

ULTRA RICE® TECHNOLOGY: ACCEPTABLE MICRONUTRIENT LOSSES AND LIMITED MICROBIAL GROWTH ENABLE SHELF LIFE EXTENSION

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What is Ultra Rice®?

PATH's Ultra Rice® fortification technology uses an extrusion process to combine rice flour with vitamins and minerals to make rice-shaped grains. The Ultra Rice® kernels are mixed into milled rice at a ratio of 1:100. The finished product looks, tastes, and smells like rice, making it easily integrated into the existing diets of target populations that consume rice as a daily staple.



Context

Why do we want to extend the shelf life?

- To prevent the unnecessary disposal of Ultra Rice® kernels at 12 months.
- To increase the likelihood that fortified rice will reach and benefit vulnerable persons.
- To enable food aid suppliers to mix Ultra Rice® kernels into milled rice so that fortified rice can be prepared prior to transport and no blending equipment is needed at the feeding site.

Objectives

- To document micronutrient losses to determine overages that must be included in the initial formulation.
- To determine if Ultra Rice® fortified kernels are suitable for consumption after 24 months of storage based on microbiological testing.

Methods

Vitamin stability testing:

Uncooked samples of Ultra Rice® kernels and fortified rice were obtained from the

World Vision warehouse and tested by Silliker Canada Co. every 6 months (up to 30 months) to determine micronutrient losses using inductively coupled plasma spectroscopy.

Microbiological testing: Uncooked samples of Ultra Rice® kernels, fortified rice, and milled rice were also tested by Silliker Canada Co. approximately every 6 months (up to 30 months) to determine the growth of aerobic bacteria, coliforms, *Escherichia coli*, *Bacillus cereus*, and yeast and molds. The World Food Programme (WFP) acceptable limits are listed in Table 1.

