# PROJECT TECHNICAL REPORT

## 1. Introduction

The strategy for providing diverse and robust chicken breeding flocks of dual-purpose breed lines in Kenya has evolved through a comprehensive and intricate approach. Despite facing challenges in establishing and sustaining effective delivery methods, particularly concerning sustainability, progress has been made in diversifying and enhancing the delivery of these vital resources. However, previous attempts to implement delivery programs for smallholder farmers and households have had limited success.

Efforts have been directed towards developing an extensive evaluation program grounded in knowledge and data, aiming to gain a profound understanding of performance and preference. The ultimate goal is to construct a strategic roadmap for optimal delivery along the production value chain. One notable aspect of this effort involves on-farm testing of Hubbard lines (RIRJA and REDJA), KUROILER, and KALRO in diverse agroecologies within Kenya. This on-farm testing was a collaborative initiative involving key organizations such as the World Poultry Foundation (WPF), the International Livestock Research Institute (ILRI), and the Kenyan Agricultural and Livestock Research Institute (KALRO).

The primary objectives of this on-farm testing initiative encompass the identification of breeds preferred by farmers and well-suited to local conditions. This entails meticulous maintenance of multiplication processes and the efficient delivery of the chosen breeds. The collaborative efforts and data-driven evaluations are pivotal in shaping an effective strategy to provide improved breeding flocks that align with the needs and preferences of farmers across the diverse agricultural landscape of Kenya. Through this initiative, a foundation is being laid for the sustainable and successful integration of dual-purpose breed lines within the agricultural sector, catering to the dynamic needs of smallholder farmers and households throughout the nation breeds.

## 2. Experimental sites

Five agro-ecological zones (counties) were selected to test two Hubbard lines (REDJA, RIRJA), Kuroiler and Local chicken. A brief description of each agro-ecological zone and the number of households selected for the experiment are indicated below.

**Bomet County** is in the highlands of the South Rift Valley region of southwestern Kenya in an area commonly referred to as Kenya's high-potential cereal and dairy livelihood zone. Kericho County borders the County to the North, Nyamira county to the west, Narok County to the south, and Nakuru County to the northeast. The County covers an area of 2037.4 $km^2$ and is subdivided into five sub-counties, namely Chepalungu (535.8 km2), Sotik, Konoin, Bomet East, and Bomet Central Sub-Counties.

**Laikipia County** covers 9,462 $km^2$ and is in the former Rift Valley province. It is ranked as the 15$^{th}$ largest County in Kenya by land size. It borders Meru County to the east, Nyeri County to the Southeast, Samburu County to the North, Isiolo County to the northeast, Baringo County to the west, Nyandarua County, and Nakuru County to the southwest. The County's altitude varies from 1,500 m above sea level at Ewaso Nyiro basin in the North to 2,611 m above sea level around Marmanet forest. The Ewaso Nyiro North basin dominates the entire county drainage. Laikipia County consists mainly of a plateau that the Aberdares border

to the south, Mt. Kenya massifs to the Southeast, and the Great Rift Valley to the west. Rainfall in the County is relief or orographic rain due to its altitude and location.

**Kakamega County** covers an area of 3,050.3 $km^2$ and borders Vihiga County to the south, Busia and Siaya Counties to the west, Bungoma and Trans Nzoia Counties to the North, Uasin Gishu County to the north-east, and Nandi County to the east. It lies between longitudes 34 and 35° East and 0 and 1° North latitudes. The County has 12 sub-counties with 60 wards consisting of 398,709 households. It has 12 constituencies, 12 sub-counties, 24 divisions, 72 locations, and 233 sub-locations. Kakamega County has a predominantly crop farming economy, with livestock farming taking a small portion of the available arable land. Sixty-one per cent of households engaged in crop and livestock production.

**Uasin Gishu County** is a highland plateau with altitudes falling gently from 2,700 metres above sea level to about 1,500 metres above sea level. The topography is higher to the east and declines gently towards the western border. The County is y divided into three zones: the upper highlands, upper midlands, and lower highlands. These zones greatly influence land use patterns as they determine the climatic conditions. The geology is dominated by tertiary volcanic rock with no known commercially exploitable minerals.

**Meru County** has varied ecological zones ranging from upper highlands, lower highlands, upper midlands, and lower midlands. The upper highlands zones cover most of the County's area ranging from Imenti South, Imenti Central, Imenti North, Part of Tigania East, Part of Tigania West, and Igembe Central Igembe South constituencies. The lower midland zones are only found in lower parts of Buuri, Igembe North, and Tigania East and West which borders Laikipia and Isiolo Counties. The rainfall distribution ranges from 300mm per annum in the lower midlands in the North to 2500mm per annum in the Southeast.

