.7	2.1	3.8	2.4	6.8	3.9	11.7	9.7	4.2	3.9
<b>Main storage methods</b>											
Sacks	%	80.7	40.2	80.0	40.6	92.3	27.7	73.9	44.9	89.3	31.5
Others	%	9.7	30.1	20.0	40.6	7.7	27.7	26.1	44.9	10.7	31.5
<b>Potato sales</b>											
<b>Sales volume and price (last 30 days)</b>											
Quantity of potato sold ('000)	Kgs	3.8	7.4	5.1	7.8	0.4	0.4	2.0	2.2	3.7	7.1
Quantity sold to Aggregators ('000)	Kgs	3.3	7.6	4.9	7.9	0.0	0.1	1.0	2.3	2.8	7.3
Quantity sold to Processors ('000)	Kgs	1.3	1.4	1.0	1.5	0.0	0.1	1.5	1.4	1.1	1.5
Quantity sold to Consumers ('000)	Kgs	1.5	1.8	1.9	2.4	0.3	0.4	1.8	1.5	1.9	2.1
Total sales revenue ('000)	KSh	183.5	342.3	246.5	357.3	17.8	27.7	82.3	90.4	191.6	348.5
Average price of potato	KSh/Kg	55.6	13.7	50.6	11.7	47.7	18.4	47.7	16.0	60.1	16.1
<b>Potato sales: destinations</b>											
Intermediaries	%	43.8	50.4	66.7	47.8	3.3	18.3	30.0	46.6	26.7	45.0
Processors	%	78.1	42.0	48.7	50.6	10.0	30.5	66.7	48.0	56.7	50.4
Individual consumers	%	93.8	24.6	79.5	40.9	96.7	18.3	100.0	0.0	96.7	18.3
<b>Potato price benchmarking</b>											
Purchase price in abundant season	KSh/Kg	24.4	7.3	26.3	10.6	19.9	7.0	20.5	6.7	24.6	7.0
Purchase price in scarce season	KSh/Kg	56.2	10.2	54.6	11.4	44.1	9.1	53.2	11.6	55.7	11.0
Selling price in abundant season	KSh/Kg	30.2	9.2	31.4	10.3	26.3	10.8	27.0	9.9	37.2	11.3
Selling price in scarce season	KSh/Kg	63.0	11.0	57.7	12.2	54.7	23.9	62.1	16.0	83.8	20.5

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

## 4.2.4 Potato processing

### Types of processed outputs

Fried potato products are by far the most important type of processed potato output in Kenya, accounting for nearly 100 percent of total processing operations (Table 4.6). The dominance of fried products is consistent across all counties and demographic groups (Annex Table 4), with mixed fried products accounting for a marginal share (less than 1 percent) primarily in Nakuru county and among female and youth processors. These findings imply that potato processing in Kenya is highly specialized and narrowly focused on a single end product. This implies that single-processed outputs dominate potato processing in Kenya, with 100 percent of processors in most counties engaged in producing one processed output, while a small share (10 percent) of Nakuru-based processors produced two types of outputs. No statistically significant differences exist by gender or age (Annex Table 4).

**Table 4.6** Potato processing and input use, by county

Variable	Measure	Total		Kiambu		Nakuru		Narok		Nyandarua		Nyeri	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<b>Type of processing done</b>		56		13		13		10		10		10	
Fried potato products	%	98.0	13.0	100.0	0.0	92.0	28.0	100.0	0.0	100.0	0.0	100.0	0.0
Mixed fried products	%	2.0	13.0	0.0	0.0	8.0	28.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Number of products processed</b>													
One	%	100.0	10.0	100.0	0.0	90.0	30.0	100.0	0.0	100.0	0.0	100.0	0.0
Two	%	0.0	10.0	0.0	0.0	10.0	30.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>Potato purchases</b>													
<b>Source and volume of potato purchases</b>													
<b>Producers</b>	%	33.9	47.8	30.8	48.0	23.1	43.9	60.0	51.6	40.0	51.6	20.0	42.2
Quantity purchased from producers	Kgs	230.3	622.3	95.7	198.4	55.4	119.5	198.1	227.8	500.5	956.9	394.4	1069.8
Value of potato purchased ('000)	KSh	8.3	22.1	5.0	11.6	2.1	4.1	6.6	6.9	19.9	43.0	10.6	25.7
Prices of potato purchased	KSh/kg	39.8	13.7	46.7	16.0	41.3	10.2	38.2	18.2	36.4	8.0	35.3	16.6
<b>Aggregators</b>	%	75.0	43.7	76.9	43.9	84.6	37.6	40.0	51.6	80.0	42.2	90.0	31.6
Quantity purchased from aggregators	Kgs	482.4	705.4	645.7	939.2	315.6	494.2	185.4	307.4	429.0	473.9	837.4	949.0
Value of potato purchased ('000)	KSh	19.5	29.4	27.0	41.2	10.5	12.3	9.5	15.4	18.6	19.4	32.4	41.1
Prices of potato purchased	KSh/kg	41.5	11.2	37.5	11.6	41.9	11.2	54.5	11.8	43.8	8.8	37.5	9.6
<b>Seasonal variation in prices</b>													
Purchase price in abundant season	KSh/kg	23.9	7.8	22.6	8.0	24.3	6.6	26.9	9.8	21.5	5.3	24.5	9.3
Purchase price in scarce season	KSh/kg	55.9	15.7	49.9	13.3	47.0	8.6	63.7	22.5	61.9	13.0	61.5	13.7
<b>Sales destinations</b>													
Consumers	%	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

### Potato sourcing and marketing

Most potato processors sourced potato from both producers and aggregators. About 34 percent of processors purchased potato directly from producers and 75 percent from aggregators (Table 4.6). Quantities purchased from producers averaged 230 kg per month, with processors paying an average of 39.8 KSh/kg when buying directly from producers. Purchases from aggregators averaged 482 kg, which is more than twice the average purchase volume from producers, indicating the importance of the potato value chain in delivering potatoes to both consumers and processors. Purchase prices from aggregators

averaged 41.5 KSh/kg, slightly higher than purchase prices from producers, which is expected. Nyandarua-based processors purchased the largest quantities from producers (501 kg), while Nyeri processors purchased the most from aggregators (837 kg). Male processors were more likely to source potatoes from both aggregators and producers than female processors (Annex Table 4).

As expected, seasonal price fluctuations that characterize the upstream potato market were also reflected in the component of the market that supplies processors. Abundant-season prices faced by processors averaged 23.9 KSh/kg, and scarce season prices averaged 55.9 KSh/kg, representing a 134 percent seasonal premium closely mirroring the pattern observed among aggregators. Abundant-season prices were relatively higher in Narok (26.9 KSh/kg), while scarce-season prices were highest in Narok (63.7 KSh/kg) and Nyandarua (62 KSh/kg).

### **Processed product destination**

Direct sales to consumers represent an exclusive market channel for potato processors in Kenya, with 100 percent of processors reporting to have sold processed outputs directly to consumers across all counties and demographic groups (Table 4.6 and Annex Table 4). This indicates a strong and universal retail orientation of potato processors. This may also reflect that most processors are small-scale, informal operations in close proximity to consumers, consistent with the structural characteristics of the processor segment described in the preceding section.

In summary, the results highlighted in this section demonstrate a strong gender and spatial segmentation, with potato production and aggregation dominated by women. Processing is largely undertaken by smaller-scale operators in close proximity to consumers, underscoring processing as an important entry point for both youth and women's participation. Production is characterized by smallholder potato farming systems with moderate but spatially varied yields, widespread use of hired labor and chemical fertilizer, limited mechanization, except in Narok county, and significant county-level variation in input use, technology adoption, and access to services. Postharvest handling remains largely manual, and storage practices are predominantly informal, with sacks the most common storage vessel and relatively short storage periods. Downstream, aggregators play a central role in linking producers to consumers and processors, with strong seasonal price arbitrage that is particularly pronounced in potato, given the very high price range between abundant and scarce seasons. However, processors are entirely consumer-oriented and exclusively specialize in fried potato products, reflecting both strong demand patterns and structural constraints within the potato value chain.

## **5. PRE- AND POSTHARVEST POTATO LOSSES IN KENYA**

In this section, we discuss the share of potato value chain agents in Kenya that face losses during potato production, at postharvest production, and in lower streams of aggregation and processing. We also discuss the volume and value of losses sustained as a share of potato production in the same value chain nodes and then summarize the self-reported causes of losses.

## 5.1 FREQUENCY OF FOOD LOSSES

### 5.1.1 Frequency of losses among producers

As discussed in section 3, we gathered data on whether potato producers experienced losses and the size of those losses during production (preharvest), harvesting (due to potato left in the field), and post-harvest production activities. Table 5.1 summarizes the frequency with which producers suffered losses during these activities. Nearly all producers surveyed encountered losses at one stage (at least), with 99 percent indicating that they encountered losses at more than one stage. Preharvest losses were reported by 77 percent of producers and postharvest losses by 95 percent. Only 2.6 percent of the producers reported leaving some of their potatoes in the field (Table 5.1).

**Table 5.1.** Share of producers that encountered losses by loss type (percent)

Category	Measure	Preharvest	Harvest	Postharvest	More than one type
<b>Total</b>	%	76.8	2.6	94.7	99.0
	SD	42.2	16.0	22.3	9.9
<b>Group</b>					
<b>Treatment</b>	%	76.8	1.6	97.7	99.4
	SD	42.3	12.6	14.9	8.0
<b>Control</b>	%	76.9	3.7	91.6	98.7
	SD	42.2	18.9	27.7	11.5
<b>Significance test</b>				***	
<b>County</b>					
<b>Kiambu</b>	%	81.8	3.4	88.2	98.0
	SD	38.7	18.3	32.4	13.9
<b>Nakuru</b>	%	71.2	0.5	97.1	99.4
	SD	45.4	7.7	16.9	7.7
<b>Narok</b>	%	70.0	0.0	100.0	100.0
	SD	46.2	0.0	0.0	0.0
<b>Nyandarua</b>	%	93.8	5.0	97.5	98.8
	SD	24.4	21.9	15.7	11.2
<b>Nyeri</b>	%	66.7	4.2	99.0	100.0
	SD	47.4	20.1	10.2	0.0
<b>Gender</b>					
<b>Female</b>	%	77.8	2.7	93.5	99.2
	SD	41.6	16.2	24.7	9.0
<b>Male</b>	%	75.3	2.5	96.7	98.7
	SD	43.2	15.7	18.0	11.2
<b>Significance test</b>					
<b>Age</b>					
<b>Youth</b>	%	71.6	1.8	96.3	99.1
	SD	45.3	13.5	18.9	9.6
<b>Mature</b>	%	78.0	2.8	94.4	99.0
	SD	41.5	16.5	23.0	10.0
<b>Significance test</b>					

Source: Authors' calculations using Kenya PHL baseline survey (2024).

A higher share of producers in treatment areas experienced postharvest losses than those in control areas, while the share that experienced preharvest losses were comparable in the two areas. Across

counties, considerable differences were observed in losses at both the preharvest and postharvest stages. Nyandarua county recorded the highest share of producers with preharvest losses (93.8 percent), while Nyeri recorded the lowest (66.7 percent). All producers in Narok and Nyeri counties reported losses at more than one stage. No statistically significant differences in the frequency of pre- and postharvest losses were observed across gender and age groups.

### **5.1.2 Frequency of losses among aggregators and processors**

All aggregators that engaged in storage reported experiencing losses during this activity, which was the most common activity, undertaken by 82 percent of aggregators. Frequency of storage losses were highest in Narok county, where 90 percent of those that stored potato reported losses, compared to only 17 percent in Nyandarua and 38 percent in Nakuru (Annex Table 5). The share of aggregators that reported losses during drying was 13 percent in the overall sample but was substantially higher in Narok (49 percent) than in the other counties, while this share was zero in Kiambu and Nakuru. Reselection losses were reported by 30 percent of aggregators in the overall sample. Aggregators in Narok county recorded the highest share (67 percent) compared to Kiambu (10 percent) and Nakuru (3 percent). Distribution and transportation losses were reported by 9 percent of aggregators in the overall sample, with considerably more male aggregators (21 percent) reporting such losses compared to female aggregators (6 percent), and among youth aggregators (16 percent) compared to mature aggregators (6 percent).

Among processors, losses were also widespread, with 85.7 percent reporting them (Annex Table 6). All processors from Nyandarua county reported losses, while processors in Nyeri recorded the lowest share at 70 percent. Although differences existed in the share of processors that reported losses across gender and age, these differences were not statistically significant.

## **5.2 VOLUME AND VALUE OF LOSSES**

Figure 5.1 provides an estimation of potato losses along the value chain from producers to aggregators and processors. These losses capture the volume and value of potatoes that were (1) totally lost (quantitative degradation) and (2) damaged but still potentially usable (qualitative degradation).

### **Total losses: Overall sample**

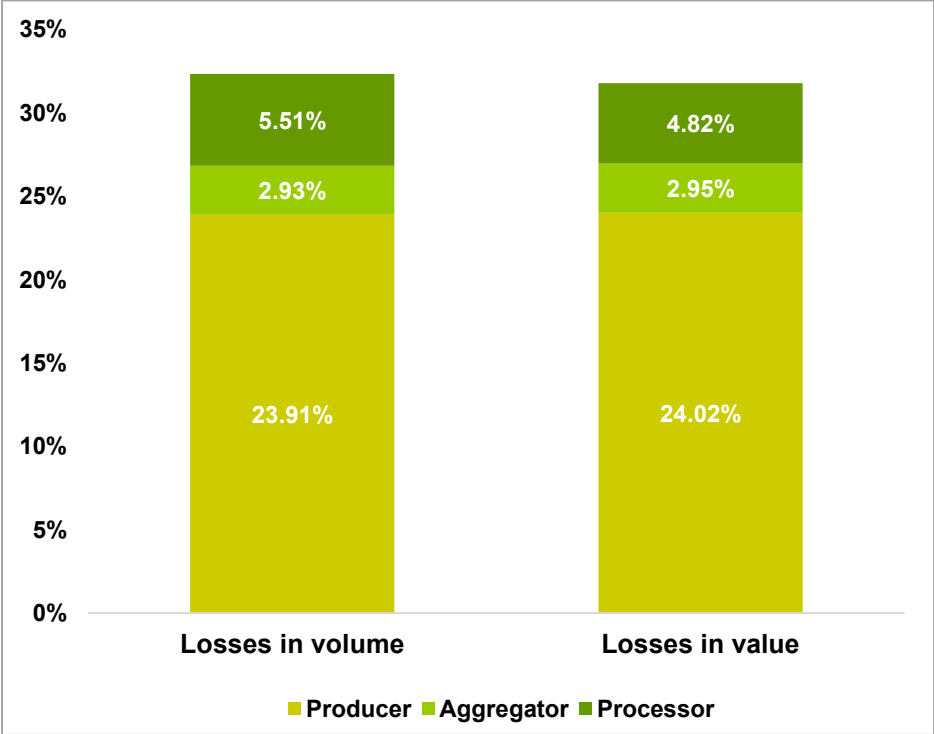
Potato losses along the value chain averaged 32.4 percent of the total volume produced. In value terms, using ideal prices, losses averaged 31.8 percent of the total production value.

Producers suffered most of these losses, accounting for an average of 74 percent of the volume and 75.6 percent of the value of potato losses. Processors sustained the second highest share of losses with 17 percent of the volume and 15.2 percent of the value of potato losses, respectively. Aggregators experienced the lowest share of losses, with an average of 9 percent and 9.3 percent of the volume and value of potato losses, respectively.

### **Total losses: Across space**

Total losses in Nyandarua county were the highest, averaging 42.5 percent of the volume and 44 percent of the value of production, followed by total value chain losses in Narok county (35.6 percent in volume and 36.7 percent in value) (Figure 5.2, panel a). The lowest share of losses was reported in Kiambu (24 percent in volume and 26.2 percent in value). In all counties, producers reported the highest proportions of losses; these rates reached 94 percent of volume of losses in Kiambu and dropped to 52.5 percent of volume of losses in Narok.

**Figure 5.1** Estimated volume and value of food losses along the potato value chain in Kenya



Source: Authors' calculations using Kenya PHL baseline survey (2024).

Aggregator losses were the lowest across all five counties, with Nyeri aggregators reporting nearly no losses, while Narok and Nyandarua aggregators reported the highest share of volume of losses at 3.4 percent and 3.1 percent, respectively. At the processor stage, Narok county stood out, with 13.5 percent of the volume and 12.1 percent of the value of losses. These rates are 8.4 percentage point (pp) and 8.5 pp higher than in Nakuru, which reported the second highest processor losses (5.1 percent in volume and 3.6 percent in value).

