



Case study for measuring food loss

Grains and Pulses sector case study

The FOLOU case study carried out by the Università Politecnica delle Marche (UNIVPM, Italy) focused on food losses in cereals under three agronomic management approaches: conventional, organic, and agroecological. The overall aim was to validate the food loss quantification manual in two key cereals: maize (*Zea mays*), and durum wheat (*Triticum turgidum* subsp. *durum*), two of the most important crops globally.

Food Loss information	
Commodity	Maize and wheat
Quantification	Weighting
Timing	Primary production: pre-harvest and/or harvesting losses

General information	
Policies	No policies exist in Italy regarding food loss.
Challenges	The main challenge has been the ability to quantify pre-harvest losses, due to the difficulty of identifying losses among a large number of cereal spikes. In addition, the methodological approach recommended by the FAO is considered to be potentially unrealistic for highly industrialized cereal production contexts. For such cases, a second methodology has therefore been proposed which, although less precise in estimating losses, can at least provide an indication of the magnitude of the problem from crop establishment through to harvest.
Technology	Perhaps, the most notable aspect is the use of a scale and software for data management and analysis; however, no additional advanced technology is required
Destination	Mainly left on the field
Benefits	At this stage, the key objective is to make a problem visible that is primarily borne by them. In the case of cereals, not only food losses are relevant, but also earlier stages, which have been shown to be even more significant in terms of discards and their impact on final yields.
Operations	Measurements required two to three people, took around one hour per site plus travel time, and were supplemented by the use of a plot combine harvester.

Wheat losses

Wheat yields differed substantially across the three management systems (Figure 1). Conventional management achieved the highest productivity, with an average yield of 7.75 t/ha. Agroecological management produced 5.87 t/ha, while organic management resulted in the lowest yield, averaging 3.11 t/ha.

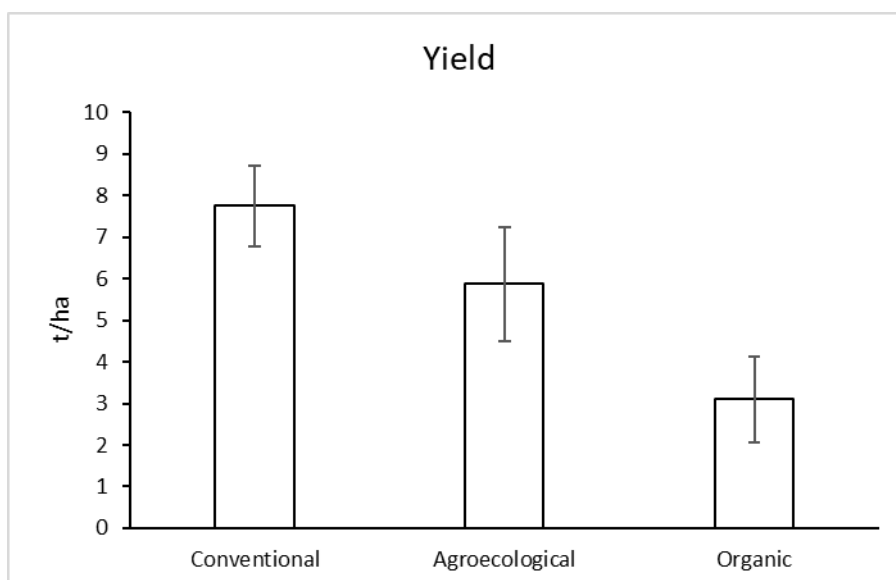


Figure 1. Wheat grain yield in the three management systems. Bars represent the standard error of the mean (N=5).

The results for wheat showed that no grains were lost prior to harvest in any of the fifteen quadrants assessed (i.e., one for each management). After the passage of the combine harvester, however, two to five grains per square meter were recorded, which equates to about 48,000 grains per hectare under conventional management and around 12,000 grains per hectare under agroecological management, while no grains were found in the organic fields. Although these figures may appear large, the losses are negligible as showed in Figure 2.

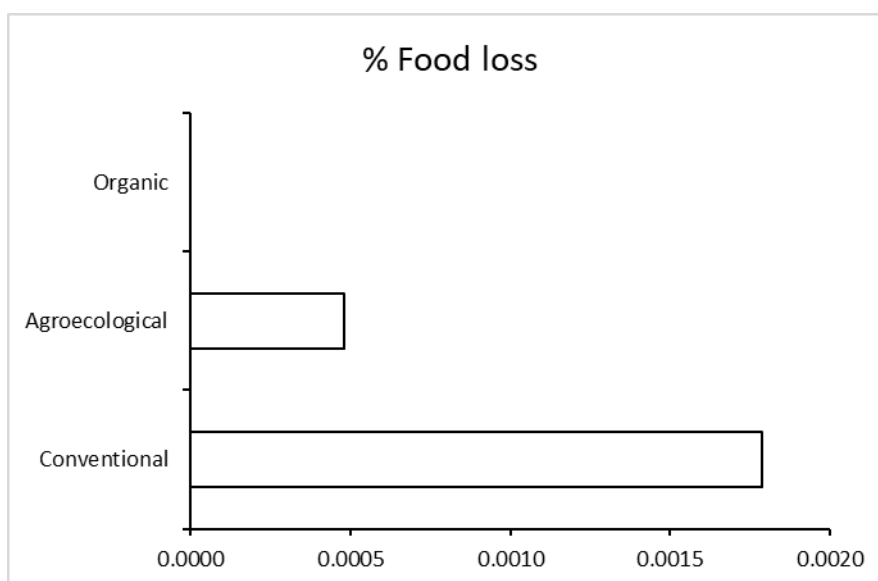


Figure 2. Wheat grain yield in the three management systems. Bars represent the standard error of the mean (N=5).

With a seeding density of 270 kg/ha and an average seed weight of 0.058 g, one ton corresponds to more than 4 million seeds. Compared with the 48,000 seeds lost (in the worst-case scenario), this represents only about 1% of the total.

In 2025, wheat food loss was assessed only under the conventional management system, where grain yield reached 6.94 ± 1.25 t/ha. On average, 1.3 grains/m² were found on the soil surface, corresponding to approximately 13,000 grains/ha. Considering an average grain weight of 0.058g, this equals 0.754 kg/ha of food loss and so represents 0.01086% of the total production. Given this negligible value, it was decided not to assess the same parameter under agroecological and organic management systems, as the number of kernels on the ground is not influenced by management practices.

Maize losses

For maize, observations were made under conventional management in 2024 and under agroecological, organic, and conventional management in 2025. In 2024, the conventional system yielded 4.39 t/ha. In 2025, organic management produced 3.50 t/ha, the agroecological system achieved 6.50 t/ha, and the highest yield was recorded under conventional management, reaching 17.6 t/ha.

Across all four sampling events, no pre-harvest losses were detected, and no grains were found on the ground after harvesting. This indicates that the main losses for maize occur during the growing season and are therefore more accurately classified as production losses.