Figure 1. Study site location

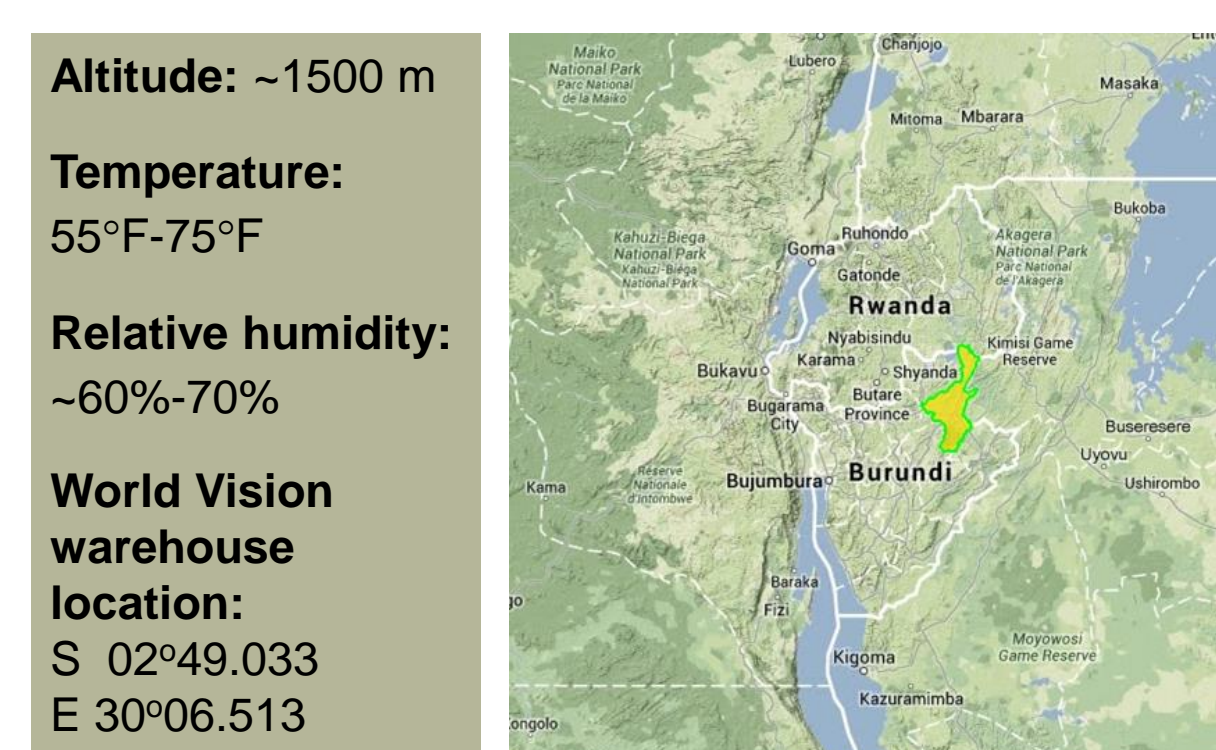
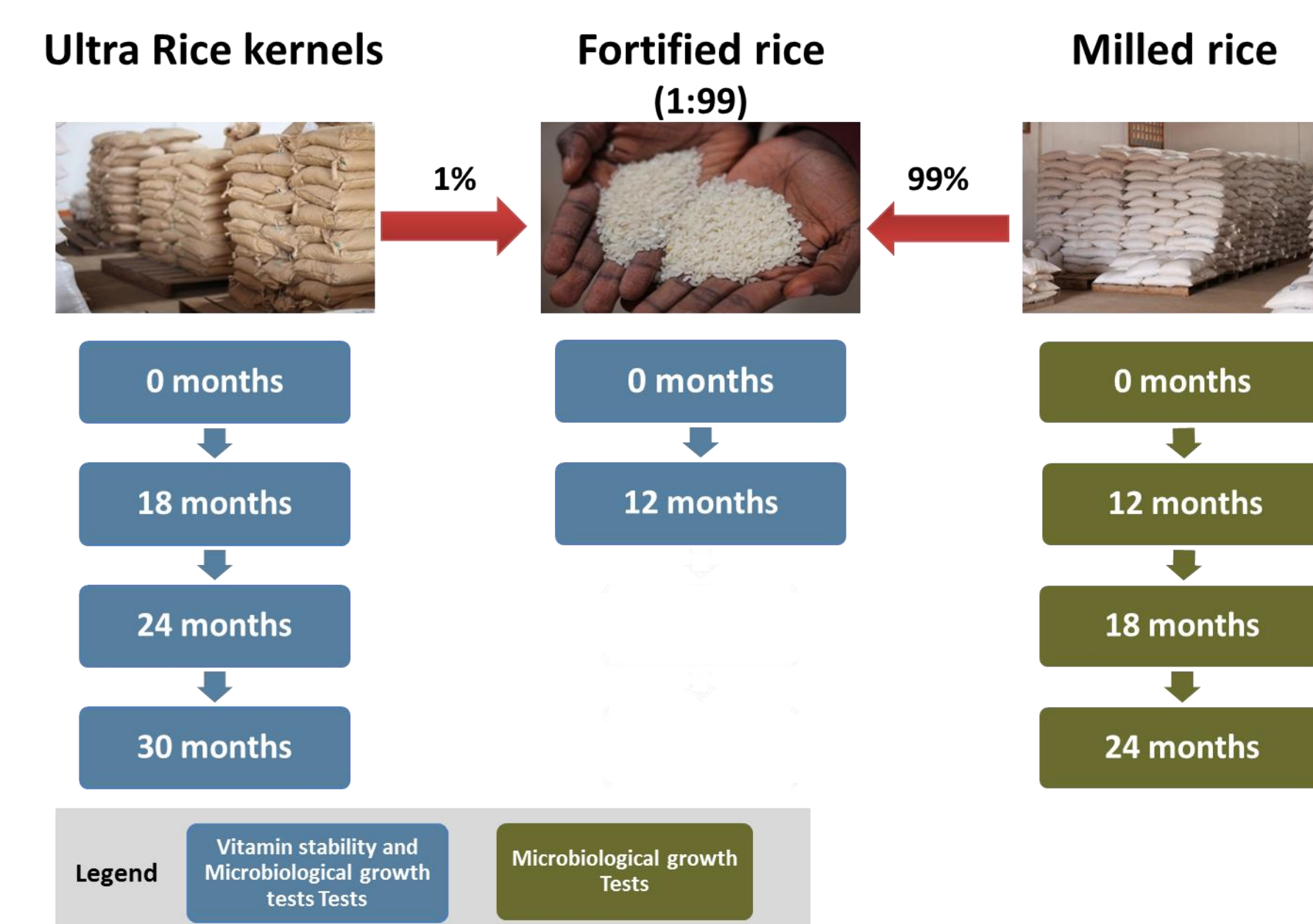


Table 1. WFP maximum levels allowed for microorganism growth in uncooked fortified rice

Microbiological organism	Maximum levels allowed
Aerobic bacteria*	10,000 cfu per g
Coliforms	10 cfu per g
<i>Escherichia coli</i>	0 cfu per g
<i>Bacillus cereus</i>	50 cfu per g
Yeasts and molds	100 cfu per g
<i>Salmonella</i>	0 per 25 g

Source: World Food Programme. Technical Specifications for the Manufacture of Fortified Rice, 2010. *The WFP mesophilic aerobic bacteria cutoff was substituted for total aerobic bacteria.