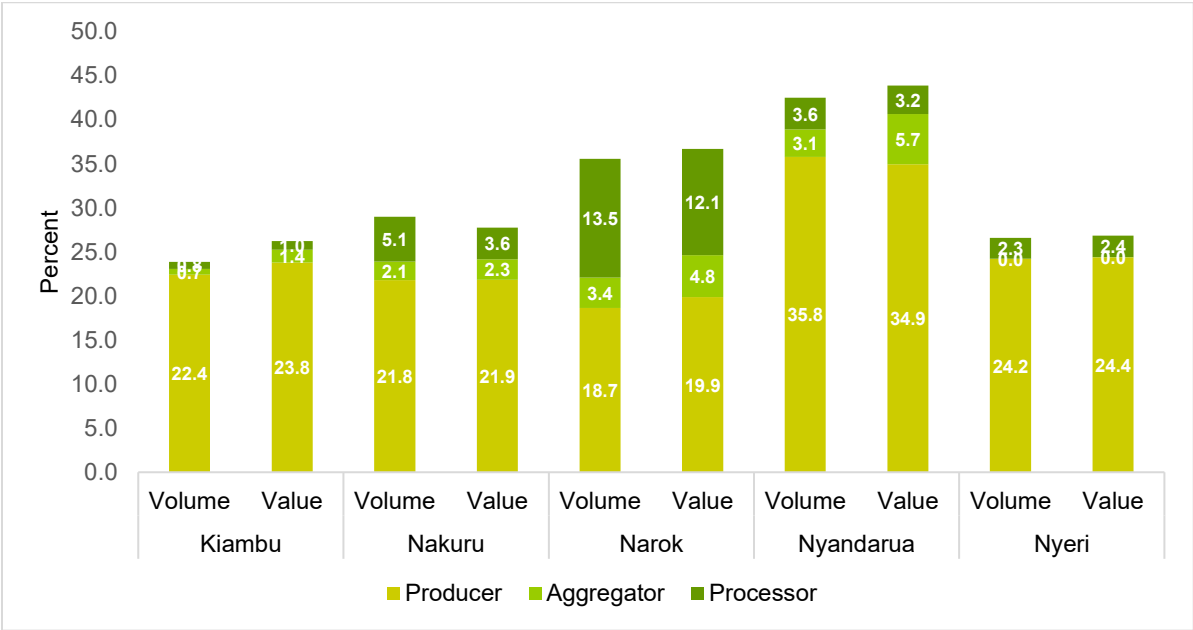
**Total losses: Across gender and age**

Total losses averaged 36 percent of the volume and value of output for female value chain agents, while the respective values were 27.3 and 28.6 percent for male value chain agents. Female value chain actors reported higher shares of losses in all three stages of the value chain, with differences of 0.4 pp, 1.5 pp, and 6.6 pp at the production, aggregation, and processing stages, respectively. Producers reported the highest losses across both genders, particularly among males, while female processors reported considerable losses.

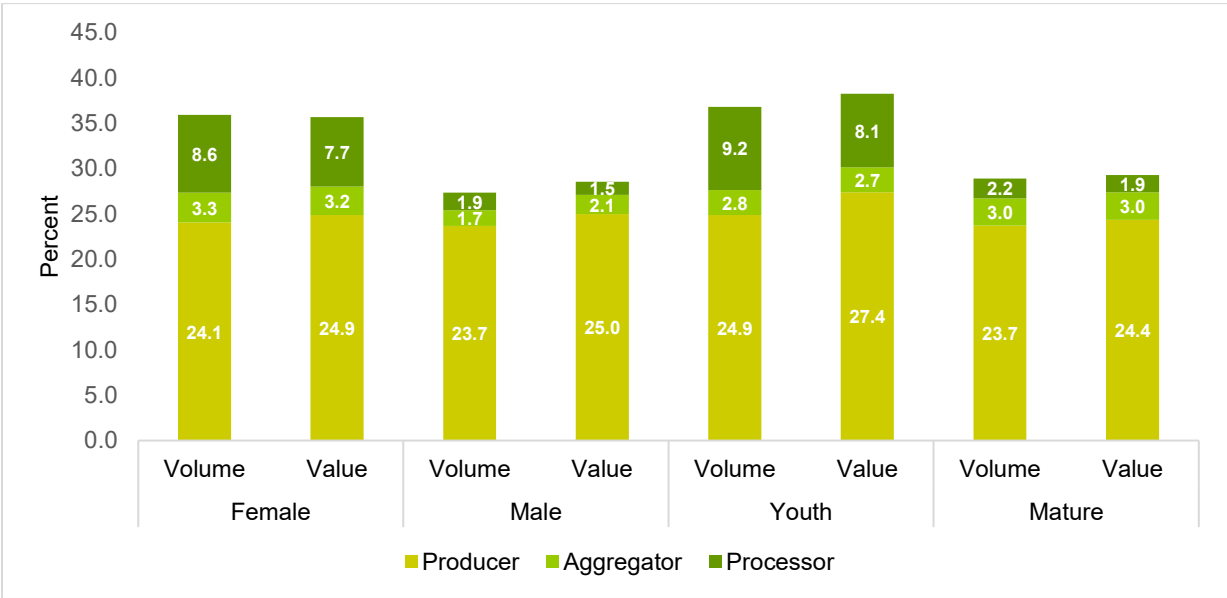
Youth value chain agents reported higher losses than their mature counterparts with average losses of 36.8 percent for the volume of production and average losses of 38.2 percent for value of production, while mature agents reported losses of about 29 percent for both volume and value of production. Young producers and processors lost more than their mature counterparts, with the producer losses differing by 1.2 pp and 3 pp in terms of volume and value, respectively, and processor losses differing by 7 pp and 6.2 pp in terms of volume and value, respectively. Mature aggregators experienced slightly higher losses in both volume and value (0.2 pp and 0.3 pp, respectively).

**Figure 5.2** Estimated volume and value of food losses along the potato value chain in Kenya

**a. Estimated volume and value of losses across counties**



**b. Estimated volume and value of losses across gender and age**



Source: Authors' calculations using Kenya PHL baseline survey (2024).

**5.2.1 Volume of losses among producers**

**Volume of losses: Overall sample**

Figure 5.3 disaggregates the volume of producer losses into preharvest, left in the field, and postharvest stages for the overall sample and across spatial and demographic characteristics. Of the total volume of potatoes lost by producers, the highest proportion (85.3 percent) occurred at the preharvest

level. Postharvest losses accounted for 13.1 percent of volume of losses. Losses due to production left in the field accounted for approximately 1.6 percent of the volume of output lost by producers.

### **Volume of losses: Across space**

Producers in treatment villages lost slightly more potatoes (24.8 percent) compared to those in control villages (23 percent). Losses in treatment villages were 20.8 percent at preharvest and 4 percent at postharvest, while the corresponding losses in control villages were 20 percent and 2.3 percent. The share of production left in the field in control villages (0.7 percent) was higher than the corresponding share in treatment villages (0.1 percent). Calculated from total producer losses, preharvest losses and losses from being left in the field were relatively more important in control villages than in treatment villages, whereas postharvest losses accounted for a higher share of total producer losses in treatment than in control villages. This suggests that producers in control villages might have been more exposed to factors adversely affecting crop growth, as well as inadequate harvesting labor and tools.

Producers in Nyandarua county reported the highest losses (35.8 percent), which was 11.6 pp higher than losses in Nyeri, the county with the next highest share of total losses. Producers in Nyandarua county had the highest share of both preharvest and postharvest volume of losses, indicating that losses in Nyandarua were not isolated to a single stage of the value chain, but reflected compounding inefficiencies across production and postharvest handling. The share of losses reported in the remaining counties ranged from 18.7 percent in Narok to 24.2 percent in Nyeri. This narrow range of loss indicates comparable loss levels and interventions in most counties and reinforces that Nyandarua is a distinct county that may require more targeted interventions.

Calculated from total producer losses, preharvest losses accounted for more than 80 percent of total volume of producer losses in all counties, ranging from 82 percent in Narok to 87.6 percent in Nyeri. The reverse occurred for postharvest producer losses, which accounted for 10 percent of the volume of producer losses in Nyeri and Kiambu. The share was highest in Narok at 18 percent, implying that being left in the field contributed insignificantly to losses across all counties.

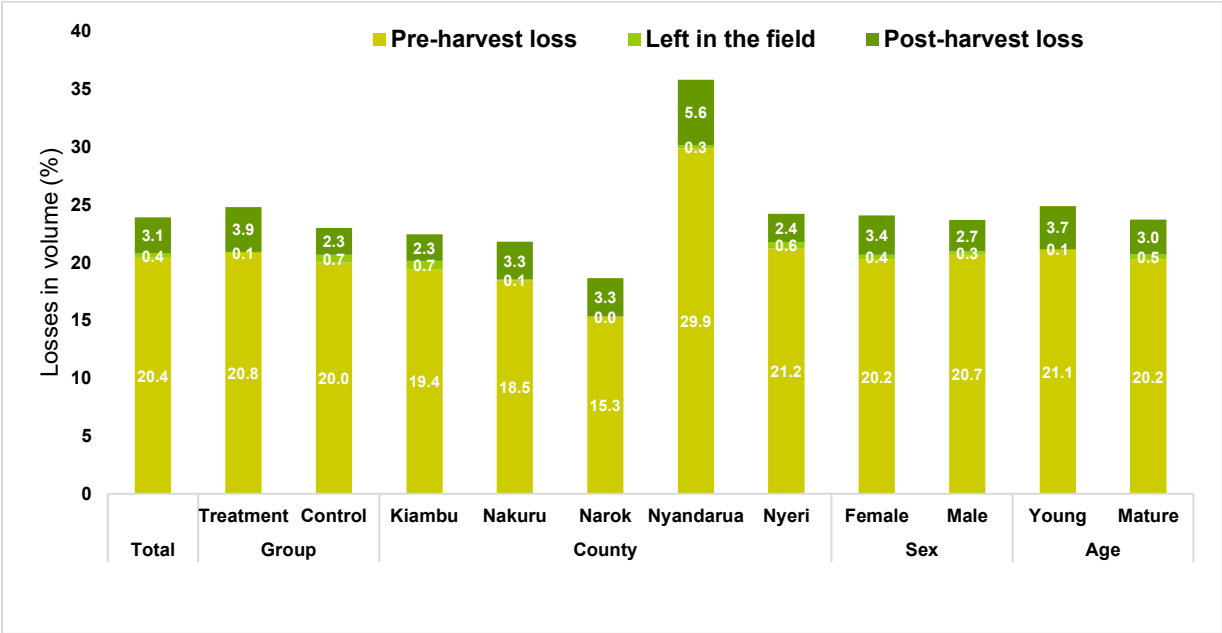
### **Volume of losses: Across gender and age**

Female producers experienced slightly higher overall losses in volume (24.1 percent) than their male counterparts (23.7 percent). When calculated from total producer losses, female producers experienced higher postharvest losses (14 percent) than did male producers (11.5 percent). The case is reversed for preharvest losses, with 87.3 percent for male producers compared with 84 percent for female producers.

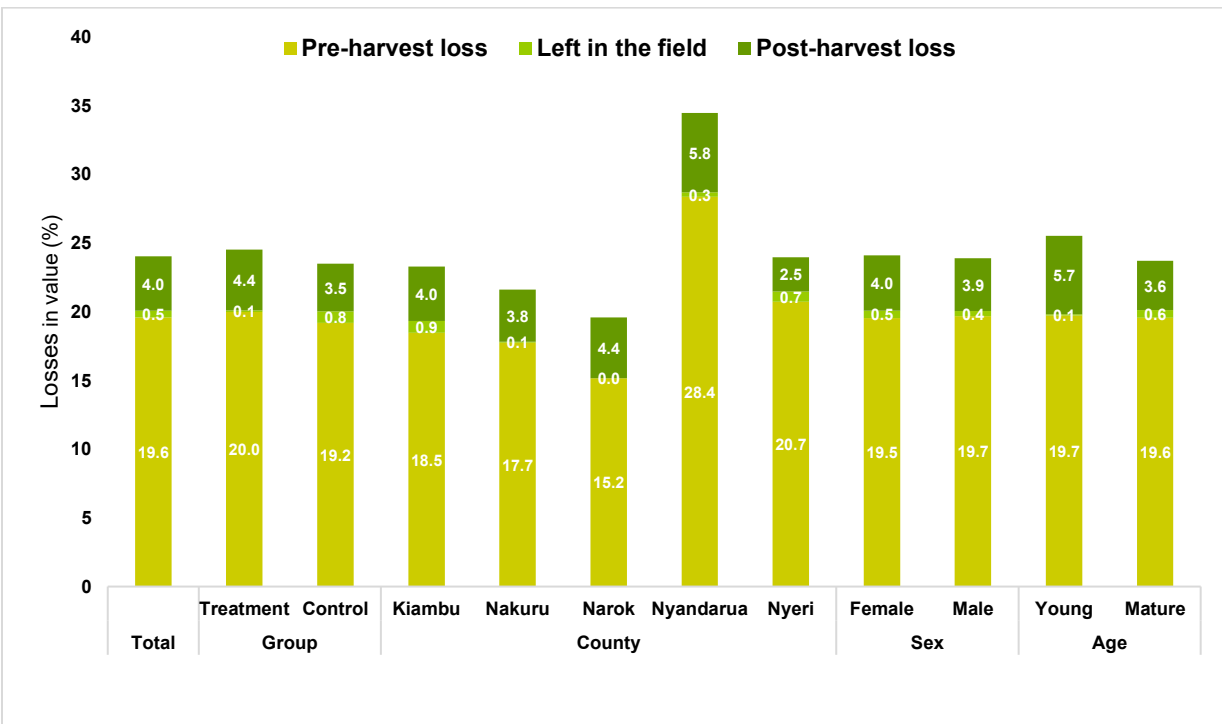
Comparing food losses by age of producer indicates that total losses among young producers, approximately 24.9 percent of the total production, are higher compared to losses among mature producers (23.7 percent). For both age groups, preharvest losses accounted for the highest share of total production. An important distinction exists for production left in the field, which accounts for 2 percent for mature producers compared to 0.3 percent for young producers. Interventions to reduce food losses among producers may need to focus on less experienced youth.

**Figure 5.3** Estimated food losses among producers, across spatial and demographic characteristics

**a. Food loss in the potato value chain as a percentage of total volume (kg) of production**



**b. Food loss in the potato value chain as a percentage of total value (Shillings) of production**



Source: Authors' calculation using Kenya PHL baseline survey (2024).

## *Value of losses among producers*

### **Value of losses: Overall sample**

Figure 5.3 (panel b) shows the value of food losses among producers, separated into pre- and postharvest losses and losses due to potatoes left in the field. The figure shows that 24.4 percent of the total production value was lost. This is higher than the share of losses in volume of production, reflecting the effect of prices in influencing the value-based measurement. Preharvest losses accounted for 81.5 percent of lost value, followed by postharvest losses at 16.6 percent.

The estimated value of producer-level losses would amount to KSh 14.5 billion if all 800,000 small-holder potato producers in Kenya experienced loss levels similar to those observed among producers in this study. Put differently, the total value of potato losses in Kenya in 2024 would be equivalent to the average annual per capita income of approximately 50,000 Kenyans, which was KSh 302,607 in 2024 (Kenya National Bureau of Statistics 2026).

### **Value of losses: Across space**

Producers in treatment villages reported slightly higher value of losses than those in control villages (24.8 percent vs. 24 percent). Calculated from total value of losses, preharvest losses accounted for 81.4 percent of total value lost for treatment-village producers, which was about the same for control-village producers (81.6 percent). Postharvest losses accounted for 18.1 percent of total lost value for treatment-village producers, while for control-village producers, it accounted for 15 percent of total lost value. This implies that the value of postharvest losses is more important for producers in treatment villages, while the value of preharvest losses is much more important in control villages, and the value of production left in the field is considerably higher for control-village producers.

Consistent with the volume of losses, the share of value lost by producers in Nyandarua (35 percent) was 10.6 pp higher than in Nyeri, the county with the next highest share of value lost. The share of value of output lost ranges from 19.9 to 23.8 percent in the three remaining counties. This alignment between value and volume losses suggests that spatial disparities are driven more by the scale of physical losses than by price differentials across counties.

### **Value of losses: Across gender and age**

Measured in terms of value, female and male producers experienced a nearly identical share of losses (24.9 and 25 percent, respectively). Preharvest losses accounted for approximately 80 percent of the total value of losses for both genders. Postharvest losses accounted for approximately 18 percent, indicating that gender differences in the size and components of value lost are minimal.

Youth producers reported losses of 27.4 percent of the value of production. This is considerably higher than losses reported by mature producers (24.4 percent). Moreover, compared with mature producers, youth producers had higher postharvest losses. However, preharvest losses accounted for 74.6 percent of total lost value for youth producers, while this was slightly higher at 81.3 percent for mature producers. Postharvest losses accounted for 25.1 percent and 16.5 percent of total value losses among youth and mature producers, respectively.