### 3. Household Identification and Chicks Distribution

To be included in this research endeavor, a household had to meet a set of specific criteria, reflecting their commitment and capacity to participate effectively. They needed to express a willingness to actively engage in the study by utilizing their farm resources to care for the test birds throughout the research duration. This demonstrates their dedication to contributing to the objectives of the study. The eligible households were required to possess sufficient housing and foraging space to comfortably accommodate a flock of 40 birds. This ensured that the birds would be provided with adequate living conditions and ample room for foraging, contributing to the accuracy and reliability of the study's findings. The participants were also expected to agree to keep the chickens in safe custody until the conclusion of data collection. This commitment to ensuring the birds' well-being until the study's completion underscored the importance of responsible animal care. Lastly, households had to already be engaged in chicken farming, aligning with the study's focus and maximizing the potential for meaningful insights and outcomes.

The selection of suitable households involved a preliminary review that considered factors such as location and existing participation in chicken farming. Targeting households on the outskirts of medium to small towns was deemed optimal, as it struck a balance between housing density and the ability to dedicate sufficient time and resources to the project. Moreover, collaboration with established farmer groups within the region was identified as the most effective approach, facilitating seamless coordination and the transfer of essential technologies, innovations, and management practices to the intended beneficiaries.

In the subsequent phase, the focus shifted to identifying eligible households for participant recruitment. Information from group leaders guided this process, resulting in the removal of some households from the initial listing. This precautionary measure was taken to maintain biosecurity and safeguard households, particularly in instances where the close proximity of flocks could pose a risk to the wellbeing of the chickens. Overall, these selection and precautionary steps ensured a sound and responsible foundation for the research study.

The project households in five Counties were supplied with brooded chicks of RIRJA and REDJA (the two Hubbard breeds), Kuroiler and KALRO. In all recipient households, existing and introduced chicks had been registered and data uploaded to ILRI's server. An average of 32 households in each County received one of the two Hubbard breeds, with each household receiving an average of 40 wing-tagged mixed-sex chicks (Table 1). Existing household chicks of age +/- 2 weeks of the age of introduced chicks were also tagged for comparison purposes.

**4. Weight Performance of test chicken strains (KALRO, KUROILER, REDJA and RIRJA) in Kenya**

The weight and growth performance of dual-purpose chickens are pivotal aspects of chicken production. While genetics undeniably influence growth performance, non-genetic factors also wield a considerable impact. Factors such as feeding practices, flock management, housing conditions, seasonal variations, chick rearing, brooding methods, and vaccination protocols all significantly influence production performance. Interventions in management play a crucial role in unlocking the production potential of indigenous chickens, proving instrumental in supporting the livelihoods of impoverished rural households. This, in turn, underscores the economic viability and sustainability of small-scale chicken production within the context of Kenya.

Table 1 below provides the body weight performance of test breeds (REDJA, RIRJA, KALRO and Kuroiler) for both male and female chickens. Variations in performance are attributed to genetic and management differences influenced by ecology, household income, and exposure to chicken production information.

**Table 1:** Means and standard deviations of boby weight at week 20 for REDJA, RIRJA, KALRO and Kuroiler breeds

| Breed | Bomet | SD | Kakamega | SD | Likipia | SD | Meru | SD | Uasin Gishu | SD |
|---|---|---|---|---|---|---|---|---|---|---|
| **Males** | | | | | | | | | | |
| REDJA | 1215.58 | 250.24 | 973.49 | 334.67 | 1146.24 | 229.40 | 957.87 | 129.83 | 1381.74 | 308.80 |
| RIRJA | 1122.50 | 313.11 | 1142.35 | 518.88 | 1201.82 | 392.77 | 884.41 | 193.02 | 1543.28 | 397.34 |
| KALRO | 907.05 | 290.41 | 792.07 | 246.93 | 805.07 | 241.12 | 700.68 | 109.84 | 1058.93 | 688.05 |
| Kuroiler | 1261.85 | 398.36 | 1558.67 | 699.86 | 976.37 | 503.94 | 1197.24 | 255.98 | 970.993 | 315.10 |
| Total | 1111.97 | 326.21 | 1100.85 | 524.01 | 1064.86 | 365.22 | 935.65 | 232.87 | 1318.97 | 455.42 |
| **Female** | | | | | | | | | | |
| REDJA | 1090.55 | 163.99 | 1022.45 | 387.44 | 1053.95 | 253.69 | 795.98 | 133.46 | 1246.34 | 255.30 |
| RIRJA | 920.07 | 246.80 | 723.574 | 278.95 | 1090.09 | 366.60 | 739.68 | 160.09 | 1319.05 | 357.83 |
| KALRO | 775.09 | 243.42 | 750.647 | 136.73 | 701.02 | 202.27 | 529.58 | 69.340 | 891.96 | 415.88 |
| Kuroiler | 1147.78 | 300.58 | 1174.13 | 467.23 | 925.98 | 397.55 | 941.37 | 217.51 | 818.53 | 155.70 |
| Total | 965.25 | 271.61 | 934.34 | 391.52 | 984.99 | 319.38 | 768.09 | 203.97 | 1143.29 | 363.83 |

