Section 1: Introduction to Flour Fortification
面粉强化简介

- Reasons for Flour Fortification 面粉强化的原因
- Overview of the Fortification Process 强化工艺概况
- Vitamins & Minerals Used in Flour Fortification面粉强化中维他命和矿物质的使用情
- Impact of Flour Fortification on Public Health 面粉强化对公众健康的影响
- Benefits to Mills from Fortifying Flour 面粉商从强化面粉中得到的利益
- Understanding Fortification Regulations 对强化规定的理解
- Ensuring Consumer Satisfaction of Fortified 确保消费者对强化的满意度
- Products Section Summary 产品概况
- References 参考

Seven Reasons to Fortify Flour 强化面粉的七个理由

1. Fortifying commonly eaten staple foods, like wheat flour, is an effective and economical way to ensure that national populations are provided with essential vitamins and minerals.一般强化的主食象小麦粉，能给本国人民提供基本的维他命和矿物质的一种有效和经济的方法。

2. These vitamins and minerals help prevent nutritional deficiencies such as iron deficiency anemia, and some health problems and birth defects.这些维他命和矿物质能帮助预防营养的缺乏，例如缺铁导致的贫血症，和其他一些健康问题。

3. Flour an ideal medium for fortification, because it is a staple food and more people can be reached by fortifying the flour at the mill than by fortifying only flour products. 面粉强化是理想的方法，很多人都因为吃主食而得到面粉强化。

4. Fortification can significantly improve the health of a national population强化面粉可改善国民的健康

Seven Reasons to Fortify Flour 强化面粉的七个理由

5. Fortifying flour can be beneficial for the national economy. Healthy citizens lead to increased productivity. 强化面粉可使国民经济受益。身体健康的国民可提高生产力。

6. The World Bank estimates that vitamin and mineral deficiencies as a whole depress GDP by as much as 5%. Fortification of key staple foods with specific vitamins and will help eliminate these deficiencies for as little as 0.15% of GDP- the approximate fortification cost世界银行评估维他命和矿物质缺乏使GDP总体下滑将近5%。主食中加入维他命使之强化，会免除缺乏使GDP少损失0.15%---大约的强化成本.[R]

7. Flour millers can play a major part in solving these nutritional problems by improving their products with the addition of key vitamins and minerals. They produce a better product, they can do so at low or no cost and they help their wholesalers to bring better products to their customers. 面粉商在改进其产品时添加关键的维他命和矿物质这些营养因素时起了重要的作用。面粉商可在低或无成本的情况下生产好的产品，面粉商帮助其批发商将好产品带给用户。