## *5.2.2 Volume and value of losses among aggregators*

### **Aggregator losses: Overall sample**

Losses reported by aggregators represent the smallest share compared with the other two value chain actors, yet these losses represent an important portion of total potato value chain losses. Aggregators'

losses accounted for 2.9 percent of both volume and value of total losses (Figure 5.4). Calculated from total value chain losses, this constitutes 9 percent of both volume and value of potatoes lost.

**Aggregator losses: Across space**

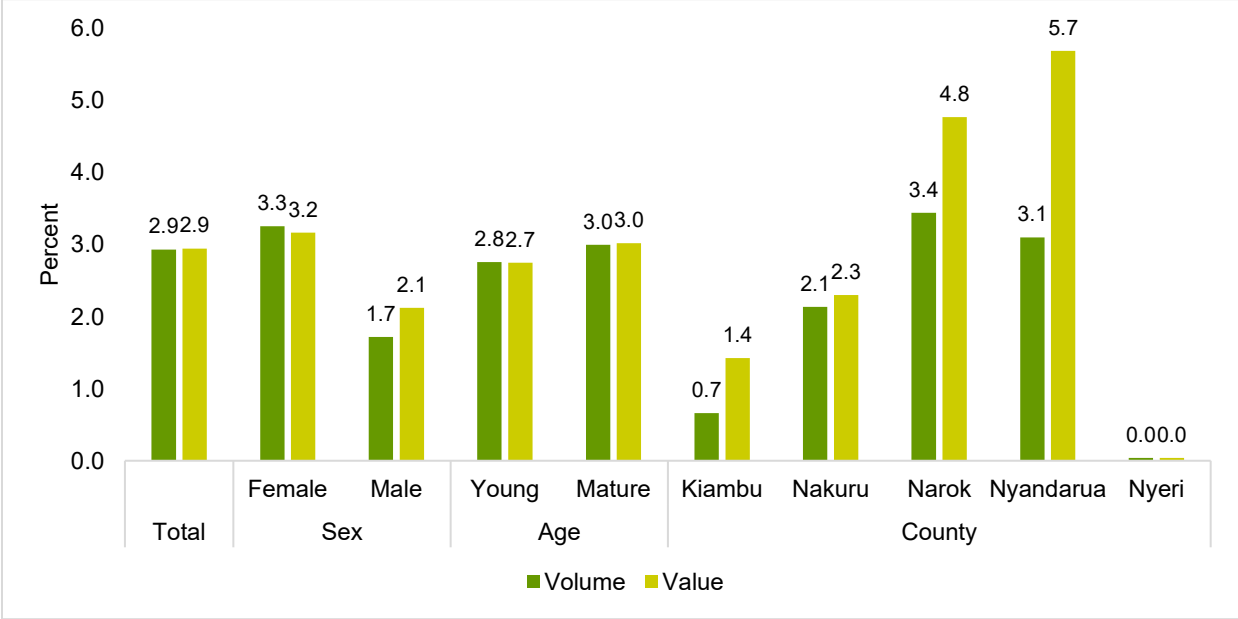
Losses in volume were not evenly distributed across counties: aggregators in Narok experienced the highest volume of losses (3.4 percent), followed by Nyandarua (3.1 percent). Aggregators from Nyeri had the lowest share of losses (0.04 percent). In terms of value, Nyandarua aggregators experienced the highest losses at 5.7 percent, followed by Narok county aggregators at 4.8 percent. Consistent with the low volume of losses in Nyeri county, the share of value of losses was near zero. In all counties, the shares of aggregators’ value of losses are higher than the corresponding shares of volume of losses. This increase in value of losses is due to increases in prices as potatoes move along the value chain.

**Aggregator losses: Across gender and age**

Female aggregators reported losses of 3.3 percent of volume of output, markedly higher than the 1.7 percent experienced by male aggregators. This gap may reflect differences in scale, techniques, or access to resources and infrastructure. Age seems to play little role since younger aggregators incurred 2.8 percent volume losses, which was only 0.2 pp less than mature aggregators.

Female aggregators incurred higher value losses (3.2 percent) than their male counterparts (2.1 percent), consistent with the gap observed in volume losses. Youth aggregators incurred 2.7 percent value losses, which was only 0.2 pp less than mature aggregators.

**Figure 5.4** Estimated food losses among aggregators, across spatial and demographic characteristics



Source: Authors’ calculation using Kenya PHL baseline survey (2024).

**5.2.3 Volume and value of losses among processors**

**Volume of losses: Overall sample**

Processors lost approximately 5.5 percent of their output volume on average (Figure 5.5). Losses incurred by processors represent a significant portion of total losses in the potato value chain, accounting for 16.8 percent of the total volume lost.

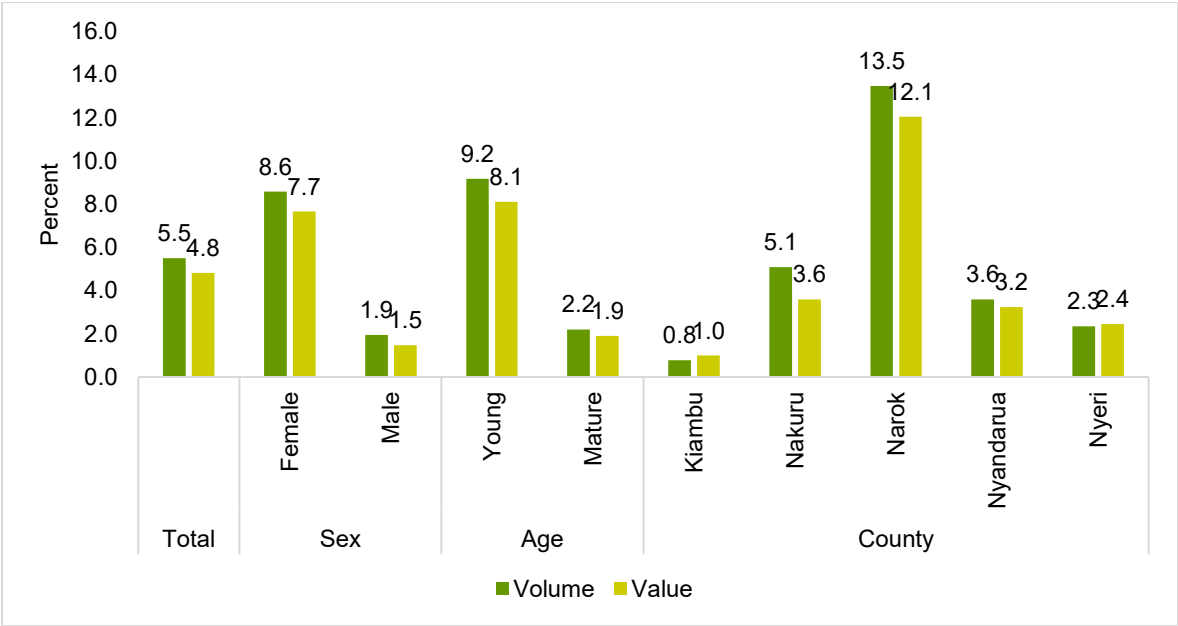
**Volume of losses: Across space**

Losses in volume were not evenly distributed across counties, with Narok processors experiencing the highest volume losses (13.5 percent) followed by processors in Nakuru (5.1 percent), Nyandarua (3.6 percent), Nyeri (2.3 percent), and Kiambu (0.8 percent), suggesting potential differences in handling practices and equipment quality.

**Volume of losses: Across gender and age**

Female processors incurred 8.6 percent volume losses, markedly higher than the 2 percent losses experienced by male processors. This gap may reflect differences in processing scale, techniques, or access to resources. Age also appears to matter, with younger processors experiencing 9.2 percent volume losses – more than quadruple the 2.2 percent losses among mature processors – suggesting that experience may confer advantages in mitigating losses during processing activities.

**Figure 5.5** Estimated food losses of processors, across spatial and demographic characteristics



Source: Authors' calculation using Kenya PHL baseline survey (2024).

**Value of losses: Overall sample**

Among processors, losses accounted for 15 percent of total value lost. However, the share of value output lost at the processing stage (4.8 percent) was lower than the share of total volume lost. This distinction suggests that volume losses do not always translate proportionally into monetary losses, likely reflecting differences in the market value of affected products.

### **Value of losses: Across space**

The spatial pattern of value losses is similar to that of volume losses. Narok processors recorded the highest value losses (12.1 percent), followed by Nyandarua processors (3.2 percent), Nakuru processors (3.6 percent), Nyeri processors (2.4 percent), and Kiambu processors (1.0 percent). Except for Kiambu county, processors in the other four counties reported shares of value lost that were lower than volume losses.

### **Value of losses: Across gender and age**

Consistent with their dominance in processing, female processors lost a larger share of value (7.7 percent) compared to male processors (1.5 percent). Younger processors experienced higher value losses (9.2 percent) than mature processors (1.9 percent), though the disparity is smaller than the one observed for volume losses, underscoring that experience and skills may mitigate both the quantity and economic impact of losses.

## **5.3 CAUSES OF FOOD LOSSES**

This section describes reported causes of losses among producers, aggregators, and processors in Kenya's potato value chain. Figure 5.6 provides a high-level overview of the causes of preharvest losses; further details are provided in Annex Tables 7 and 8. Similarly, Figure 5.7 provides a high-level overview of causes of harvest left in the field/harvesting problems, while Figure 5.8 covers causes of postharvest producer losses, details of which are provided in Annex Tables 9 and 10. Annex Tables 11 through 14 summarize the causes of losses among aggregators and processors.

### **5.3.1 Causes of losses among producers**

#### **Causes of losses: Overall sample**

##### **Preharvest**

Producers reported encountering several challenges that contributed to preharvest potato losses: 60.4 percent reported problems associated with pest infestations and disease, followed by 40.6 percent reporting excessive rain. Lack of chemical inputs and poor seed quality were reported by 18.4 percent and 14.6 percent of producers, respectively. Other reported causes of losses included damage caused by animals and rodents, lack of rain, weed infestation, and theft.

##### **Left in the field**

Among the 2.6 percent of producers that left good harvest in the field, the majority cited financial constraints on acquiring labor, specifically high labor costs, lack of funds to hire labor, or low market prices. Additionally, some producers cited the lack of available labor to support harvesting as a contributing factor (Figure 5.7).

##### **Postharvest**

Figure 5.8 depicts the main sources of losses across all postharvest activities. The most frequently reported causes of losses were poor storage practices (20.4 percent of producers), fungi and insect infestation (19.7 percent), climate variability (17.9 percent), and damage to potatoes caused by laborers (16.1 percent). Potato spillage/being blown away (6.2 percent), poor packaging (5.8 percent), and sacks not being properly tied, sewn, or cleaned (5.6 percent) played a moderate role, while categories such as transport (3.02 percent); plagues, rodents, and animals (4.11 percent); and miscalculations

during selling (0.85 percent) were relatively minor. Theft (0.24 percent) and chemical misapplication (0.12 percent) were negligible across the sample

Annex Table 11 provides a more detailed description of losses across different postharvest activities. Producers encountered challenges across most postharvest stages, with causes of losses being reported at each stage. Less than 1 percent of producers reported losses during transportation. Approximately 5.7 percent of producers reported losses during the hauling of potatoes. In both cases, the losses were mainly due to poor packaging, poorly maintained sacks (ruptured), and/or improperly tied sacks. Some producers indicated that the distance from the farm to the storage house, bad roads, and production being blown away contributed to losses while transporting and hauling potatoes.

Approximately, a quarter of the producers reported encountering problems related to postharvest activities such as drying, grading, and sorting. The reported causes of losses at this stage were largely due to laborers, including mixing poor-quality tubers with good ones in the same sacks, trampling potatoes while selecting and classifying, and poor packaging (Annex Table 9).

Half of producers reported encountering storage-related challenges. The most reported causes of losses at this stage included fluctuations in moisture and temperature, fungal and bacterial infestations, and spillage. Nearly 5 percent of producers indicated losing part of their harvest during selling; the two main causes of losses at this stage were accidents (1 percent) and bad weather (1.6 percent).

### **Causes of losses: Across space**

#### **Preharvest**

Compared to producers in control areas, a higher share of producers from treatment villages cited pest infestation and disease, lack of rain, lack of chemical inputs, theft, and poor seed quality as major contributors to preharvest losses. In contrast, excessive rainfall was more frequently reported by producers in control villages. This pattern suggests that treatment villages may be more exposed to input-related and production management constraints, while control villages appear more vulnerable to weather-related shocks, particularly heavy rainfall (Figure 5.6, panel b).

Ninety-two percent of producers in Nyandarua reported preharvest problems and 82 percent in Kiambu, with the lowest share was found in Nyeri (67 percent), indicating substantial variation in production risk. Sixty three percent and 50.7 percent of producers in Nyandarua and Kiambu, respectively, reported excessive rain as a preharvest problem, compared to 35 percent in Nyeri, 27 percent in Nakuru, and 23.3 percent in Narok. In contrast, lack of rain was more frequently cited in Narok (18.3 percent), while it was reported by less than 10 percent of producers in the other counties. This contrast reflects differing climatic pressures across counties, with some areas facing excess moisture and others experiencing water deficits.

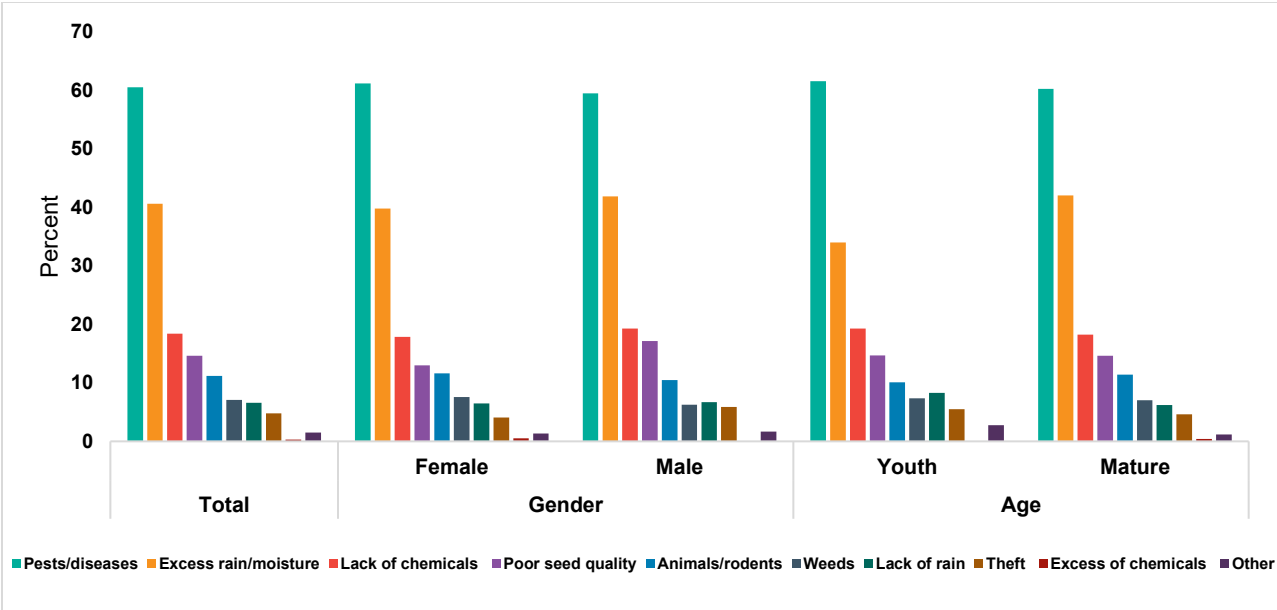
More than half of the producers in all five counties reported pest infestation and disease as a cause of preharvest losses. This share rose to 86.3 percent in Nyandarua, highlighting the severity in that county. Nyandarua also stood out with respect to weed infestation, which was reported by approximately one-fifth of producers, compared to less than 5 percent in the rest of the counties.

Input-related constraints also varied geographically. Twenty nine percent of producers in Nakuru, 26.3 percent in Nyandarua, and 20 percent in Narok reported losses due to lack of chemical inputs, compared to 11.3 percent in Kiambu and 7.3 percent in Nyeri. Twenty five percent and 21.2 percent of producers from Kiambu and Narok, respectively, reported animal-related crop damage as a preharvest problem, possibly reflecting proximity to grazing areas, which may result from a shortage of land.

