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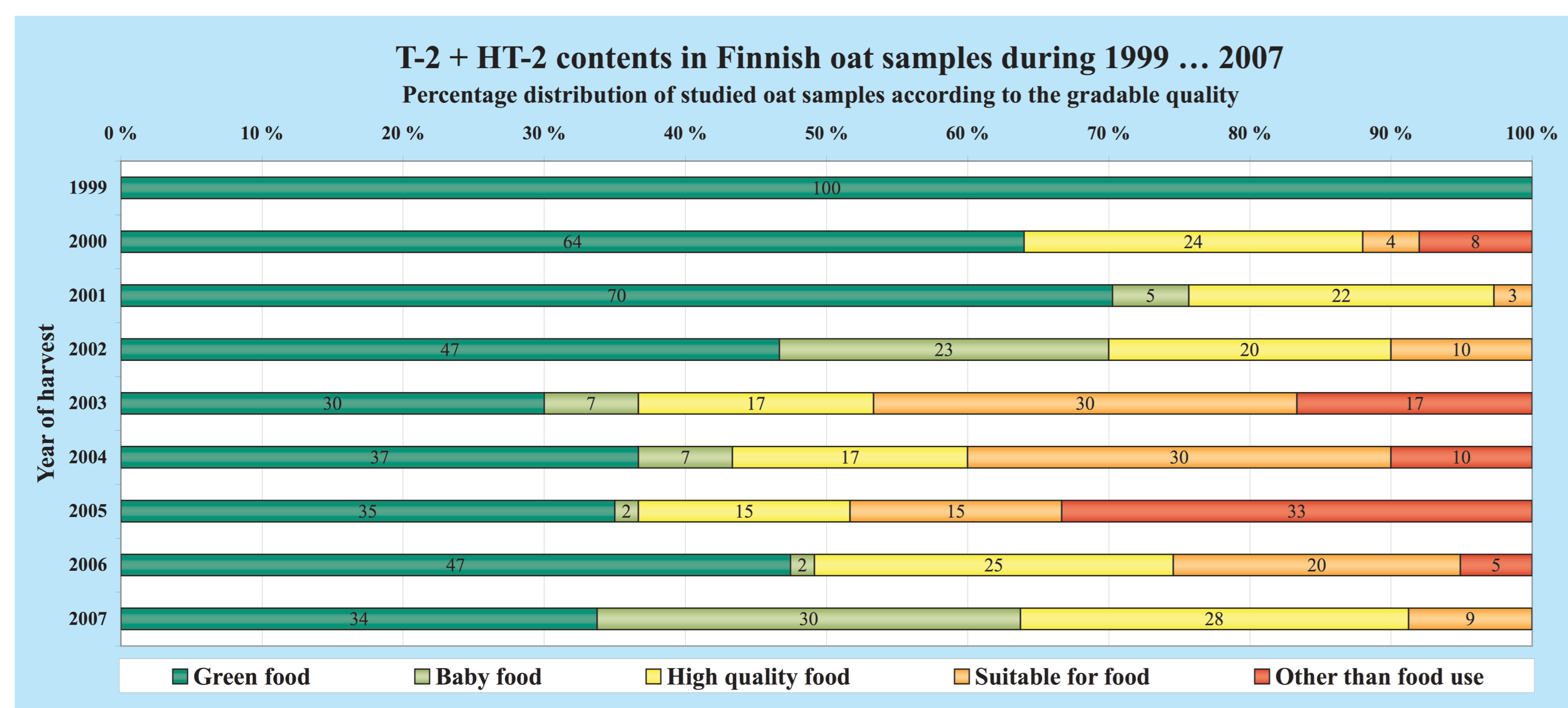