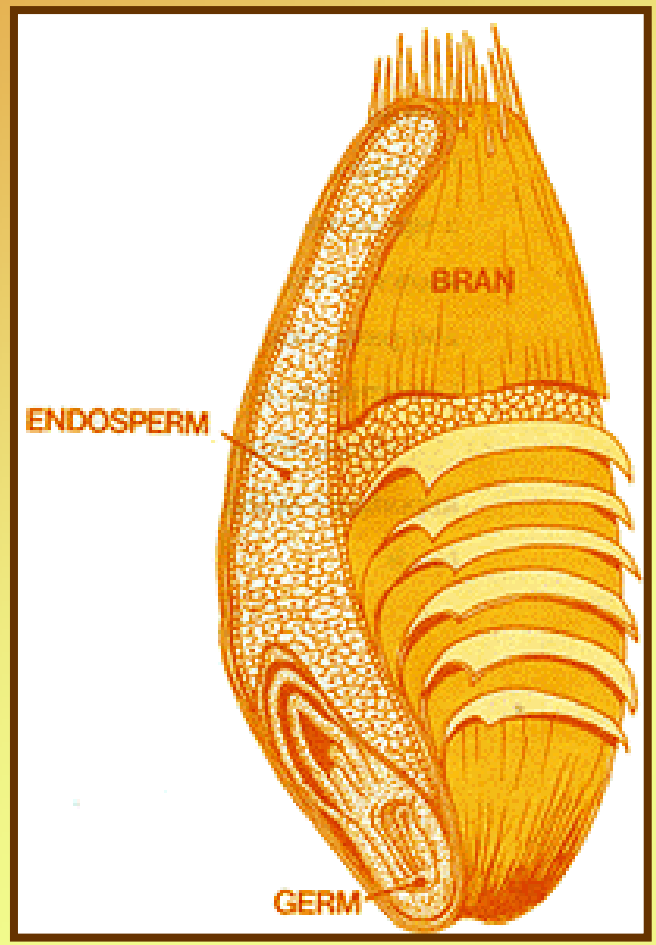
Overview of Flour Fortification面粉强化的概况

Fortification is the process of adding vitamins and minerals to flour during the milling process, resulting in a higher quality, more nutritious product.面粉强化是在制粉过程中添加维他命和矿物质，可生产出高质量的，更多营养的产品

Vitamins and minerals are typically added to flour during the milling process via small amounts of a powdered “micronutrient premix”. 面粉中加入维他命和矿物质，是典型的方法。即在制粉过程中通过加入少量粉状“微量营养素预混合料”

More information about premixes can be found in *Section 2* of this toolkit. 预混合料的更多信息可在第2部分中找到

Overview of Flour Fortification面粉强化的概况



Prior to milling, whole grain wheat contains significant levels of calories, protein, carbohydrates and dietary fiber (macronutrients) and also many vitamins and minerals (vitamins and minerals). But most of the vitamins and minerals are contained in the bran and the germ of the wheat. 制粉前，整个谷物小麦包含重要的卡路里，蛋白质，碳水化合物和大量营养素的饭食纤维层，维他命和矿物质。但大多数的维他命和矿物质是含在小麦的麸皮及胚芽里

When flour is milled, the bran and the germ are removed and discarded leaving mostly pure, white endosperm. But this results in many of the vitamins and minerals being removed leaving a product that is less nutritious than the whole grain wheat. 当面粉加工时，麸皮和胚芽脱落，剩下大部分纯的白色胚乳，但这也导致了脱落了维他命和矿物质的产品要比全谷物小麦营养少了很多。

Overview of Flour Fortification面粉强化的概况

Table 3.8 Nutrient Composition of Whole and Refined Wheat [R]

Nutrient	*Level units*	*Whole Wheat**		*Wheat Flour**		*Percent Retention*
		Level	*INQ*	*Level*	*INQ*	
Calories	kcal/100g	339	1.0	364	1.0	105%
Protein	%	13.7	1.2	10.3	0.9	80%
Calcium	ppm	340	0.2	150	0.1	44%
Iron -men	ppm	54	3.9	12.0	0.8	22%
-women			1.8		0.4	
Zinc	ppm	35	2.0	7.0	0.4	20%
Thiamin	ppm	4.1	2.0	2.0	0.9	49%
Riboflavin	ppm	1.1	0.5	0.4	0.2	37%
Niacin	ppm	48	1.9	10	0.4	21%
	NE	83	3.3	32	1.3	
Pyridoxine	ppm	3.8	1.7	1.0	0.4	24%
Folates	ppm	0.41	0.6	0.25	0.3	61%
Phosphorus	mg/100g	346	2.7	108	0.9	31%
Phytic acid	mg/100g	800		280		35%

* Whole wheat protein and micronutrient levels can vary widely. Iron, for example, can range from 30 ppm to over 100 ppm. The values shown here are averages taken from USDA Food Composition Tables.
* *Normal white, non-fortified, all-purpose flour with 75% extraction

The table shows the degree to which nutrients are reduced during milling. 100 grams/day of whole wheat flour supplies 22% of the United States Recommended Daily Allowance for iron. Refined flour has less than one fourth of this amount (less than 6% of the RDA)
这个表格显示了制粉过程中营养减少的度数。每天100克全麦粉补充了的美国人日摄食量中对铁的22%的需要。精炼油少于总数量的1/4。（少于日摄食量的6%)

Overview of Flour Fortification面粉强化的概况

Fortification can restore to milled flour the natural levels of vitamins and minerals found in the wheat kernel or whole wheat flour. This process is commonly referred to as “enrichment” or “restoration”. It is one type of fortification. 强化部分在粉碎的面粉中找到，维他命和矿物质的天然层在小麦核或全麦粉中。这个工艺通常在“浓缩”或“还原”中提及。这是个典型的强化方法。