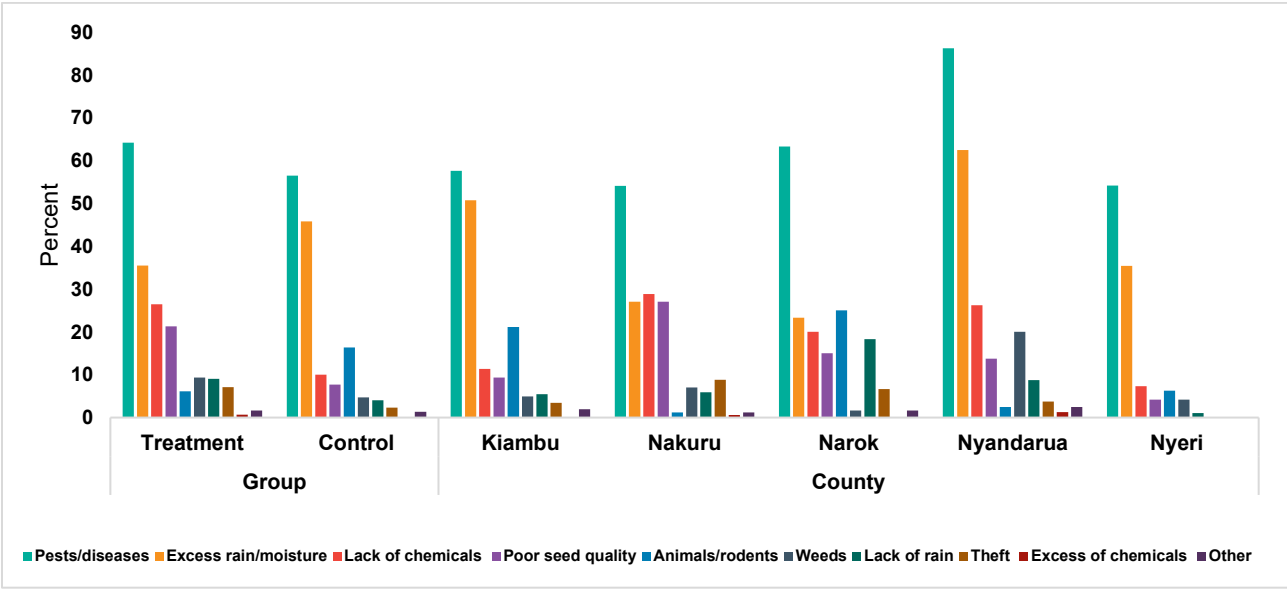
Twenty seven percent of producers in Nakuru, 15 percent in Narok and 14 percent in Nyandarua reported poor seed quality as a cause of preharvest losses, while this was relatively low in Nyeri (4.2 per cent). Producers in Nyandarua faced a wider range and higher intensity of factors contributing to preharvest losses compared to producers in other counties. This concentration of risk factors likely helps explain why, as shown in the previous section on volume of losses, Nyandarua recorded a higher share of volume of potato losses at the pre- and postharvest stages, as well as for aggregators.

**Figure 5.6** Self-reported causes of preharvest losses (percent)

**a. Causes of preharvest losses, by demographic characteristics**



**b. Causes of preharvest losses, across counties**



Source: Authors' calculation using Kenya PHL baseline survey (2024).

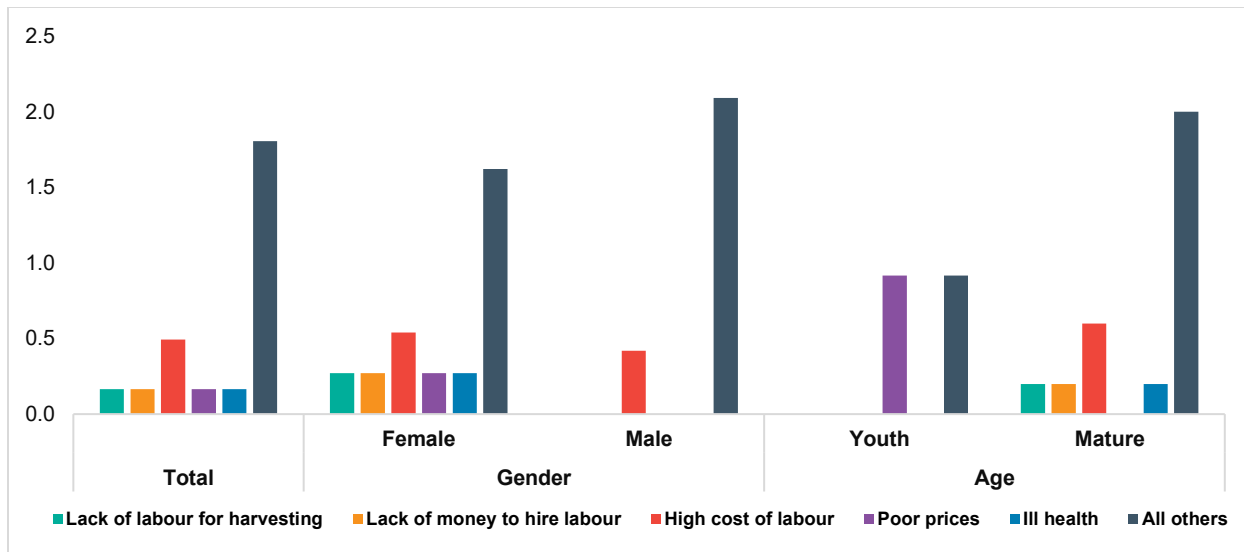
### Left in the field

A relatively higher share of producers from control villages left potatoes unharvested in the field (3.7 percent in control villages vs. 1.6 percent from treatment villages). While control-village producers reported multiple problems (lack of labor, lack of money to hire labor, high cost of labor, ill health) leading to leaving potatoes unharvested, treatment-village producers only reported poor prices as the cause for leaving potatoes in the field (Figure 5.7, panel b).

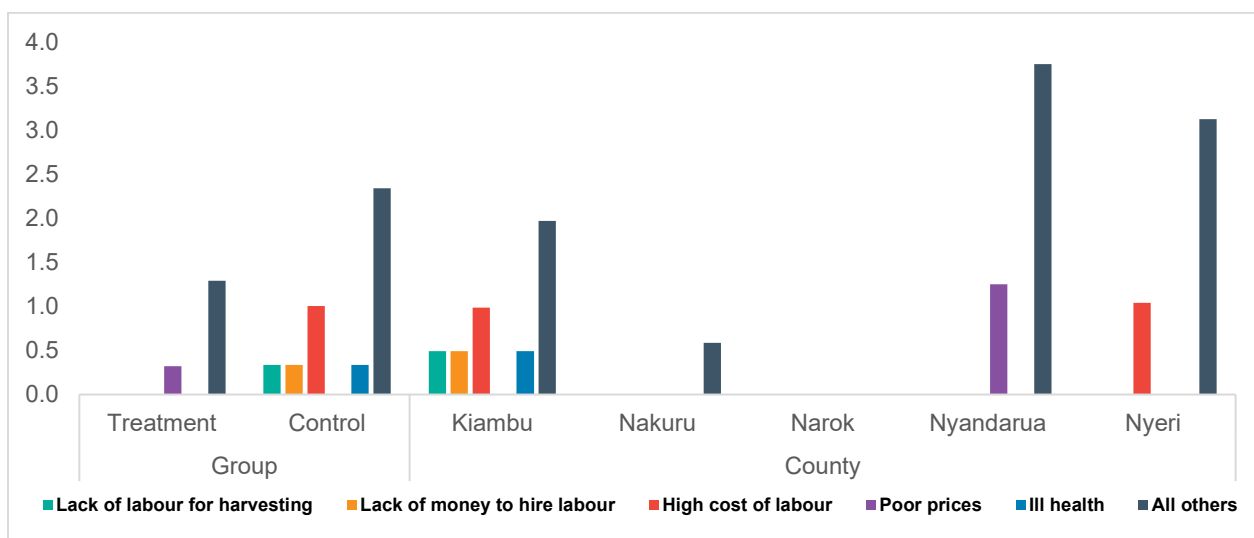
Producers who left potatoes in the field in Nyandarua (5.0 percent), Nyeri (4.2 percent), and Kiambu (3.4 percent) reported the leading causes of losses to be high labor costs and poor prices. One percent of producers from both Kiambu and Nyeri counties reported high labor costs as the reason for leaving harvests in the field, while 1 percent of producers from Nyandarua cited poor prices as the main cause (Figure 5.7, panel b)

**Figure 5.7** Self-reported causes of harvest left in the field (percent)

#### a. Causes of leaving harvest in the field, by demographic group



#### b. Causes of leaving harvest in the field, across spatial groups



Source: Authors' calculation using Kenya PHL baseline survey (2024).

## Postharvest

The main sources of postharvest losses were similar across treatment and control groups (Figure 5.8, panel b). In the treatment group, fungi/insect infestation (22.6 percent) and poor storage (19.1 percent) were the leading causes, followed by climate variability (16 percent) and laborer damage (14.2 percent). In contrast, the leading causes of losses in the control group were storage (23 percent), climate variability (21.6 percent), and laborer damage (19.8 percent), while fungi and insect infestation were relatively less prominent (14.1 percent). The treatment group experienced higher shares for spillage/blown away (5.1 pp higher) and poor packaging (4.6 pp higher), whereas the control group recorded higher values for plagues, rodents, and animals (3.5 pp higher) and miscalculations during selling (1.9 pp higher). Other categories, such as theft and chemical misapplication, remained negligible in both groups.

Sources of loss varied substantially across counties. Poor storage practices were consistently high, particularly in Nyandarua (27 percent), Narok (23.2 percent), and Kiambu (23.7 percent). Fungi and insect infestation were another dominant factor in Nyandarua (31.8 percent), as well as in Nakuru (21.7 percent) and Nyeri (19.1 percent). Climate variability was also significant across all counties, especially in Kiambu (21.9 percent) and Nyeri (20.6 percent). Damage to potatoes caused by laborers was prominent in Kiambu (22 percent) and Nakuru (21 percent) but minimal in Narok (1.3 percent) and Nyandarua (2.4 percent). Meanwhile, potato spillage/blown away and poor packaging showed notable variation, with higher values in Narok (10.6 percent and 11.3 percent, respectively), while transport-related losses were most pronounced in Nyeri (10.3 percent). Overall, cross-county patterns reinforce that biological factors and storage-related challenges are the most critical drivers of losses, though their relative importance varies by location.

Annex Table 10 details the various causes of losses at different stages of postharvest activities. Storage was the stage where most losses occurred, with a higher share of treatment-area producers experiencing losses at this stage (62.3 percent vs. 40.5 percent). Across counties, storage losses were reported by 77 percent of producers in Narok, 65 percent in Nyandarua, 60 percent in Nakuru, 43.8 percent in Kiambu, and 33.3 percent in Nyeri.

The second highest stage of postharvest losses was at the postharvest handling stage; this was cited by 24.5 percent of the producers, with a 5.2-pp-higher frequency among control-village producers. Across counties, Narok (35 percent) had the highest share of producers reporting losses during various postharvest handling activities, while Nyandarua (3.8 percent) had the lowest share (Annex Table 10).

A significantly higher share of treatment-village producers (8.1 percent treatment vs. 3.3 control) reported experiencing losses during the hauling stage. Across counties, 16.7 percent, 10 percent, and 7.3 percent of producers from Narok, Nyandarua, and Nyeri counties, respectively, reported losses at the hauling stage compared to 1.5 percent in Kiambu and 4.1 percent in Nakuru. The main causes of producer losses at this stage were poor packaging, improperly tied sacks, and ruptured sacks (Annex Table 10).

### **Causes of losses: Across gender and age**

#### Preharvest

A slightly higher share of female producers (78 percent) reported experiencing preharvest losses than did male producers (75.3 percent). Pests and diseases were the leading causes of preharvest losses among both genders, followed by excessive rain. Across age groups, a 6-pp-higher share of mature

producers reported experiencing preharvest losses. Similarly, pest infestation and disease were reported to be the main causes of losses by both young and mature producers (61.5 percent and 60.2 percent, respectively). Excessive rainfall was the second most cited problem by both age groups, with a 8.1-pp-higher share of mature producers reporting it as a cause of preharvest losses.

### Left in the field

For production of potatoes left in the field, a 1-pp-higher share of mature producers reported leaving their production in the field, while this share only differed by 0.2 pp between male and female producers. The causes of leaving potatoes in the field did not significantly differ across gender and age.

### Postharvest

A comparison by gender shows that the overall pattern of causes of losses is similar, as depicted in Figure 5.8 (panel a). A slightly higher share of female producers reported experiencing losses due to potato spillage/blown away (7.3 percent women vs. 4.4 percent men) and damage to potatoes by laborers (16.8 percent vs. 14.9 percent), while more male producers reported losses caused by fungi and insect infestation (21.4 percent men vs. 18.6 percent women) and poor storage practices (21.4 percent vs. 19.8 percent). More male producers also reported experiencing transport-related losses (4.0 percent men vs. 2.4 percent women) and slightly higher miscalculation during selling. In contrast, female producers reported experiencing climate variability and poor packaging. Despite these differences, both groups consistently identified storage and biological factors as the dominant sources of losses (Figure 5.8, panel a).

Across age groups, a higher share of youth reported losses related to poor storage practices (1.2 pp), poor packaging (4.8 pp), and sacks not being properly tied, sewn, or cleaned (2.2 pp) compared to mature producers (Figure 5.8, panel a). In contrast, a higher proportion of mature producers reported experiencing losses due to climate variability (2.1 pp), laborer damage (2.6 pp), and fungi and insect infestation (1.5 pp). Theft, miscalculation during selling, and chemical misapplication were less reported as sources by youth producers, whereas a slightly higher proportion of mature producers encountered these problems. Overall, while both age groups highlighted storage and fungi/insects infestation as key drivers, youth appear more affected by handling and packaging issues, while mature respondents were relatively more affected by environmental and labor-related factors.

These losses occurred at different stages of postharvest activities (further details are available in Annex Table 9). As noted earlier, the overall share of producers that reported transportation-related losses was low. This pattern remained consistent when disaggregating by producers' age and sex, with no youth producers reporting transport losses. Furthermore, none of the reported causes of transportation-related losses differed across gender and age groups of producers. This suggests that transport losses are both limited in magnitude and evenly distributed across demographic groups.

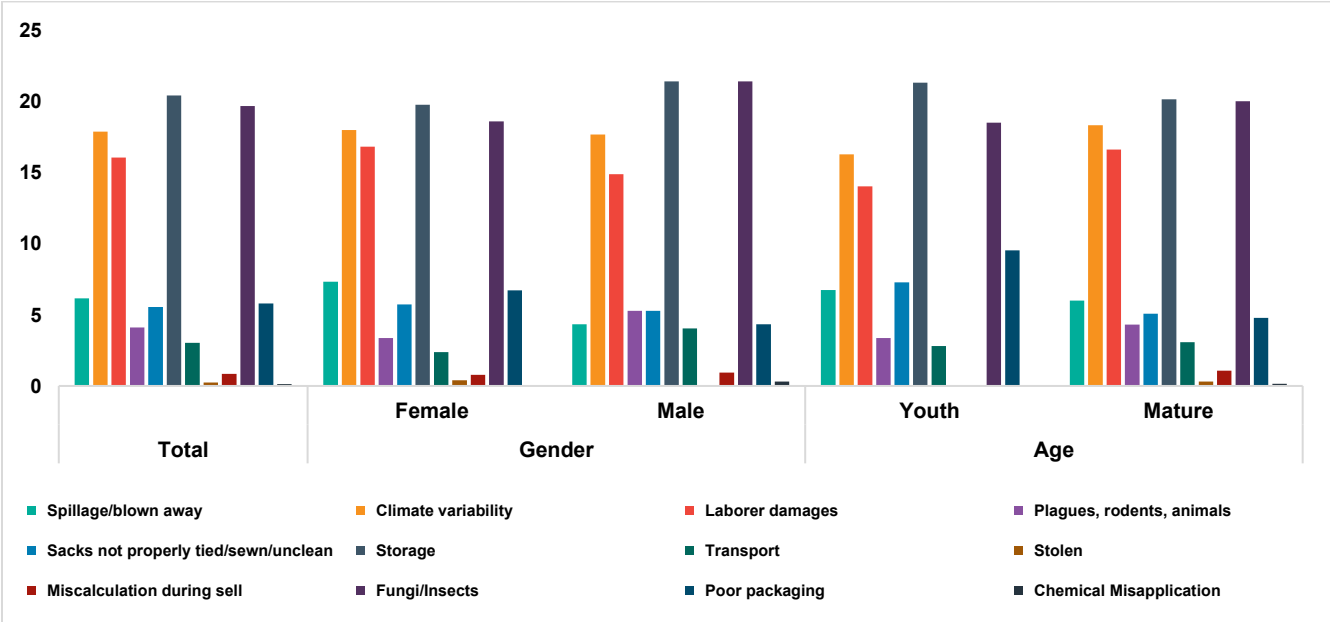
In contrast, age differences emerged during the hauling stage. A higher percentage of youth producers reported experiencing losses during hauling (10.1 percent youth vs. 4.8 percent mature). An important hauling-related cause that differed by age was improperly tied sacks, which affected 5 pp more youth than mature producers. There were no differences across gender in hauling-related causes of losses. This suggests that younger producers may face greater challenges in handling and packaging practices during hauling, potentially reflecting differences in experience, labor supervision, or access to appropriate materials.