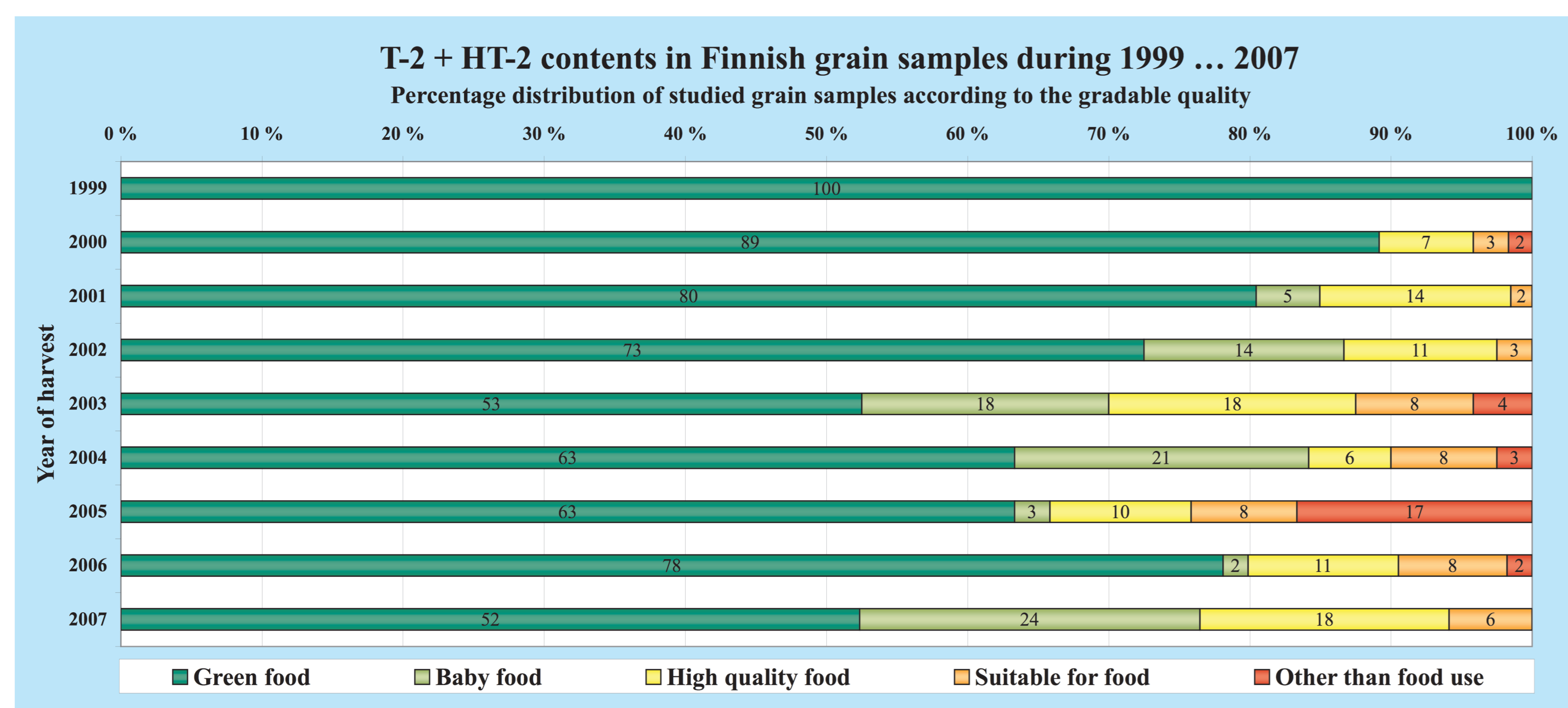
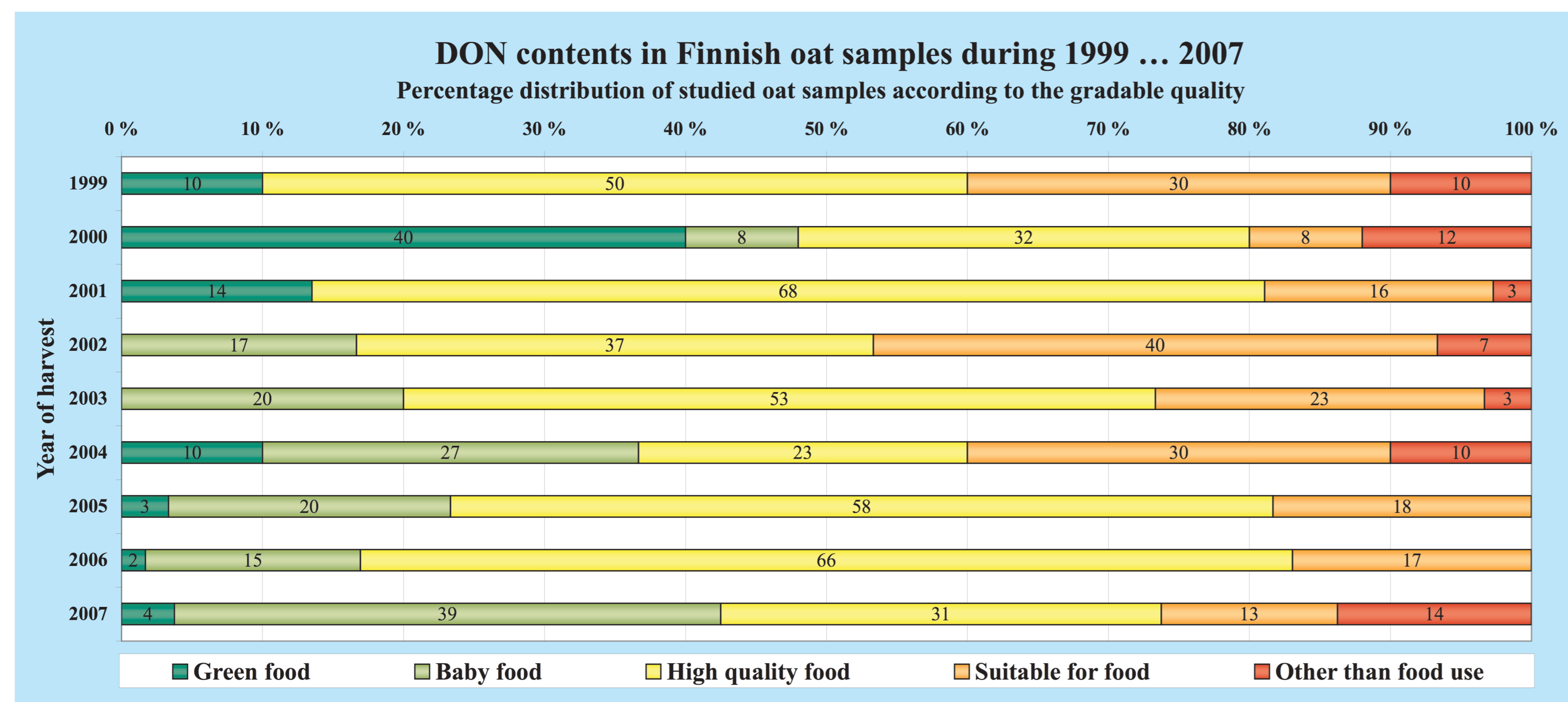