The weights of male chickens were monitored from the moment of their introduction into the project households at 4 weeks of age until they reached 20 weeks, at which point households were granted

permission to manage their disposition. Disposal methods encompassed sales to interested buyers, household consumption, or exchanging them with other farms for crossbreeding initiatives. By the 20th week, the target weight for roosters was set at a minimum of 1500 g to ensure they met the standards for local hotels and household consumption. However, due to the fluctuations in the market and varying farmer preferences, not all farmers were able or willing to part with their roosters. Some deliberately chose to retain the male chickens for the purpose of mating with the introduced hens, a strategic move aimed at securing a replacement flock. Despite advisories provided to the project households against mating the introduced chickens, a significant number persisted in this practice, giving rise to a new generation of offspring.

More than 90% of the households, exhibited a distinct preference for the introduced chicken over their existing domestic chicken. This preference was attributed to several factors, including the rapid growth, substantial body size, adaptability to the semi-scavenging environment, and notable egg production capabilities in the introduced chicken. As a result of this inclination toward the introduced chicken breed, numerous households made the strategic decision to expand their production capacities. This involved augmenting their flock sizes and subsequently capitalizing on the sale of fertilized eggs or day-old chicks, showcasing an innovative and entrepreneurial approach to bolstering their chicken operations.

**Comparison of male chicken breed performance**

The growth trend of the four chicken breeds (Table 1) across the five counties (Bomet, Kakamega, Uasin Gishu, Laikipia and Meru) was a clear indication of prevailing conditions that interacted with the genetic potential of the chicken breeds. For instance, the regions in Laikipia county where the testing was done (Olmoran and Igwamiti) are resource-scarce areas; where finding food and water for both humans and livestock is a problem. As indicated in the test chicken breeds' weight performance, none of the test chicken breeds attained 1500 g by twenty weeks of age. Despite this, RIRJA, REDJA and Kuroiler cocks out-performed KALRO chicken in Laikipia county. Olmoran for instance, being a relatively dry area with a large number of wild animals and birds, experienced a high occurrence of chicken diseases including but not limited to fowl pox, and infectious coryza. Several households lost entire chicken flocks and the surviving ones did so under tough environmental conditions. Medical interventions are non-existent in this region and farmers rely on traditional herbs (indigenous knowledge) for the treatment of sick chickens.

Meru County is on the Kenyan highlands and located on the Eastern side of the Mount Kenya ring. The households involved in preference and performance testing live on the Leeward side of the mountain; receiving relatively less rainfall than the windward side. Predominantly, households engage in cash crop production (Khat in Athwana and tobacco in Mworoga). This situation creates an unprecedented shortage of feeds for chicken and other livestock in the area. Despite this case, Kuroiler was able to achieve more than 1500 g while RIRJA and REDJA weighed slightly above 1000 g. KALRO breed did not reach 1000 g at 20 weeks; implying that households had to keep it for a longer time to sale them or use for family consumption.

Bomet, Kakamega and Uasin Gishu were the most favourable counties with respect to weight performance; since most of the chicken, breeds attained more than 1500 g at twenty weeks. This was despite breed performance variations. Kuroiler outperformed all the other breeds in Kakamega and Meru while RIRJA and REDJA performed best in Uasin Gishu and Bomet.

Usasin Gishu County produced the heaviest cocks of the RIRJA and REDJA breed as compared to other counties. This county, being in a highly productive agricultural location was expected to produce higher weight for all breeds but KALRO and Kuroiler did not seem to perform as well. A possible reason would be the season when KALRO and Kuroiler chicken reached Uasin Gishu.