At the postharvest handling stage (sorting, grading, drying, packaging, and curing), the overall share of producers that encountered losses differed only marginally between young and mature producers.

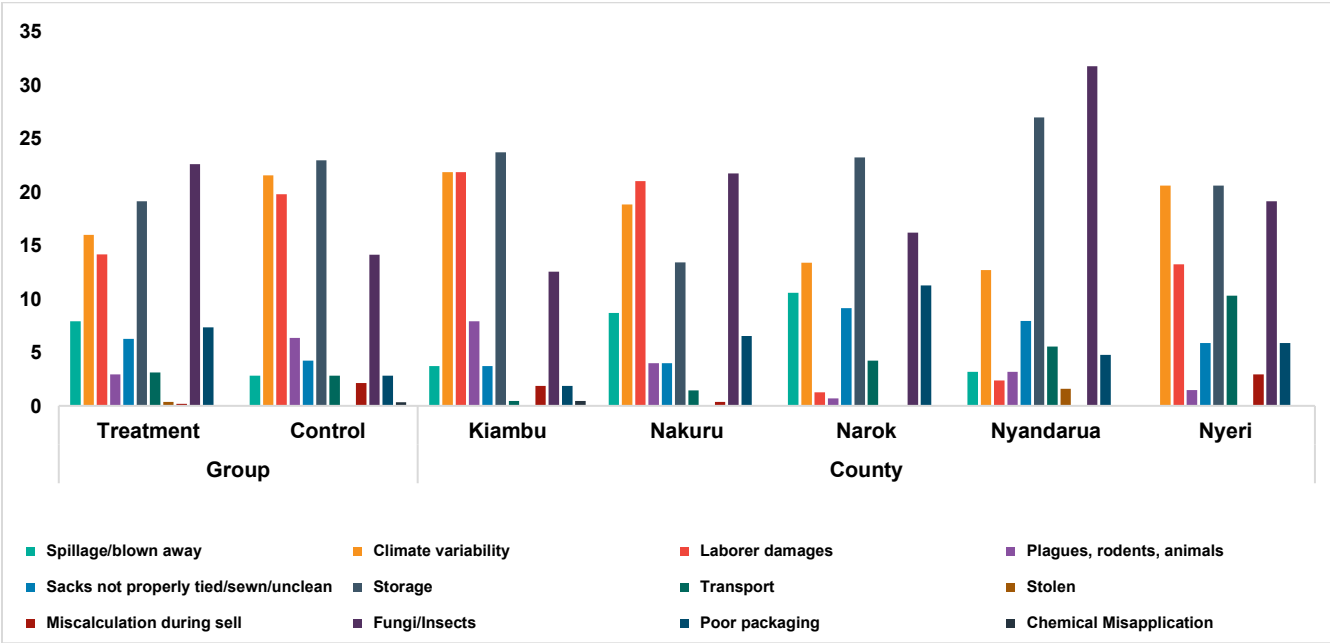
However, a higher proportion of young producers reported losses caused by improperly tied sacks (6.4 percent youth vs. 1.4 percent mature), while a higher proportion of mature producers cited adverse weather as a cause of postharvest handling related losses. There were no significant differences in the causes of losses at this stage across genders.

**Figure 5.8** Self-reported causes of postharvest losses (percent)

**a. Causes of postharvest losses, by demographic group**



**b. Causes of postharvest losses, across spatial groups**



Source: Authors' calculation using Kenya PHL baseline survey (2024).

The share of producers that reported storage related losses was similar across gender, and the reported causes did not differ by gender. However, age differences were evident. A higher share of young producers reported storage losses (58.7 percent youth vs. 50 percent mature). Despite this difference, the reported causes of losses at storage (changes in moisture, fungal and bacterial infestation, and spillage) did not significantly differ between young and mature producers. This may indicate that while younger producers are more likely to experience storage losses, the underlying storage constraints are common across age groups.

Finally, the share of producers reporting losses at the point of sale was similar for producers across gender and age groups, although male and mature producers reported slightly higher shares. Overall, the analysis suggests that demographic differences are most pronounced during hauling and storage, particularly for youth producers, while gender does not appear to systematically shape the likelihood or causes of losses across stages (Annex Table 9).

### ***5.3.2 Causes of losses at the aggregator and processor stages***

Aggregators and processors incurred measurable losses across key postharvest activities. The post-harvest activities included in our surveys for aggregators included drying, potato reselection, storage, distribution and transportation, with more details available in Annex Tables 11 and 12.

Approximately 49.7 percent of the aggregators stored potatoes, with 60.6 percent experiencing losses at this stage. Moisture-related damage and damage caused by heat were reported by 70 percent and 60 percent of the aggregators who stored potatoes, respectively. Other losses were caused by rodents (1.3 percent) and infestation (6.3 percent).

Potato reselection was practiced by 50.3 percent of aggregators. Among these aggregators, 59.3 percent reported losses while participating in this activity. Spillage was reported by nearly 19 percent of aggregators as a cause for losses during this stage, while 50 percent of aggregators reported their tubers being bruised during the reselection process.

Roughly 18.6 percent of aggregators engaged in transportation and distribution, with 46.7 percent of them reporting losses during this activity. The main identified causes of losses during transport were spillage and transport accidents, which were reported at 21.4 percent and 78.6 percent respectively, indicating weaknesses in packaging integrity and vehicle handling during movement along the value chain.

For processors, the causes of potato loss are summarized in Annex Tables 13 and 14. Across the multiple processing steps practiced by processors, the major causes of losses included staining, rotting, small potato size, and peeling. These repeating patterns experienced by value chain actors, especially handling postharvest activities, underscore systemic issues in equipment quality, technical training, and postharvest management practices that span the entire potato value chain.

## 6. CORRELATES OF PRE- AND POSTHARVEST POTATO LOSSES IN KENYA<sup>10</sup>

Tables 6.1 and 6.2 present results from the econometric analyses examining factors correlated with the occurrence and severity of pre- and postharvest potato losses, respectively. The tables report marginal effects. In the Probit models, marginal effects indicate the change in the probability (in percentage points) of experiencing pre-/postharvest damage associated with a one-unit increase in a covariate, holding other variables constant. In the Tobit models, marginal effects indicate the change in the expected observed loss intensity (in percentage points) associated with a one-unit increase in the corresponding covariate.

### 6.1 PREHARVEST LOSSES

The econometric analyses included several variables on producers' demographic characteristics, such as age, gender, education, experience growing potato, and other household characteristics, to investigate whether, holding other factors constant, these characteristics are correlated with the likelihood and intensity of Irish potato losses. The results provide insights into some of the demographic factors correlated with food losses. Young producers have a lower likelihood of experiencing preharvest losses than mature producers, which is the omitted category in the regression (Table 6.1, first two columns of numbers). The likelihood of preharvest losses declines with producers' household size, which implies that availability of sufficient labor reduces the likelihood of losses. Producers' level of education is positively associated with the likelihood of losses, which may imply that better educated firms are more likely to identify preharvest potato damage/losses. Household wealth index – a proxy for productive and durable assets – is negatively correlated with the likelihood of preharvest losses. This result suggests that farmers with greater asset ownership are able to invest in loss reduction at preharvest and the result is consistent with findings by Bachewe et al. (2020) and Kaminski and Christiaensen (2014).

Several variables capture producers' input use and marketing behavior. The probability of preharvest losses increases with the area cultivated with potato (log potato area). This positive correlation is consistent with increased probability of losses occurring with cultivated area (or volume of output), while the insignificant estimate on the intensity equation may reflect that, conditional on damage occurring, larger-scale producers may have as many incentives as smaller farms and greater capacity to limit losses, because the gains from mitigation are larger in absolute terms.

The share of output sold is negatively correlated with the intensity of preharvest losses. This pattern may arise because, conditional on damage occurring, market-oriented producers have greater incentive to implement measures that reduce qualitative losses, which will ultimately improve their revenue. To capture marketing incentives, the analysis includes the producer price gap (the difference between lean- and ample-season prices). A larger price gap is associated with a lower likelihood of preharvest losses, consistent with the interpretation that stronger expected returns increase incentives to invest effort in loss-reducing practices and timely harvesting.

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<sup>10</sup> The econometric analysis identifies factors associated with preharvest and postharvest losses. As such, we use the terms "correlations" and "associations" to emphasize the observational nature of the baseline data and that the reported relationships should be interpreted as correlational rather than causal.

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Several variables capture producers' input use and marketing behavior. The probability of preharvest losses increases with the area cultivated with potato (log potato area). This positive correlation is consistent with increased probability of losses occurring with cultivated area (or volume of output), while the insignificant estimate on the intensity equation may reflect that, conditional on damage occurring, larger-scale producers may have as many incentives as smaller farms and greater capacity to limit losses, because the gains from mitigation are larger in absolute terms.

**Table 6.1** Marginal effects of factors correlated with preharvest losses of potatoes in Kenya

	Probit: Dep. variable experienced preharvest damages? (=1 if yes)		Tobit: Dep. variable preharvest losses (%)	
	Coefficient	SE	Coefficient	SE
Gender (=1 if male)	0.021	0.016	0.329	1.389
Youth (=1 if producer 35 or less)	-0.032*	0.017	0.117	1.955
Highest level of schooling attained	0.014*	0.008	-0.602	1.038
Years of experience growing potato	0.000	0.000	-0.051	0.059
Number of household members	-0.004*	0.003	-0.108	0.336
Wealth index	-0.008*	0.004	0.207	0.448
Member of agricultural cooperative (=1 if yes)	-0.027**	0.012	-1.339	2.176
Log potato area	0.011**	0.005	-0.872	0.999
Share of output sold	-0.033	0.029	-19.976***	4.655
Log of producer price gap	-0.028***	0.011	0.290	1.475
Seed type (=1 if improved)	0.043***	0.014	-3.267**	1.460
Applied chemical fertilizer (=1 if yes)	-0.016	0.039	-10.104*	5.185
Applied Insect or pest control	0.062***	0.021	10.124***	2.700
Farmer trained on improved harvesting (=1 if yes)	-0.038**	0.016	-3.901	2.533
Used hired labor (=1 if yes)	-0.024	0.016	-0.563	2.057
Faced barriers accessing input markets (=1 if yes)	-0.010	0.011	-0.119	1.500
Accessed credits (=1 if yes)	0.010	0.014	1.718	1.643
Causes of damage index	0.014***	0.004	2.342***	0.521
Average preharvest rainfall	-0.000	0.000	0.034***	0.012
Average preharvest temperature	-0.004	0.004	-1.078*	0.577
Treatment category	-0.245***	0.054	3.793	3.882
County (=1 if Kiambu)	-0.243***	0.045	6.016*	3.201
County (=1 if Nakuru)	-0.021	0.023	-5.688*	3.007
Log-Likelihood	-56.3		-2,506.3	
Number of observations	609		609	

**Source:** Authors' analyses using Irish potato postharvest baseline survey data (2024).

**Note:** Estimates with \*\*\*, \*\*, and \* are significant at 1 %, 5 %, and 10 %, respectively.

The share of output sold is negatively correlated with the intensity of preharvest losses. This pattern may arise because, conditional on damage occurring, market-oriented producers have greater incentive to implement measures that reduce qualitative losses, which will ultimately improve their revenue. To capture marketing incentives, the analysis includes the producer price gap (the difference between lean- and

ample-season prices). A larger price gap is associated with a lower likelihood of preharvest losses, consistent with the interpretation that stronger expected returns increase incentives to invest effort in loss-reducing practices and timely harvesting.

Among input management variables, applying chemical fertilizer is negatively correlated with the intensity of preharvest losses. Existing evidence suggests that improved input use, including chemical fertilizers, is associated with better crop management and reduced losses, primarily through enhanced plant vigor and lower susceptibility to pests and diseases (Sheahan and Barrett 2017; Kaminski and Christiaensen 2014; Affognon et al. 2015). In contrast, the use of insect/pest control is associated with a higher likelihood of preharvest losses. The observed positive correlation is consistent with evidence that farmers often apply agrochemicals after pest or disease outbreaks have already occurred, leading to a spurious positive association between pesticide use and crop losses (Sheahan et al. 2017; Dillon and Barrett 2017). Farmers' use of improved potato seed varieties is positively associated with the likelihood of preharvest losses, but it is negatively associated with the intensity of preharvest losses. This pattern may reflect the dual role of improved varieties: while adopters may face a higher likelihood of losses due to greater exposure to risk or expanded production, improved seeds can enhance crop resilience and management efficiency, thereby reducing the intensity of losses conditional on their occurrence (Asfaw et al. 2012; Walker and Alwang 2015).

Skills-related variables are also associated with reduced losses. Receiving harvesting training is negatively correlated with the likelihood of preharvest losses, consistent with better harvest timing and handling practices that reduce shattering and other field losses. Similarly, membership in agricultural cooperatives is negatively correlated with the likelihood of preharvest losses. This may indicate that membership in cooperatives informs farmers about improved agronomic practices, enhances access to inputs and extension services, and facilitates information-sharing on pest and disease management, thereby helping to reduce preharvest losses.

We construct a biotic and abiotic stress index using principal components analysis based on 10 variables capturing whether producers experienced insects, plant diseases, weeds, and related stressors. These factors represent production shocks that could potentially contribute to both pre- and postharvest losses. The estimate of this index is positively correlated with both the probability and intensity of preharvest losses. This result is consistent with evidence that exposure to production shocks – such as pests, diseases, and environmental stressors – significantly increases crop damage and yield losses (Lobell et al. 2011; Savary et al. 2019). These stressors can affect crop outcomes at multiple stages of production, thereby increasing both the probability of loss occurrence and its severity.

The results indicate that higher temperatures during the preharvest period are associated with lower preharvest loss intensity, while increased precipitation is associated with higher losses. The negative association between temperature and losses may reflect conditions that reduce moisture-related damage, pest proliferation, or disease pressure in certain contexts. In contrast, the positive relationship between precipitation and losses is consistent with evidence that excessive rainfall can increase crop susceptibility to pests and diseases, promote fungal growth, and lead to waterlogging, all of which contribute to higher preharvest losses (Rosenzweig et al. 2002; Savary et al. 2019). These findings suggest that moisture-related factors may play a more critical role than heat stress in driving preharvest losses in the study context.

In summary, the econometric results show that demographic, farm, and management factors are significantly associated with preharvest potato losses. Younger producers are less likely to experience losses, while larger household size reduces this likelihood, suggesting that labor availability matters. A larger

cultivated area increases the probability of losses, whereas market orientation and price incentives influence loss intensity and likelihood. Improved input use, such as fertilizer, reduces loss intensity, while pesticide use is positively correlated with loss occurrence, likely reflecting reactive application. Improved seed varieties increase loss likelihood but reduce intensity. Training reduces losses, while biotic and abiotic stressors significantly increase both loss probability and severity. Climate effects are mixed and context dependent.

## 6.2 POSTHARVEST LOSSES

Results from the econometric analyses of postharvest losses among potato producers are presented in Table 6.2. The findings indicate that farmers' years of experience producing potato is negatively correlated with both the likelihood and intensity of postharvest losses, suggesting that experienced farmers are better able to implement effective harvesting, handling, storage, and marketing practices that minimize losses, a finding consistent with previous studies linking farming experience to improved farm management and technology use (Feder et al. 1985; Abdulai and Huffman 2014). The results also indicate that the household wealth index is negatively correlated with the intensity of postharvest losses. This result aligns with findings by Bachewe and colleagues (2020) and Kaminski and Christiaensen (2014), suggesting that greater asset ownership enhances producers' ability to invest in improved storage and handling practices.

The share of output sold is negatively correlated with both the likelihood and intensity of postharvest losses. This pattern is consistent with evidence that market-oriented producers have stronger incentives to adopt improved postharvest management practices – such as better storage, handling, and timely marketing – to protect product quality and maximize returns (Affognon et al. 2015; Sheahan and Barrett 2017). Farmers that prepare potatoes for sale have a higher probability and intensity of losses. The positive association between value addition practices (such as sorting, grading, drying, packaging, and curing) and both the probability and intensity of postharvest losses may reflect greater commercialization and stricter quality standards. Market-oriented value chains often impose higher quality requirements, leading to increased rejection or downgrading of produce, which is recorded as losses (Affognon et al. 2015; Bachewe et al. 2026).