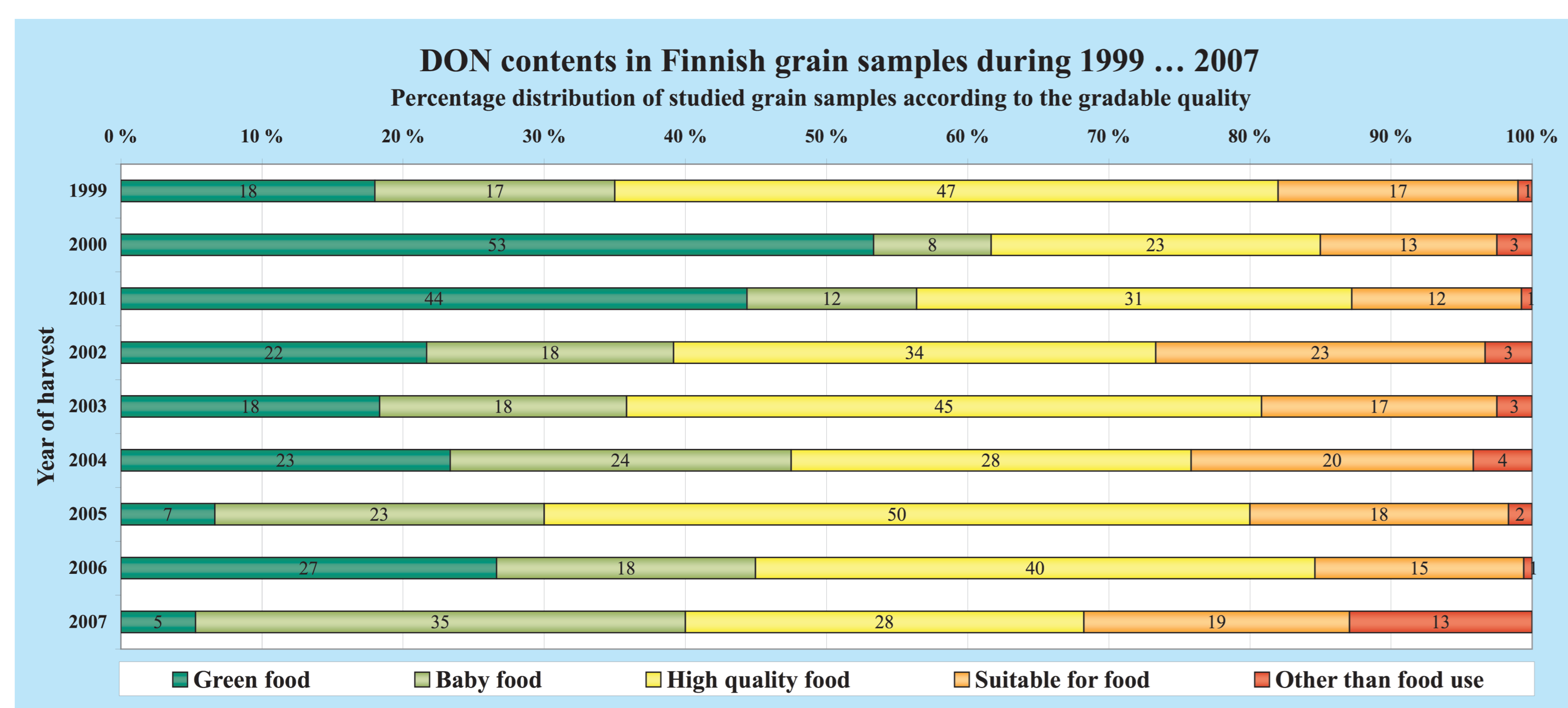
2) Finnish Food and Safety Authority Evira, FI-00790 Helsinki [www.evira.fi](http://www.evira.fi)