Fortification can also add vitamins and minerals back in amounts than are higher than as naturally present in the whole wheat kernel. This type of fortification is very common and is used where the populations consuming flour and flour products are deficient in one or more of the vitamins and minerals added. 强化粉可以加入比自然麦粒中含有量更高的维生素和矿物质。这种强化粉很常见，常用于人们消费面粉或面制品时在一种或更多的维生素或矿物质的摄取量不足的地方。

Another type of fortification used to help prevent deficiencies adds additional vitamins and minerals that are not naturally present in wheat. Examples include vitamin A, and/or calcium and/or Vitamin B12另一种强化的方法是帮助预防不能够在小麦中体现的维他命和矿物质的缺乏。包含维他命A， 和/或鈣和/或维他命B12.[R]

Vitamins & Minerals Used in Flour Fortification
强化面粉中使用的维他命和矿物质

Common minerals and vitamins added to flour在面粉中加入的矿物质和维他命

- Iron铁
- Zinc锌
- Folic Acid 叶酸
- the B vitamins (Thiamin, Riboflavin and Niacin) 维他命B
- In some countries Vitamin A, Calcium and B12 are added.
  在一些国家，也会添加维他命A，钙和B12

How to decide on premix ingredients:怎样决定预混合料成分

- Generally, these decisions are made with the help of nutrition and research organizations that are involved in nutrition standards and problems of the population. 一般情况，由从事营养标准的营养和研究机构决定
- Decisions about which vitamins and minerals will be added to wheat flour决定添加哪些维他命和矿物质到小麦粉中
  depends on a number of factors:依赖于下列因素：
  - -- existing government regulations,现有政府的规则
  - -- dietary needs and deficiencies in the population 饭食需要和人口的缺乏
  - -- the cost of different premix combinations不同预混合料合并的本
  - -- results of research aimed at determining vitamin and mineral deficiencies维他命和矿物质缺乏做为研究结果

More information to help guide decision making on which vitamins and minerals should be added to flour are found in Section 2. 关于在面粉中添加维他命和矿物质的指导方法请参阅第2部分

Impact of Flour Fortification on Public Health
面粉强化对公众健康的影响

Fortification is a success强化是成功的

- The United States and Canada have successfully fortified flour with vitamins and minerals since 1941. Because of this process, several vitamin deficiencies have been virtually eliminated in these countries. 美国和加拿大自1941年有了成功的强化面粉。有了这个工艺，这些国家几项维他命缺乏也排除了。

- The fortification process has a been tested again and again in countries around the world, as successful fortification programs have been implemented in many countries. 强化工艺在很多国家试验了多次，成功的强化内容在许多国家成功完成。