Technology and management practices also play an important role. Use of improved potato seed varieties is positively correlated with intensity of postharvest losses. This correlation may reflect indirect effects operating through increased production and increased probability of preharvest losses. Improved varieties are typically associated with higher yields and greater marketable surplus, which can increase the volume of output exposed to postharvest handling and storage risks (Asfaw et al. 2012; Sheahan and Barrett 2017). The use of third-party agricultural services is negatively correlated with both the probability and intensity of postharvest losses. This is consistent with evidence that access to such advisory services improves farmers' management practices, including harvesting, handling, and storage, thereby reducing losses (Anderson and Feder 2007; Davis et al. 2012; Bachewe et al. 2019). This finding also suggests opportunities to engage youth, particularly young women, in the provision of agrifood-system services, including advisory support, quality monitoring, and postharvest management, thereby linking loss reduction with employment creation. Hired labor use is positively correlated with increased likelihood and intensity of postharvest losses, which may imply that, conditional on postharvest losses occurring, their intensity could increase with the use of hired labor. This is consistent with the literature on labor supervision, which suggests that hired workers may exert lower effort in the absence of close monitoring, leading to inefficiencies in harvesting and postharvest handling (Feder 1985; Otsuka et al. 1992). Bachewe et al. (2026) find a similar result in Nigeria.

The damage index constructed using 10 biotic and abiotic stressors is positively associated with the likelihood and intensity of postharvest losses. This is consistent with evidence that production-stage stressors – such as pests, diseases, and weather shocks – can have persistent effects that extend into the postharvest period, increasing susceptibility to spoilage, quality deterioration, and handling losses (Bachewe et al. 2026; Savary et al. 2019; Affognon et al. 2015).

We also include the share of preharvest losses as an explanatory variable in the postharvest loss equations. This variable is positive in both models, indicating that higher preharvest losses are associated with both greater probability and higher severity of postharvest losses. This finding underscores the spread of losses – particularly qualitative deterioration – along the value chain. Qualitative damage occurring at preharvest may intensify during storage and handling, and latent defects not immediately observable at harvest may manifest in later stages, increasing both the likelihood and severity of postharvest losses (Affognon et al. 2015; Hodges et al. 2011; Bachewe et al. 2026).

**Table 6.2** Marginal effects of factors correlated with postharvest losses of potatoes in Kenya

	Probit: Dep. variable experienced postharvest damages? (=1 if yes)		Tobit: Dep. variable postharvest losses (%)	
	Coefficient	SE	Coefficient	SE
Gender (=1 if male)	-0.010	0.043	-0.914	0.928
Youth (=1 if producer 35 or less)	-0.051	0.045	-0.656	1.357
Highest level of schooling attained	-0.005	0.027	0.184	0.510
Years of experience growing potato	-0.003*	0.002	-0.089*	0.054
Number of household members	-0.001	0.009	0.038	0.280
Wealth index	-0.019	0.012	-0.677***	0.252
Member of agricultural cooperative (=1 if yes)	0.028	0.050	0.289	1.175
Log potato area	0.033	0.024	0.718	0.525
Share of output sold	-0.344***	0.073	-12.270***	2.617
Log of producer price gap	-0.048	0.036	-0.531	0.742
Seed type (=1 if improved)	0.058	0.046	2.142**	0.929
Applied chemical fertilizer (=1 if yes)	0.076	0.100	0.676	2.987
Applied Insect or pest control	0.041	0.068	1.948	1.709
Used third party agricultural services	-0.326**	0.146	-6.724*	4.020
Farmer prepared soil manually (=1 if yes)	0.115	0.100	2.219	2.628
Farmer used modern transportation (=1 if yes)	0.013	0.067	1.165	1.601
Used modern storage (=1 if yes)	-0.009	0.046	-1.244	1.015
Farmer mechanically grades harvest	0.187	0.210	1.488	3.220
Storage fumigated before storing (=1 if yes)	-0.117	0.103	-3.328	2.336
Farmer prepares potato for marketing	0.217***	0.077	5.889***	2.102
Used hired labor (=1 if yes)	0.088*	0.051	1.966*	1.102
Causes of damage index	0.056***	0.015	1.049***	0.365
Share of preharvest potato losses (%)	0.003**	0.001	0.089***	0.033
Barriers reaching markets	0.069	0.043	1.145	1.199
Average postharvest rainfall	0.000	0.000	0.004	0.010
Average postharvest temperature	0.001	0.011	-0.375	0.366
Treatment category	0.219***	0.064	4.698**	1.891
County (=1 if Kiambu)	0.153**	0.060	3.047*	1.836
County (=1 if Nakuru)	0.004	0.053	-1.344	1.490
Log-Likelihood	-370		-1,242	
Number of observations	609		609	

**Source:** Authors' analyses using Irish potato postharvest baseline survey data (2024).

**Note:** Estimates with \*\*\*, \*\*, and \* are significant at 1 %, 5 %, and 10 %, respectively.

Although the data are from the baseline survey, the treatment-category variable is statistically significant in both equations. The results indicate a lower likelihood of preharvest losses in treatment areas but a higher likelihood and intensity of postharvest losses. This pattern is difficult to reconcile with the descriptive evidence, which shows higher levels of both preharvest and postharvest losses in treatment areas, suggesting that the estimated treatment effect should be interpreted with caution.

In summary, the econometric results show that wealth, market orientation, and management practices are significantly correlated with postharvest losses among potato producers in Kenya. Wealthier households and more market-oriented farmers experience lower losses, reflecting better incentives and capacity for improved handling and storage. In contrast, value addition practices are associated with higher reported losses, likely due to stricter quality standards in commercial markets. Improved seed use is positively associated with loss intensity, possibly through scale effects. Third-party services reduce losses, while hired labor increases loss intensity due to supervision challenges. Production stressors and preharvest losses strongly increase both the likelihood and severity of postharvest losses, highlighting loss propagation.

## 7. CONCLUSION AND POLICY RECOMMENDATIONS

This study provides a comprehensive assessment of pre- and postharvest losses along the potato value chain using detailed micro-level data collected from producers, aggregators, and processors. By combining descriptive evidence across multiple value chain nodes with econometric analysis at the producer level, the study contributes to a more complete understanding of the magnitude, distribution, and correlates of food losses in SSA. Importantly, it moves beyond producer-centric approaches by explicitly quantifying losses downstream of the farm gate.

The descriptive results show that food losses are widespread, substantial, and occur across all stages of the value chain. Our results imply that if producer-level potato loss rates observed in this study were representative among Kenya's 800,000 smallholder potato producers, it would amount to approximately KSh 14.5 billion annually – equivalent to the average annual per capita income of about 50,000 Kenyans in 2024. While producers account for a large share of total losses – particularly during preharvest and early postharvest stages – aggregators and processors also experience significant losses during storage, handling, transportation, and processing. These downstream losses reflect inefficiencies in infrastructure, handling practices, and market coordination. The findings further indicate that losses are not evenly distributed. There is considerable heterogeneity across value chain agents and across production and marketing environments. Particularly, postharvest losses become more prominent beyond the farm gate, highlighting the importance of considering the full value chain rather than focusing exclusively on production-stage losses.

The econometric results, based on producer-level data, highlight that both pre- and postharvest losses are systematically associated with household characteristics, input use, and production conditions. Demographic factors, farm size, and labor availability shape the likelihood of losses, while input use and management practices exhibit nuanced effects. Exposure to biotic and abiotic stressors consistently increases both the probability and intensity of losses. For postharvest losses, asset ownership and market participation reduce losses, while commercialization-related practices such as sorting and grading are associated with higher measured losses, likely reflecting stricter quality standards. Importantly, preharvest losses are a strong predictor of postharvest losses, underscoring the interdependence of losses across stages of the value chain.

Taken together, the findings demonstrate that food losses are cumulative and interconnected, arising from constraints that span the production, aggregation, and processing stages. By integrating evidence across value chain actors, the study highlights that losses are not confined to a single node but are the result of interacting inefficiencies in production practices, market systems, infrastructure, and information flows. This value chain perspective represents an important contribution to the literature, which has largely focused on farm-level losses, and provides a stronger empirical basis for designing interventions that address losses holistically rather than in isolation.

Several policy implications follow. First, reducing food losses requires an integrated value chain approach that simultaneously addresses constraints faced by producers, aggregators, and processors. While strengthening preharvest management through improved input use, climate-resilient practices, and extension services remains critical, these efforts must be complemented by investments in postharvest systems beyond the farm gate. Second, improving storage, transportation, and handling infrastructure is essential to reduce losses among aggregators and processors, where inefficiencies in logistics and market coordination contribute significantly to overall losses. Third, promoting market integration and commercialization can incentivize better loss management across all actors, although this must be accompanied by support that enables value chain participants to meet quality standards without incurring excessive rejections. Fourth, expanding access to agricultural advisory and service provision systems – including those targeting postharvest handling and downstream actors – can enhance management practices throughout the value chain. Furthermore, food loss reduction strategies could be explicitly linked to youth employment objectives by supporting youth-led enterprises in aggregation, storage management, transportation, quality control, and advisory services, particularly activities that lower entry barriers for young women. Finally, given the strong linkage between pre- and postharvest losses, policies should explicitly account for the propagation of losses across stages and prioritize interventions that jointly address production risks and postharvest constraints.

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## ABOUT THE AUTHORS

**Fantu Bachewe**, Research Coordinator, Development Strategies and Governance (DSG) Unit, International Food Policy Research Institute (IFPRI)

**Geoffrey Baragu**, Research Associate, Agrifood Innovation and Resilience Unit, IFPRI

**Josue Niyonsingiza**, Senior Research Analyst, DSG Unit, IFPRI

**Olufemi Popoola**, Research Analyst, DSG Unit, IFPRI

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## ACKNOWLEDGMENTS

The authors would like to thank Luciana Delgado, who led the effort to collect the data used in this report. Oliver Kirui, John Ulimwengu, and James Warner provided feedback and comments on this report. Additionally, the authors would also like to thank Claire Davis and other members of IFPRI's Communications and Public Affairs Division for copyediting and related publication services.

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# ANNEX

**Annex Table 1. Potato value chain agents in Kenya, by demographic characteristic**

Variable	Measure	Female		Male		Sig. test	Youth		Mature		Sig. test
		Mean	SD	Mean	SD		Mean	SD	Mean	SD	
<b>Producers</b>											
<b>Observations</b>	<b>Number</b>	<b>239</b>		<b>370</b>			<b>109</b>		<b>500</b>		
Age	Years	48.5	12.9	49.3	13.2		31.0	2.7	52.9	11.0	***
Education in years	Years	5.6	2.6	5.6	2.6		4.9	2.7	5.8	2.6	**
Experience in years	Years	14.5	11.6	14.3	11.0		6.7	4.6	16.1	11.7	***
Main occupation is farming	%	90.4	29.6	95.7	20.4	**	87.2	33.6	95.0	21.8	**
Main occupation is not farming	%	4.3	20.4	9.6	29.6	***	12.8	3.2	5.0	1.0	***
Household size	Number	4.8	2.4	4.5	2.2		4.8	1.8	4.6	2.4	
Household assets (000)	KSh	39.2	41.52	61.8	52.3	***	56.6	47.4	46.2	47.1	**
<b>Aggregators</b>											
<b>Observations</b>	<b>Number</b>	<b>127</b>		<b>34</b>			<b>44</b>		<b>117</b>		
Gender of head (=1 if male)	%	0.0	0.0	100.0	0.0		20.5	40.8	21.4	41.2	
Age	Years	42.8	12.0	42.7	12.4		28.5	4.2	48.1	9.3	***
Experience in years	Years	12.6	8.2	13.1	9.0		7.5	4.8	14.7	8.5	***
Share of formal business	%	5.5	22.9	11.8	32.7		2.3	15.1	8.6	28.1	
<i>Business type</i>											
Has no store	%	70.1	46.0	55.9	50.4		75.0	43.8	64.1	48.2	
Has store	%	29.9	46.0	44.1	50.4		25.0	43.8	35.9	48.2	
<i>Role in Business</i>											
Owner	%	100.0	0.0	94.1	23.9	**	97.7	15.1	99.2	9.3	
Boss/Manager	%	0.0	0.0	5.9	23.9	**	2.3	15.1	0.9	9.3	
Member of cooperative	%										
<b>Processors</b>											
<b>Observations</b>	<b>Number</b>	<b>68</b>		<b>13</b>			<b>46</b>		<b>35</b>		
Gender of head (=1 if male)	%	0.0	0.0	100.0	0.0		25.0	43.9	35.0	48.9	
Age	Years	32.9	8.1	36.5	10.6		28.4	3.7	43.7	6.9	***
Experience in years	Years	4.6	3.8	5.4	6.1		3.5	1.7	7.4	6.6	**
<i>Business type</i>											
Formal	%	32.5	47.4	68.8	47.9	*	33.3	47.8	60.0	50.3	
Informal	%	67.5	47.4	31.3	47.9	*	66.7	47.8	40.0	50.3	
<i>Role in Business</i>											
Head/Owner	%	95.0	22.1	87.5	34.2		94.4	23.2	90.0	30.8	
Employee	%	2.5	15.8	6.3	25.0		2.8	16.7	5.0	22.4	
Assistant	%	2.5	15.8	6.3	25.0		2.8	16.7	5.0	22.4	

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

**Annex Table 2. Potato preharvest production and input use, by demographic characteristic**

Variable	Meas-ure	Female		Male		Sig. test	Youth (15-35 years)		Mature (>35 years)		Sig. test
		Mean	SD	Mean	SD		Mean	SD	Mean	SD	
<b>Observations</b>	Number	370		239			109		500		
<b>Outputs</b>											
Total output harvested ('000)	kgs	1.5	2.4	2.7	3.5	***	2.4	3.2	1.9	2.9	
Yield ('000)	kgs/ha	5.7	4.3	7.0	4.8	***	7.4	5.0	6.0	4.4	**
<b>Land</b>											
Total area operated	Ha	0.5	0.4	0.6	0.6	***	0.5	0.5	0.5	0.5	
Area rented, sharecropped, etc.	Ha	0.2	0.3	0.3	0.4	**	0.2	0.3	0.3	0.4	
Total potato area	Ha	0.3	0.3	0.4	0.4	***	0.3	0.3	0.3	0.3	
Used mechanical equipment	%	0.2	0.4	0.3	0.5	*	0.3	0.5	0.3	0.4	
<b>Tilling type used</b>											
Manual	%	78.9	40.8	70.7	45.6	*	73.4	44.4	76.2	42.6	
Animal	%	0.3	5.2	0.4	6.5		0.0	0.0	0.4	6.3	
Mechanized	%	4.1	19.8	6.3	24.3		10.1	30.3	3.8	19.1	**
More than one method	%	16.8	37.4	22.6	41.9		16.5	37.3	19.6	39.7	
<b>Variable inputs</b>											
Seed use	kgs/ha	1210.8	674.2	1414.6	700.8	***	1494.0	705.4	1246.5	681.0	***
Improved seed used	%	27.8	44.9	31.0	46.3		33.9	47.6	28.0	44.9	
Applied organic fertilizer	%	49.5	50.1	43.5	49.7		30.3	46.2	50.8	50.0	***
Applied chemical fertilizer	%	88.7	31.8	90.4	29.6		93.6	24.6	88.4	32.1	
No. of times chemical fertilizer applied	Number	1.3	0.5	1.4	0.6	*	1.3	0.5	1.3	0.6	
Rate of fertilizer application	kgs/ha	485.4	736.2	572.1	824.8		378.5	563.7	550.2	808.3	**
<b>Crop protection</b>											
Chemical insecticide	%	56.0	49.7	72.0	45.0	***	69.7	46.2	60.6	48.9	
Biological insecticides	%	0.3	5.2	0.4	6.5		0.9	9.6	0.2	4.5	
Herbicides	%	13.8	34.5	22.6	41.9	**	16.5	37.3	17.4	38.0	
Fungicides	%	67.3	47.0	74.5	43.7		80.7	39.6	67.8	46.8	**
Biological pest control	%	0.5	7.3	1.3	11.2		0	0	1	10.0	
Integrated pest management	%	0	0	0	0		0	0	0	0	
Value of modern inputs applied ('000)	KSh/Ha	40.3	27.2	44.9	28.4	*	40.8	25.9	42.4	28.2	
<b>Harvesting</b>											
<b>Harvesting Method</b>											
Manual	%	100.0	0.0	100.0	0.0		100.0	0.0	100.0	0.0	
<b>Other inputs</b>											
Used hired labor	%	74.6	43.6	80.8	39.5		76.2	42.8	77.2	42	
Used irrigation	%	5.1	22.1	5.9	23.5		7.3	26.2	5	21.8	
Used formal credit	%	43.5	49.6	33.5	47.3	*	43.1	49.8	38.8	48.8	
Used informal credit	%	1.6	12.6	0.4	6.5		1.8	13.5	1.0	10.0	
Member of agricultural cooperative	%	14.1	34.8	10.9	31.2		11.9	32.6	13.0	33.7	
Used agricultural services	%	3.8	19.1	3.4	18.0		6.4	24.6	3.0	17.1	
<b>Barriers toward</b>											
Accessing input/service markets	%	41.9	49.4	41.8	49.4		40.4	49.3	42.2	49.4	
Reaching markets/buyers	%	17.8	38.3	18.0	38.5		17.4	38.1	18.0	38.5	