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## Introduction

The central goal of grain cultivation is the production of high-quality food or feed-related raw materials for the processing industry. To reach the goal safety aspects of cereal grains have to be certified in addition to the high technical quality of grains. For these purposes a continuous grain quality monitoring programme has been carried out as part of a National Quality Strategy in Finland since 1999. The aim of this programme has been the systematic analysis and documentation of grain quality and safety data, including the traceability of each sample. Traceability implies that from the samples studied background factors such as the habitat of a plant, type of soil, variety of the grain, quality of seed and seed dressing, plant rotation, nitrogen fertilization, plant protection procedures during the growing season, growth period, harvesting-related moisture, harvest quantities and harvest drying can be determined. In the monitoring study mycotoxins such as trichothecenes, zearalenone and ochratoxin A have been determined in representative Finnish cereal samples.

## Results and discussion



## Formation of *Fusarium* toxins and their toxic effects

Contaminant	Source of formation	Toxic effects
Mycotoxins: <i>Fusarium</i> -toxins	Natural toxins in Finnish cereal grains: the most frequently isolated <i>F. species</i> are <i>F. avenaceum</i> , <i>F. graminearum</i> , <i>F. culmorum</i> , <i>F. poae</i> , <i>F. sporotrichioides</i> , <i>F. langsethiae</i>	<b>In humans:</b> indisposition, effects of the central nervous system and heaviness of heart <b>in animals:</b> loss of appetite and reduced weight gain, vomiting, heavy diarrhoea, swelling, nervous system disturbances and infertility

## Materials and methods

The representative grain samples (120 - 170 samples per year) were collected after harvest from all cultivation zones in Finland. Finnish Food and Safety Authority Evira was responsible for the sample collection. DON, DAS, 3-AcDON, 15-AcDON, FX, NIV, T-2 and HT-2 toxins were determined from the grain samples employing GC-MS technique. Zearalenone and ochratoxin A were identified and quantified by HPLC.

The upper and lower limits of DON and T-2 + HT-2 concentration values for the colour classification					
Category of the cultivation factor	Green food	Baby food	High quality food	Suitable for food	Other than food use
Name of the colour classification box					
Cultivation factor of the studied grain	Upper limit of DON concentration	< LOD	< 200 µg/kg	< 500 µg/kg	Oat 1750 µg/kg, other cereals 1250 µg/kg
	Lower limit of DON concentration	0	LOD	> LOD	> 200 µg/kg
	Upper limit of T-2 + HT-2 concentration	< LOD	< 50 µg/kg	< 200 µg/kg	500 µg/kg
	Lower limit of T-2 + HT-2 concentration	0	LOD	> LOD	> 200 µg/kg

## Conclusions

According to the results of the monitoring study, the possible risk factors for *Fusarium* fungi contamination and the formation of toxins in Finland have been identified. The following cultivation-related directives have been made for farmers to better control the *Fusarium* contamination:

- rotation, one-sided cultivation of cereals is not recommended
- careful selection of the type of grain and the variety: spring grains are more sensitive to a *Fusarium* contamination than winter grains; late varieties have a higher risk due to the variable weather at the end of August or in the beginning of September
- pay attention to the quality of seed; seed dressing is recommended also for oats
- put effort to the vigorous growth of grains
- careful and fast harvest drying; moisture content < 14 %, also in years of good harvest conditions
- last, but not least, minimize the risks by professional cultivation

Cultivation field	Risk factors for <i>Fusarium</i> fungi	Risk factors for <i>Fusarium</i> fungi				farmer's observation of risk factors for <i>Fusarium</i> fungi
		no risk	low risk	high risk	critical risk	
Location	cropping zone 1	irrespective of grain				
	cropping zone 2	irrespective of grain				
	cropping zone 3	irrespective of grain				
	cropping zone 4	irrespective of grain				
Soil	soil type	clay				
		sand				
Preceding crop in rotation	2 year growth of same plant in the same area	oats				
	3 year growth of same plant in the same area	wheat or barley				
	4 year growth of same plant in the same area	wheat or barley				
	5 year growth of same plant in the same area	wheat or barley				
Sowing and tilling methods	sowing method of previous autumn	zero-till				
	sowing method of previous autumn	not vertiflora				
Cultivation process	traditional cultivation	oats				
	organically grown	irrespective of grain				
Cultivated plant	correlate with grain	oats				
	correlate with variety	wheat or barley				
Quality of seed	no quality guarantee	irrespective of grain				
	quality guarantee	irrespective of grain				
Rate of fertilization	in accordance with cultivation guide of grain	oats				
	out of line with cultivation guide of grain	wheat or barley				
Plant protection	herbicides	oats				
	herbicides and plant disease	wheat or barley				
Weather conditions during growing season	start of growing season	rainy				
	during flowering season	dry				
Weather conditions during harvesting	harvesting season	late				
	temperature variation	large				
Harvesting and drying	under 5 %	irrespective of grain				
	5 - 25 %	oats				
Flattening %	over 25 %	wheat or barley				
	over 25 %	irrespective of grain				
Drying	warm air-drying	under 25 %				
	non immediate drying	over 25 %				
Sorting of grain	assorted	irrespective of grain				
	storage space	irrespective of grain				

## Acknowledgements

Special thanks for all the support to the Fingrain group managed by Commercial councillor Seppo Koivula. [www.fingrain.fi](http://www.fingrain.fi)