Figure 2. The frequency of sampling of pure Ultra Rice® kernels, fortified rice (1% Ultra Rice® kernels:99% milled rice), and milled rice



Results

Figure 3. Micronutrient losses within Ultra Rice® kernels over 30 months of storage

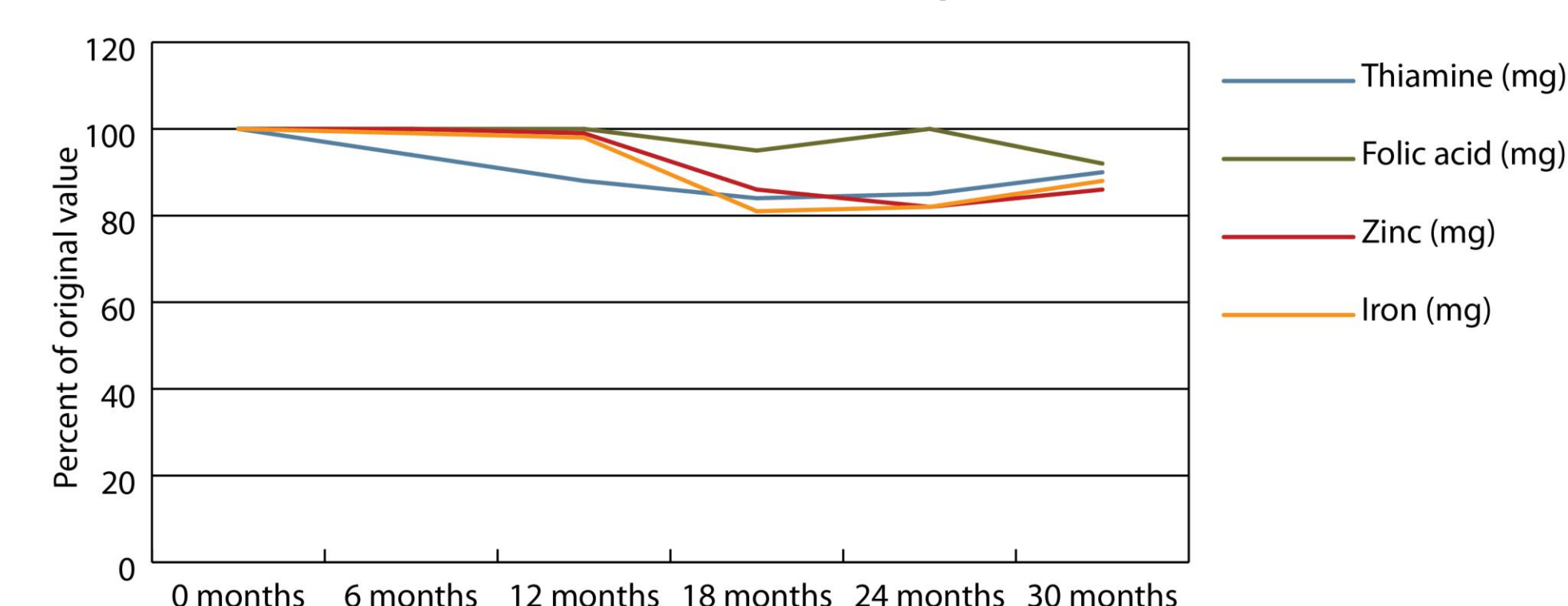
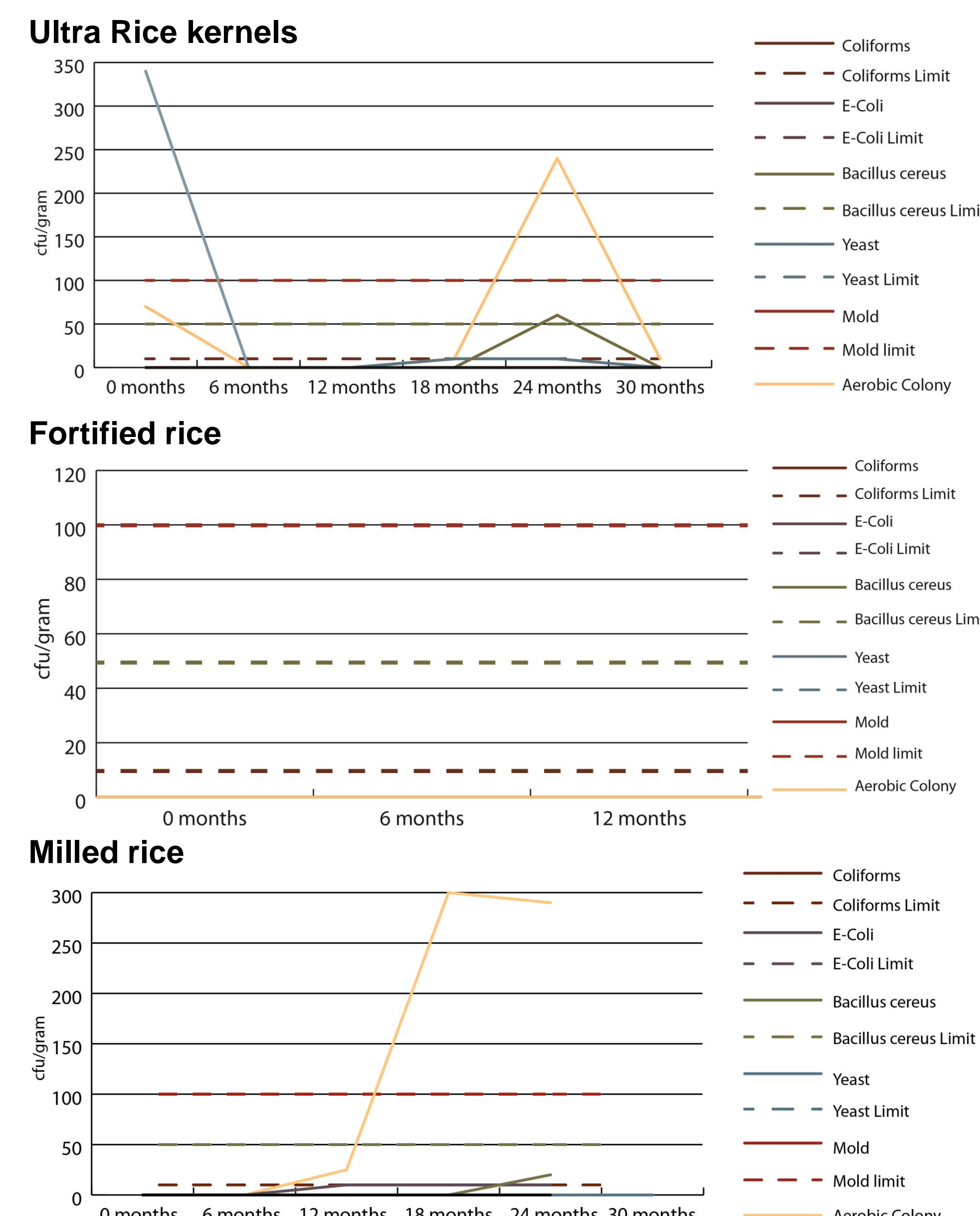