Impact of Flour Fortification on Public Health
面粉强化对公众健康的影响

Impact of fortified flour has been measured强化面粉标准的影响

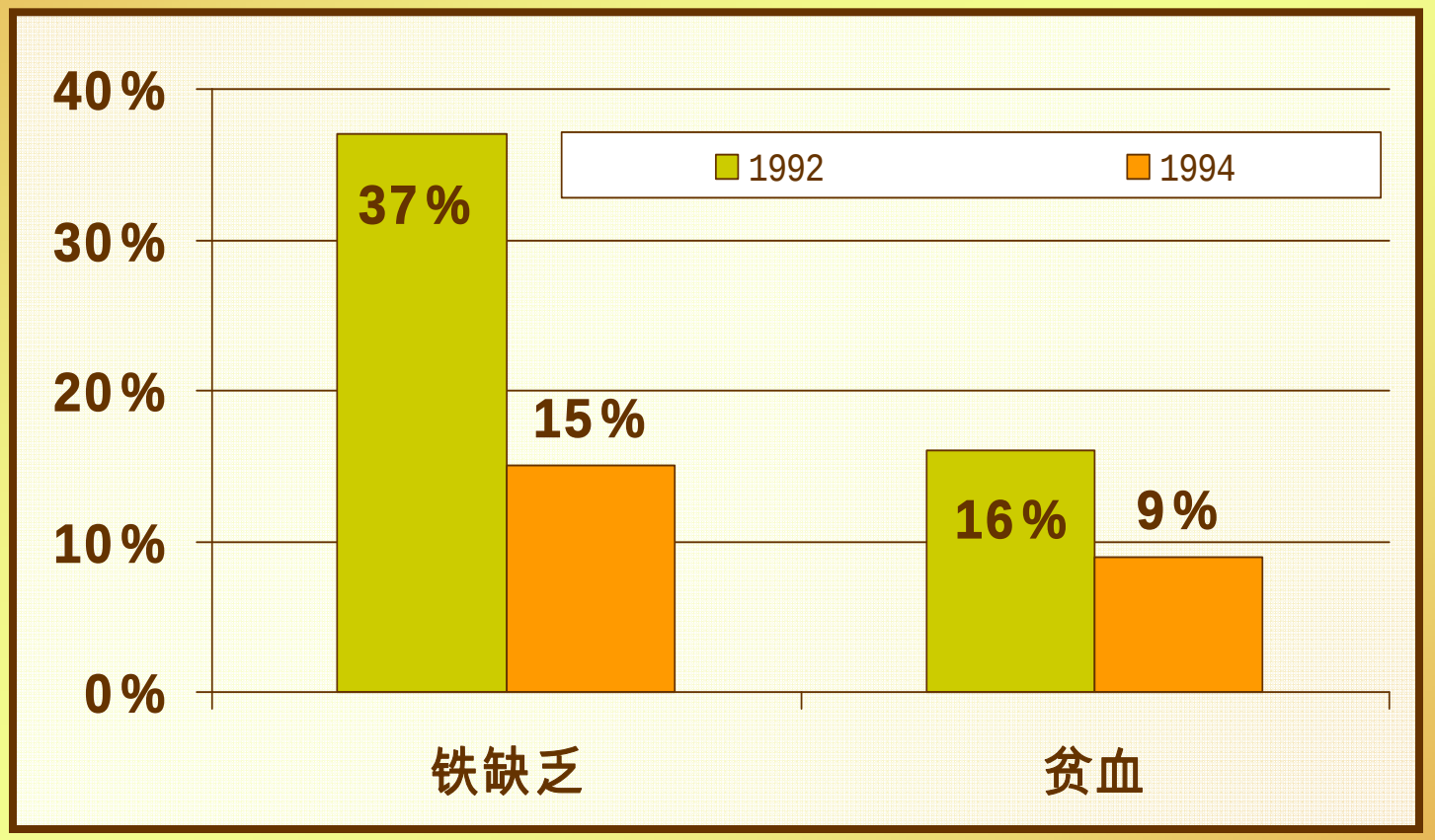
- In the United States, folic acid fortification is estimated to have an annual economic benefit of between $312 million and $425 million. The net reduction in direct costs are estimated to be between $88 million and $145 million per year在美国，叶酸的强化给国民经济带来了￥312million 和$145million的收益直接成本中的净减少估计带来了$88和$145美元.[R]

- In a Canadian study of 38000 Ontarian women aged 18 to 42 years, there was a significant increase of 214 nmol/L in the (geometric) mean RBC folate concentration after fortification began in January 1998 (unpaired t-test: $p<0.001$). This increase resulted in a decreased prevalence of folate deficiency from 6.3 percent pre-fortification to 0.88 percent post-fortification加拿大对来自安大略省的38000名女性，年龄从18岁至42岁进行的调查显示，自1998年一月进行面粉强化后，叶酸浓度增加到214nmol/L.此叶酸浓度的增加使强化前的百分之6.3减少到强化后的百分之0.88。[R]

- Through iron fortification of wheat and corn flours, Venezuela has “effectively halted a trend towards increased prevalence of (iron) deficiency due to inadequate food consumption as a result of a declining economy”通过小麦和玉米粉的铁强化，委内瑞拉暂停了由于不充分的食物消耗增加了铁缺乏而使经济下降.[R]