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

**Annex Table 3. Postharvest activities of potato producers, by gender and age distribution**

Variable	Measure	Female		Male		Sig. test	Youth (15-35 years)		Mature (>35 years)		Sig. test
		Mean	SD	Mean	SD		Mean	SD	Mean	SD	
<b>Observations</b>	Number	370		239			109		500		
<b>Harvesting</b>	%	100.0	0.0	99.6	6.5		99.1	9.6	100	0.0	*
<b>Harvesting Method</b>											
Manual	%	100.0	0.0	100.0	0.0		100.0	0.0	100.0	0.0	
<b>Received training to enhance skills</b>											
	%										
<b>Transportation</b>											
	%	14.3	35.1	15.5	36.3		11.0	31.4	15.6	36.3	
Manual	%	8.0	26.0	6.0	24.0		4.0	19	8.0	27.0	
Mechanical	%	4.0	19.0	7.0	25.0		5.0	21.0	5.0	22.0	
Both	%	1.0	10.0	1.0	11.0		1.0	10.0	1.0	10.0	
<b>Hauling</b>											
	%	87.0	33.7	87.5	33.2		90.8	29	86.4	34.3	
Manual	%	73.0	44.0	73.0	44.0		75.0	43.0	73.0	45.0	
Mechanical	%	6.0	23.0	5.0	23.0		6.0	23.0	6.0	23.0	
Both	%	5.0	21.0	5.0	21.0		6.0	25.0	4.0	20.0	
<b>Grading</b>											
	%	91.4	28.2	93.3	25.1		89.9	30.3	92.6	26.2	
Manual	%	85.0	36	87.0	34.0		80.0	40.0	87.0	34.0	
Mechanical	&	0.0	6.0	0.0	5.0		0.0	0.0	0.0	6.0	
Both	%	6.0	24.0	6.0	24.0		10.0	30.0	5.0	22.0	
<b>Storage</b>											
	%	89.7	30.4	86.2	34.6		87.2	33.6	88.6	31.8	
Average storage period	Days	43.1	26.1	38.1	20.3	*	43.4	25.3	40.7	24.0	
Maximum quantity stored (000)	MT	0.6	1.3	0.9	1.5	**	0.8	1.4	0.7	1.4	
<b>Storage location</b>											
Home	%	73.8	44.0	67.0	47.1		71.6	45.3	71.1	45.4	
Farm	%	1.5	12.2	3.9	19.4		4.2	20.2	2.0	14.1	
Community warehouse	%	0.3	5.5	0.0	0.0		1.1	10.3	0.0	0.0	*
<b>Storage method</b>											
Sacks	%	33.0	47.0	34.0	47.0		35.0	48.0	33.0	47.0	
On a platform covered	%	24.0	43.0	24.0	43.0		17.0	38.0	25.0	44.0	
On bare floor uncovered	%	17.0	38.0	11.0	32.0		17.0	37.0	14.0	35.0	
On a platform uncovered	%	7.0	26.0	9.0	29.0		12.0	33.0	7.0	26.0	
All other storage methods	%	9.0	29.0	8.0	27.0		6.0	25.0	9.0	29.0	
<b>Pre-storage activities</b>											
Cleaning storage site	%	81.9	38.5	86.4	34.4		88.4	32.2	82.6	37.9	
Cleaning storage sacks/bags	%	27.7	44.8	35.0	47.8		33.7	47.5	29.8	45.8	
Preparing site (ventilation)	%	44.6	49.8	50.5	50.1		46.3	50.1	47.0	50.0	
Curing	%	3.6	18.7	1.5	12.0		3.2	17.6	2.7	16.3	
Fumigation of storage site	%	2.7	16.3	1.0	9.8		0.0	0.0	2.5	15.6	

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

**Annex Table 4. Potato processing and input use, by demographic characteristic**

Variable	Meas- ure	Female		Male		Sig. test	Youth (15-35 years)		Mature (>35 years)		Sig. test
		Mean	SD	Mean	SD		Mean	SD	Mean	SD	
<b>Type of processing done</b>											
Fried potato products	%	98.0	16.0	100.0	0.0		97.0	17.0	100.0	0.0	
Mixed fried products	%	3.0	16.0	0.0	0.0		3.0	17.0	0.0	0.0	
<b>Number of products processed</b>											
One	%	98.0	16.0	100.0	0.0		97.0	17.0	100.0	0.0	
Two	%	3.0	16.0	0.0	0.0		3.0	17.0	0.0	0.0	
<b>Potato purchases</b>											
<b>Source and volume of potato purchases</b>											
<b>Producer</b>	%	35.0	48.3	31.3	47.9		30.6	46.7	40.0	50.3	
Quantity purchased from producers	kgs	133.6	240.4	471.8	1087.4		181.1	521.0	318.8	779.8	
Value of potato purchased ('000)	KSh	5.1	9.5	16.1	38.3		8.0	24.0	8.8	18.9	
Prices of potato purchased	KSh/kg	39.9	10.7	39.7	21.8		44.2	14.1	33.8	11.4	
<b>Intermediaries</b>	%	67.5	47.4	93.8	25.0		75.0	43.9	75.0	44.4	
Quantity purchased from intermediaries	kgs	280.6	515.1	986.9	868.8	*	473.6	798.2	498.4	516.2	
Value of potato purchased ('000)	KSh	11.7	20.7	39.1	38.4	**	20.0	34.5	18.6	17.4	
Prices of potato purchased	KSh/kg	43.8	11.6	37.4	9.5		42.1	12.0	40.3	10.1	
<b>Seasonal variations in prices</b>											
Purchase price in abundant season	KSh/kg	25.2	8.1	20.6	6.3	*	24.1	7.2	23.6	9.0	
Purchase price in scarce season	KSh/kg	54.5	14.4	59.2	18.6		54.3	15.9	58.7	15.4	
<b>Sales</b>											
Consumers	%	100.0	0.0	100.0	0.0		100.0	0.0	100.0	0.0	

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

**Annex Table 5.** Frequency of losses among aggregators, by practiced activity (percent)

Category	Measure	Drying	Re-selection	Storage	Distribution and transportation
<b>Total</b>	%	13.0	30.0	50.0	9.0
	SD	34.0	46.0	50.0	28.0
<b>County</b>					
<b>Kiambu</b>	%	0.0	10.0	50.0	3.0
	SD	0.0	31.0	50.0	18.0
<b>Nakuru</b>	%	0.0	3.0	38.0	6.0
	SD	0.0	18.0	49.0	25.0
<b>Narok</b>	%	49.0	67.0	90.0	28.0
	SD	51.0	48.0	31.0	46.0
<b>Nyandarua</b>	%	3.0	37.0	17.0	0.0
	SD	18.0	49.0	38.0	0.0
<b>Nyeri</b>	%	3.0	23.0	43.0	0.0
	SD	18.0	43.0	50.0	0.0
<b>Gender</b>					
<b>Female</b>	%	13.0	29.0	50.0	6.0
	SD	34.0	46.0	50.0	23.0
<b>Male</b>	%	12.0	32.0	50.0	21.0
	SD	33.0	47.0	51.0	41.0
<b>Significance test</b>					***
<b>Age</b>					
<b>Youth</b>	%	18.0	41.0	52.0	16.0
	SD	39.0	50.0	51.0	37.0
<b>Mature</b>	%	11.0	26.0	49.0	6.0
	SD	32.0	44.0	50.0	24.0
<b>Significance test</b>					**

Source: Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

**Annex Table 6.** Frequency of losses among processors (percent)

Category	Measure	Experienced losses
<b>Total</b>	%	85.7
	SD	35.3
<b>County</b>		
<b>Kiambu</b>	%	90.0
	SD	31.6
<b>Nakuru</b>	%	76.9
	SD	43.9
<b>Narok</b>	%	92.3
	SD	27.7
<b>Nyandarua</b>	%	100.0
	SD	0.0
<b>Nyeri</b>	%	70.0
	SD	48.3
<b>Gender</b>		
<b>Female</b>	%	85.0
	SD	36.1
<b>Male</b>	%	87.5
	SD	34.2
<b>Significance test</b>		
<b>Age</b>		
<b>Youth</b>	%	89.0
	SD	31.9
<b>Mature</b>	%	80.0
	SD	41.0
<b>Significance test</b>		

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

**Annex Table 7. Sources of preharvest losses, by gender and age**

Measure	Total		Female		Male		Sig test	Youth		Mature		Sig test	
	Mean	SD	Mean	SD	Mean	SD		Mean	SD	Mean	SD		
<b>Preharvest</b>													
<b>Encountered preharvest problems</b>	%	76.8	42.2	77.8	41.6	75.3	43.2		71.6	45.3	78	41.5	*
Reasons for preharvest losses													
Pests/diseases	%	60.4	48.9	61.1	48.8	59.4	49.2		61.5	48.9	60.2	49.0	
Excess rain/moisture	%	40.6	49.1	39.7	49.0	41.8	49.4		33.9	47.6	42	49.4	
Lack of chemicals	%	18.4	38.8	17.8	38.3	19.2	39.5		19.3	39.6	18.2	38.6	
Poor seed quality	%	14.6	35.4	13.0	33.6	17.2	37.8		14.7	35.6	14.6	35.3	
Animals/rodents	%	11.2	31.5	11.6	32.1	10.5	30.7		10.1	30.3	11.4	31.8	
Weeds	%	7.1	25.6	7.6	26.5	6.3	24.3		7.3	26.2	7	25.5	
Lack of rain	%	6.6	24.8	6.5	24.7	6.7	25.0		8.3	27.7	6.2	24.1	
Theft	%	4.8	21.3	4.1	19.7	5.9	23.5		5.5	22.9	4.6	21.0	
Excess of chemicals	%	0.3	5.7	0.5	7.3	0.0	0.0		0.0	0.0	0.4	6.3	
Other	%	1.5	12.1	1.4	11.6	1.7	12.9		2.8	16.4	1.2	10.9	
<b>Left in the field</b>													
<b>Left potatoes unharvested in the field</b>	%	2.6	16.2	2.7	16.2	2.5	15.7		1.8	13.5	2.8	16.5	
Reason for leaving potatoes in the field													
Lack of labor for harvesting	%	0.2	4.1	0.3	5.2	0.0	0.0		0.0	0.0	0.2	4.5	
Lack of money to hire labor	%	0.2	4.1	0.3	5.2	0.0	0.0		0.0	0.0	0.2	4.5	
High cost of labor	%	0.5	7.0	0.5	7.3	0.4	0.4		0.0	0.0	0.6	7.7	
Poor prices	%	0.2	4.1	0.3	5.2	0.0	0.0		0.9	9.6	0	0.0	
Ill health	%	0.2	4.1	0.3	5.2	0.0	0.0		0.0	0.0	0.2	4.5	
All others	%	1.8	13.3	1.6	12.6	2.1	14.3		0.9	9.6	2	14.0	
<b>Encountered harvesting problems</b>	%	92.9	25.6	92.7	26.0	93.3	25.0		93.6	24.6	92.8	25.9	
Reasons for harvesting losses													
Bad weather	%	28.6	45.2	28.6	45.3	28.5	45.2		33.9	47.6	27.4	44.6	
Inappropriate handling	%	70.6	45.0	71.9	45.0	68.6	46.5		76.1	43.0	69.4	46.0	
Poor skills	%	35.1	47.8	33.8	47.4	37.2	48.4		33.0	47.2	35.6	47.9	
All others	%	21.5	41.1	23.8	42.6	18.0	38.5		22.0	41.6	21.4	41.1	

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

**Annex Table 8. Source of preharvest losses, by spatial characteristic**

	Meas- ure	Treatment		Control		Sig test	Kiambu		Nakuru		Narok		Nyandarua		Nyeri	
		Mean	SD	Mean	SD		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<b>Preharvest</b>																
<b>Encountered preharvest problems</b>	%	76.8	42.3	76.9	42.2		81.8	38.7	71.2	45.4	70.0	46.2	93.8	24.4	66.7	47.4
<b>Preharvest loss causes</b>																
Pests/diseases	%	64.2	48.0	56.5	49.7	*	57.6	49.5	54.1	50.0	63.3	48.6	86.3	34.7	54.2	50.1
Excess rain/moisture	%	35.5	47.9	45.8	49.9	***	50.7	50.1	27.1	44.6	23.3	42.7	62.5	48.7	35.4	48.1
Lack of chemicals	%	26.5	44.2	10.0	30.1	***	11.3	31.8	28.8	45.4	20.0	40.3	26.3	44.3	7.3	26.1
Poor seed quality	%	21.3	41.0	7.7	26.7	***	9.4	29.2	27.1	44.6	15.0	36.0	13.8	34.7	4.2	20.1
Animals/rodents	%	6.1	24.0	16.4	37.1	***	21.2	41.0	1.2	10.8	25.0	43.7	2.5	15.7	6.3	24.3
Weeds	%	9.4	29.2	4.7	21.2	**	4.9	21.7	7.1	25.7	1.7	12.9	20.0	40.3	4.2	20.1
Lack of rain	%	9.0	28.7	4.0	19.7	**	5.4	22.7	5.9	23.6	18.3	39.0	8.8	28.4	1.0	10.2
Theft	%	7.1	25.7	2.3	15.1	***	3.4	18.3	8.8	28.4	6.7	25.2	3.8	19.1	0.0	0.0
Excess of chemicals	%	0.6	8.0	0.0	0.0		0.0	0.0	0.6	7.7	0.0	0.0	1.3	11.2	0.0	0.0
Other	%	1.6	12.6	1.3	10.1		2.0	13.9	1.2	1.8	1.7	12.9	2.5	15.7	0.0	0.0
<b>Left in the field</b>																
Left potatoes in the field	%	1.6	12.6	3.7	18.9		3.4	18.3	0.6	8.0	0.0	0.0	5.0	21.9	4.2	20.1
<b>Reason for leaving potatoes in the field</b>																
Lack of labor for harvesting	%	0.0	0.0	0.3	5.8		0.5	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lack of money to hire labor	%	0.0	0.0	0.3	5.8		0.5	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
High cost of labor	%	0.0	0.0	1.0	10.0		1.0	9.9	0.0	0.0	0.0	0.0	0.0	0.0	1.0	10.2
Poor prices	%	0.3	5.7	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	1.3	11.2	0.0	0.0
Ill health	%	0.0	0.0	0.3	5.8		0.5	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
All others	%	1.3	11.3	2.3	15.1		2.0	13.9	0.6	7.7	0.0	0.0	3.8	19.1	3.1	17.5
Encountered harvesting problems	%	96.1	0.2	89.6	0.3	***	85.2	0.4	95.3	0.2	96.7	0.2	97.5	0.2	99.0	0.1
<b>Reasons for harvesting losses</b>																
Bad weather	%	29.4	45.6	27.8	44.9		24.1	42.9	22.9	42.2	45.0	50.2	31.3	46.6	35.4	48.1
Inappropriate handling	%	80	40.3	60.9	49.0		68.0	46.8	90.0	30.1	91.7	27.9	48.8	50.3	44.8	50.0
Poor skills	%	34.5	47.6	35.8	48.0		26.6	44.3	22.9	42.2	28.3	45.4	63.8	48.4	55.2	50.0
All others	%	20.6	40.5	22.4	41.8		21.7	41.3	18.2	38.7	16.7	37.6	28.8	45.5	24	42.9

