One of the most challenging tasks in today's food industry is controlling the product quality throughout the food supply chain. In this paper, we integrate food quality in decision-making on production and distribution in a food supply chain. We provide a methodology to model food quality degradation in such a way that it can be integrated in a mixed-integer linear programming model used for production and distribution planning. The resulting model is applied in an illustrative case study, and can be used to design and operate food distribution systems, using both food quality and cost criteria.