Figure 4. Microbiological growth test results for Ultra Rice® kernels and milled rice



Results: Micronutrient losses

After 30 months of storage, the losses of iron (12%), zinc (14%), thiamine (10%), and folic acid (8%) were small at less than 20% of the original values.

Results: Microbiological growth

Ultra Rice® kernels:

Microbiological growth counts were below the WFP limits at 30 months. Yeast and *Bacillus cereus* counts were temporarily elevated at one time point. *Salmonella* tests were negative at every time point.

Fortified rice:

Microbiological growth counts were below the WFP limits at 12 months. *Salmonella* tests were negative at every time point.



Milled rice:

Microbiological growth counts were below the WFP limits at 24 months. *Salmonella* tests were negative at every interval.

Limitations

Samples of fortified rice and milled rice were not collected to 30 months.

Conclusions

Ultra Rice® kernels: Safe for consumption after 30 months of storage, suggesting the Ultra Rice® shelf life can be extended to 24 months in similar environments.

Fortified (blended) rice: Safe for consumption after 12 months of storage. Microbiological growth was the lowest (undetectable) in fortified rice, suggesting fortified rice to be safe for consumption after 30 months of storage in similar environments.

Micronutrient overages of 20% are sufficient for 30 months of storage in similar environments.

This study should be repeated in hot, humid conditions.

Acknowledgements

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