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

**Annex Table 9. Sources of postharvest losses, by age and sex of producer**

	Meas- ure	Total		Female		Male		Sig test	Youth		Mature		Sig test
		Mean	SD	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
<b>Faced transportation issues</b>	%	0.7	8.1	0.3	5.2	1.3	1.1		0.0	0.0	0.8	8.9	
Reasons for transport losses													
Poorly tied/ruptured sack	%	0.5	7.0	0.3	5.2	0.8	9.1		0.0	0	0.6	7.7	
Bad road and distance	%	0.3	5.7	0.3	5.2	0.4	6.5		0.0	0	0.4	6.3	
Poor packaging/loading	%	0.5	7.0	0.3	5.2	0.8	9.1		0.0	0	0.6	7.7	
Bad weather	%	0.3	5.7	0.3	5.2	0.4	6.5		0.0	0	0.4	6.3	
<b>Faced hauling problems</b>	%	5.7	23.3	6.2	24.2	5.0	21.9		10.1	30.3	4.8	21.4	**
Reasons for losses at hauling													
Poorly tied/ruptured sack	%	4.1	19.9	4.9	21.5	2.9	16.9		8.3	27.7	3.2	17.6	**
Bad road and distance	%	1.8	13.3	21.6	14.6	1.3	11.2		1.8	13.5	1.8	13.3	
Poor packaging/loading	%	3.1	17.4	3.5	18.4	2.5	15.7		5.5	22.9	2.6	15.9	
All others	%	1.1	10.7	1.6	12.6	0.4	6.5		0.0	0.0	1.4	11.8	
<b>Faced postharvest handling problems</b>	%	24.5	43.0	25.9	43.9	22.2	41.6		27.5	44.9	23.8	42.6	
Postharvest handling loss causes													
Quality leakage in sacks	%	9.7	29.6	10.5	30.7	8.4	27.7		11.0	31.4	9.4	29.2	
Sieve-induced bruising	%	3.3	17.8	3.2	17.7	3.3	18.0		3.7	18.9	3.2	17.6	
Trampling by laborers	%	8.4	27.7	8.6	28.1	7.9	27.1		8.3	27.7	8.4	27.8	
Poor packaging/loading	%	4.8	21.3	5.7	23.2	3.3	18.0		10.1	30.3	3.6	18.6	***
All others	%	8.1	27.2	8.4	27.7	7.5	26.5		7.3	26.2	8.2	27.5	
<b>Faced storage problems</b>	%	51.6	50.0	51.1	50.1	52.3	50.1		58.7	49.5	50.0	50.1	*
Causes of losses at storage													
Changes in moisture	%	27.8	44.8	27.0	44.5	28.9	45.4		34.9	47.9	26.2	44.0	
Changes in temperature	%	20.5	40.4	21.9	40.8	19.7	39.8		25.7	43.9	19.4	39.6	
Fungi/bacteria	%	25.9	43.9	24.6	43.1	28.0	45.0		30.3	46.2	25	43.3	
Spillage	%	7.1	25.6	8.1	27.3	5.4	22.7		10.1	30.3	6.4	24.5	
All others	%	10.5	30.7	9.2	28.9	12.6	33.2		10.1	30.3	10.6	30.8	
<b>Faced issues during selling</b>	%	4.1	19.8	3.5	18.4	5.0	21.9		1.8	13.5	4.6	21.0	
Causes of losses at selling													
Accident	%	1.0	9.9	0.3	5.1	2.1	14.3		1.8	13.5	0.8	8.9	
Bad weather	%	1.6	12.7	1.6	12.6	1.7	12.9		0.0	0.0	20	14.0	
Others	%	0.7	8.1	0.8	9.0	0.4	6.5		0.0	0.0	0.8	9.0	

Source: Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

**Annex Table 10.** Sources of postharvest losses, by spatial characteristic

	Me asu re	Treatment		Control		Sig tes t	Kiambu		Nakuru		Narok		Nyandarua		Nyeri	
		Mean	SD	Mean	SD		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<b>Faced transportation issues</b>	%	0.6	8.0	0.7	8.2		0.5	7.0	0.0	0.0	1.7	12.9	1.3	11.2	1.0	10.2
Reasons for transport losses																
Poorly tied/ruptured sack	%	0.6	8.0	0.3	5.7		0.0	0.0	0.0	0.0	1.7	12.9	1.3	11.2	1.0	10.2
Bad road and distance	%	0.3	5.6	0.3	5.8		0.0	0.0	0.0	0.0	0.0	0.0	1.3	10.2	1.0	11.2
Poor packaging/loading	%	0.5	5.7	0.7	8.1		0.5	7.0	0.0	0.0	0.0	0.0	1.3	11.2	1.0	10.2
Bad weather	%	0.3	5.7	0.3	5.8		0.5	7.0	0.0	0.0	0.0	0.0	1.3	11.2	0.0	0.0
<b>Faced hauling problems</b>	%	8.1	27.3	3.3	18.0	**	1.5	12.1	4.1	19.9	16.7	37.6	10.0	30.2	7.3	26.1
Reasons for losses at hauling																
Poorly tied/ruptured sack	%	6.7	25.2	1.3	11.5	***	0.5	7.0	3.5	18.5	16.7	37.6	6.3	24.4	3.1	17.5
Bad road and distance	%	3.2	17.7	0.3	5.8		0.0	0.0	1.2	10.8	6.7	25.2	5.0	21.9	1.0	10.2
Poor packaging/loading	%	4.5	20.8	1.7	12.8	**	0.5	7.0	1.8	13.2	10.0	30.2	6.3	24.4	4.2	20.1
All others	%	1.3	11.3	1.0	10		1.0	10	0.6	7.7	0.0	0.0	3.8	19.1	1.0	10.2
<b>Faced postharvest handling problems</b>	%	21.9	41.4	27.1	44.5		24.6	43.2	25.9	43.9	35.0	48.1	3.8	19.1	32.3	47.0
Postharvest handling loss causes																
Quality leakage in sacks	%	13.2	33.9	6.0	23.8	***	7.9	27.0	18.2	38.7	15	36.0	1.3	11.2	2.1	14.4
Sieve-induced bruising	%	3.5	18.5	3.0	17.1		4.4	20.6	6.4	24.7	0.0	0.0	0.0	0.0	0.0	0.0
Trampling by laborers	%	8.1	27.3	8.7	28.2		9.4	29.2	9.4	29.3	11.7	32.4	2.5	15.7	7.3	26.1
Poor packaging/loading	%	8.4	27.8	1.0	10	***	1.5	12.1	8.8	28.5	16.7	37.6	1.3	11.2	0.0	0.0
All others	%	2.9	16.8	13.4	34.1		8.4	27.8	2.9	16.9	5.0	22	1.3	11.2	24.0	42.9
<b>Faced storage problems</b>	%	62.3	48.5	40.5	49.2	***	43.8	49.7	55.9	49.8	76.7	42.7	65.0	48.0	33.3	47.4
Causes of losses at storage																
Changes in moisture	%	33.5	47.3	21.7	41.3		25.1	43.5	21.8	41.4	55.0	50.1	42.5	49.7	14.6	35.5
Changes in temperature	%	26.5	44.2	14.4	35.1		14.8	35.6	30	46.0	30	46.0	16.3	37.1	13.5	34.4
Fungi/bacteria	%	38.7	48.8	12.7	33.4	***	13.3	34.0	34.1	47.6	38.3	49.0	48.8	50.3	11.5	32.0
Spillage	%	11.9	32.5	2.0	14.0	***	3.0	17.0	12.9	33.7	25.0	43.7	0.0	0.0	0.0	0.0
All others	%	8.7	28.2	12.4	33.0		12.3	32.9	8.8	28.5	1.7	12.9	13.8	34.7	12.5	33.2
<b>Faced issues during selling</b>	%	1.0	9.8	7.4	26.2	***	7.4	26.2	1.2	10.8	1.7	12.9	0.0	0.0	7.3	26.1
Causes of losses at selling																
Accident	%	0.3	5.7	1.7	12.8		0.5	7.0	0.6	7.7	0.0	0.0	0.0	0.0	4.2	2.0
Bad weather	%	0.6	8.0	2.7	16.2		3.9	19.5	0.6	7.7	1.7	12.9	0.0	0.0	0.0	0.0
Others	%	0.0	0.0	1.3	11.5		1.5	12.1	0.0	0.0	0.0	0.0	0.0	0.0	1.0	10.2

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

**Annex Table 11.** Problems that caused aggregator losses by practiced activity across demographic characteristics

	Total		Youth		Mature		Sig test	Female		Male		Sig test
	%	SD	%	SD	%	SD		%	SD	%	SD	
<b>Drying</b>	84	37.4	88.9	33.3	81.3	40.3		81.0	40.2	1	0.0	
Weight loss due to drying	76.2	43.6	75.0	46.3	76.9	43.9		0.8	39.3	50	57.7	
<b>Re-selection</b>	59.3	49.4	75.0	44.2	52.6	50.4	*	56.9	49.9	68.8	47.9	
Spillage	18.8	39.4	22.2	42.8	16.7	40		21.62	40	9.09	30	
Tubers bruised during process	50.0	50.5	50.0	51.4	50.0	50		45.95	50.0	63.64	50.0	
<b>Storage</b>	60.6	49.0	69.7	47.0	57.6	50.0		58.3	50.0	70.8	46.0	
Spillage	12.5	33.3	4.3	20.9	15.8	36.8		12.70	30.0	11.8	30.0	
Infestation	6.3	24.4	4.3	20.9	7.0	25.8		6.35	20.0	5.9	20.0	
Rodents	1.3	11.2	4.3	20.9	0.0	0.0		1.59	10.0	0.0	0.0	
Moisture	70.0	46.1	60.9	49.9	73.7	44.4		74.60	40.0	52.9	50.0	*
High temperature	60.0	49.3	73.9	44.9	54.4	50.3		65.08	50.0	41.2	50.0	*
<b>Distribution and Transportation</b>	46.7	50.7	87.5	35.4	31.8	47.7	***	41.2	50.7	53.8	51.9	
Spillage	21.4	42.6	28.6	48.8	14.3	37.8		28.6	48.8	14.3	37.8	
Accidents	78.6	42.6	57.1	53.5	100	0.0	*	85.7	37.8	71.4	48.8	

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

**Annex Table 12.** Problems that caused aggregator losses by practiced activity across spatial characteristics

	Kiambu		Nakuru		Narok		Nyandarua		Nyeri	
	%	SD	%	SD	%	SD	%	SD	%	SD
<b>Drying</b>	0.0	0.0	0.0	0.0	90.5	30.1	100	-	33.3	57.7
Weight loss due to drying	0.0	0.0	0.0	0.0	84.2	0.0	0	0.0	0.0	0.0
<b>Re-selection</b>	23.1	43.9	7.1	26.7	81.3	39.7	91.7	28.9	70.0	48.3
Spillage	33.3	57.7	100	0.0	26.9	45.2	0.0	0.0	0.0	0.0
Tubers bruised during process	100	0.0	100	0.0	65.4	48.5	27.3	46.7	0.0	0.0
<b>Storage</b>	51.7	50.9	38.7	49.5	100	0.0	38.5	50.6	54.2	50.9
Spillage	40.0	50.7	16.7	38.9	5.7	23.6	0.0	0.0	0.0	0.0
Infestation	0.0	0.0	0.0	0.0	8.6	28.4	20.0	44.7	7.7	27.7
Rodents	0.0	0.0	0.0	0.0	0.0	0.0	20.0	44.7	0.0	0.0
Moisture	73.3	45.8	50.0	52.2	82.9	38.2	40.0	54.8	61.5	50.6
High temperature	20.0	41.4	83.3	38.9	80.0	40.6	60.0	54.8	30.8	48.0
<b>Distribution and Transportation</b>	9.1	30.2	66.7	57.7	78.6	42.6	0.0	0.0	0.0	0.0
Spillage	100	0.0	0.0	0.0	18.2	40.5	0.0	0.0	0.0	0.0
Accidents	0.0	0.0	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

**Annex Table 13.** Problems that caused processor losses in quantity and quality by demographic characteristic

	All		Female		Male		Youth		Mature	
	%	SD	%	SD	%	SD	%	SD	%	SD
<b>Causes of losses for step 1 processing</b>										
Stained potatoes	26.8	44.9	24.1	43.5	33.3	49.2	33.3	48.0	14.3	36.3
Rotten	7.3	26.4	10.3	31.0	0.0	0.0	3.7	19.2	14.3	36.3
Small size	4.9	21.8	6.9	25.8	0.0	0.0	7.4	26.7	0.0	0.0
Peeling	22.0	41.9	17.2	38.4	33.3	49.2	22.2	42.4	21.4	42.6
Damaged	22.0	41.9	24.1	43.5	16.7	38.9	18.5	39.6	28.6	46.9
Coloring (green/black)	9.8	30.0	13.8	35.1	0.0	0.0	11.1	32.0	7.1	26.7
Others	7.3	26.4	3.4	18.6	16.7	38.9	3.7	19.2	14.3	36.3
<b>Causes of losses for step 2 processing</b>										
Stained potatoes	28.6	48.8	16.7	40.8	100	0.0	33.3	51.6	0.0	0.0
Rotten	14.3	37.8	16.7	40.8	0.0	0.0	16.7	40.8	0.0	0.0
Small size	42.9	53.5	50.0	54.8	0.0	0.0	33.3	51.6	100	0.0
Other	14.3	37.8	16.7	40.8	0.0	0.0	16.7	40.8	0.0	0.0
<b>Causes of losses for step 3 processing</b>										
Stained potatoes	7.1	26.7	0.0	0.0	16.7	40.8	10.0	31.6	0	0.0
Damaged	21.4	42.6	25.0	46.3	16.7	40.8	30	48.3	0	0.0
Small size	42.9	51.4	37.5	51.8	50.0	54.8	30	48.3	75	50.0
Other	28.6	46.9	37.5	51.8	16.7	40.8	30	48.3	25	50.0
<b>Causes of losses for step 4 processing</b>										
Small size	41.7	51.5	62.5	51.8	0.0	0.0	37.5	51.8	50	57.7
Others	58.3	51.5	37.5	51.8	100	0.0	62.5	51.8	50	57.7
<b>Causes of losses for step 5 processing</b>										
Small size	50.0	70.7	0.0	0.0	50	70.7	50	70.7	0	0.0
Other	50.0	70.7	0.0	0.0	50	70.7	50	70.7	0	0.0

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

**Annex Table 14.** Problems that caused processor losses in quantity and quality across spatial characteristics

	Kiambu		Nakuru		Narok		Nyandarua		Nyeri	
	%	SD	%	SD	%	SD	%	SD	%	SD
<b>Causes of losses for step 1 processing</b>										
Stained potatoes	0.0	0.0	85.7	37.8	36.4	50.5	0.0	0.0	16.7	40.8
Rotten	12.5	35.4	0.0	0.0	18.2	40.5	0.0	0.0	0.0	0.0
Small size	0.0	0.0	0.0	0.0	18.2	40.5	0.0	0.0	0.0	0.0
Peeling	12.5	35.4	0.0	0.0	9.1	30.2	55.6	52.7	33.3	51.6
Damaged	50.0	53.5	0.0	0.0	0.0	0.0	33.3	50.0	33.3	51.6
Coloring (green/black)	0.0	0.0	14.3	37.8	18.2	40.5	11.1	33.3	0.0	0.0
Others	25.0	46.3	0.0	0.0	0.0	0.0	0.0	0.0	16.7	40.8
<b>Causes of losses for step 2 processing</b>										
Stained potatoes	0.0	0.0	100	0.0	50	70.7	0.0	0.0	0.0	0.0
Rotten	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Small size	0.0	0.0	0.0	0.0	50	70.7	100	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100	0.0
<b>Causes of losses for step 3 processing</b>										
Stained potatoes	0.0	0.0	25.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0
Damaged	0.0	0.0	0.0	0.0	50.0	57.7	0.0	0.0	33.3	57.7
Small size	0.0	0.0	0.0	0.0	25.0	50.0	100	0.0	66.7	57.7
Other	0.0	0.0	75.0	50.0	25.0	50.0	0.0	0.0	0.0	0.0
<b>Causes of losses for step 4 processing</b>										
Small size	0.0	0.0	28.6	48.8	100	0.0	50.0	70.7	0.0	0.0
Others	100	0.0	71.4	48.8	0.0	0.0	50.0	70.7	0.0	0.0
<b>Causes of losses for step 5 processing</b>										
Small size	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0

**Source:** Authors' analyses using data from the baseline survey of food losses in the Irish potato value chain of Kenya (2024).

This publication has been prepared in the context of the Strengthening Food Systems to Promote Increased Value Chain Employment Opportunities for Youth partnership with the Mastercard Foundation. It is a five-year initiative running between 2022 and 2027 to gain insight into the latest trends and challenges in agrifood systems, and how addressing market inclusion and post-harvest losses can enable dignified and fulfilling livelihoods for young women and men. The views expressed do not necessarily represent those of the Foundation, its staff, or its Board of Directors. This publication has not been independently peer reviewed. Any opinions expressed here belong to the author(s) and are not necessarily representative of or endorsed by IFPRI.

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1201 Eye Street, NW, Washington, DC 20005 USA | T. +1-202-862-5600 | F. +1-202-862-5606 | Email: [ifpri@cgiar.org](mailto:ifpri@cgiar.org) | [www.ifpri.org](http://www.ifpri.org) | [www.ifpri.info](http://www.ifpri.info)

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