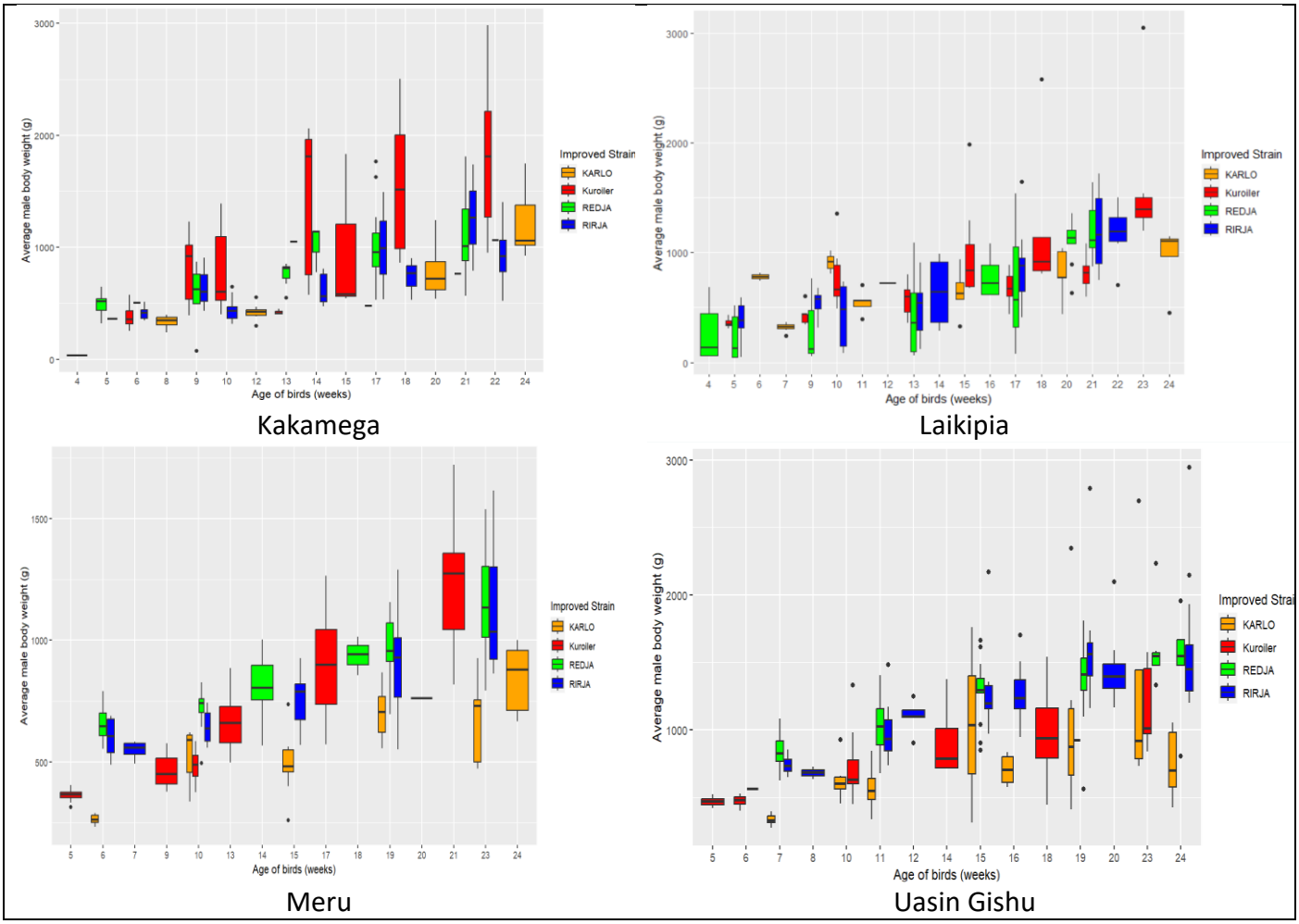


**Figure 1:** Growth performance of test chicken of different breeds (KALRO, KUROILER, REDJA and RIRJA) in different Counties in Kenya

For Bomet and Kakamega, Kuroiler reached 1500 g at 24 weeks which was at least four weeks earlier than all other breeds. In a similar scenario as previously reported in the cocks' weight performance in Uasin Gishu county; RIRJA and REDJA outperformed the other breeds. A similar situation was recorded by hens; where the two breeds attained 1500 g of weight at 24 weeks followed later on at 48 weeks by Kuroiler. Based on this information, it is notable that RIRJA and REDJA were best favoured by the environmental and production conditions in Uasin Gishu and other counties.

In Meru and Laikipia, it took REDJA, RIRJA and Kuroiler 28 weeks to attain 1500 g; being the longest time the three breeds took to attain the target weight. As mentioned earlier, the testing villages in Laikipia County are in a resource-scarce area; therefore, feed and water resources are highly constrained. This coupled with high disease and parasite incidence in the area made all chickens have a relatively slow growth rate.

The KALRO chicken had a lower performance in comparison with RIRJA, REDJA and Kuroiler in all counties; while reaching 1500 g in Bomet county only at 28 weeks.

A systematic decline in growth is noticed from week 32 in Bomet, Kakamega, Uasin Gisu and Meru for RIRJA, REDJA and partly for Kuroiler; this age coincided with the planting season. A common practice in smallholder farmer households is to restrict the movement of chicken during this time to avoid losing planted and/or germinating seeds. Despite this scenario, most chicken are released later in the evening to allow for quick feeding under supervision.