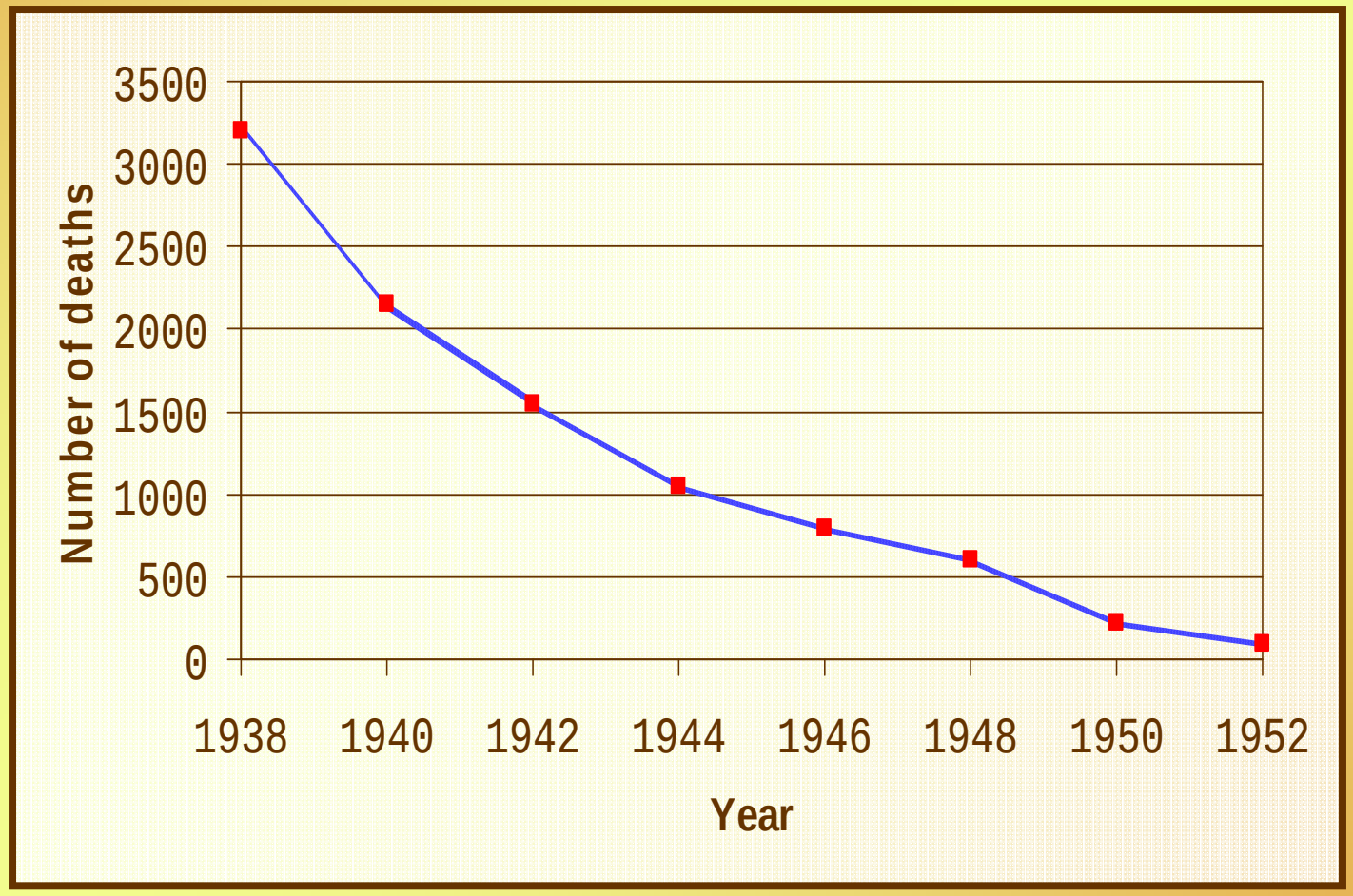
Impact of Flour Fortification on Public Health
面粉强化对公众健康的影响

Impact of flour fortification: anemia & iron deficiency in Venezuela
强化面粉的影响：在委内瑞拉贫血和铁缺乏的显示



Impact of Flour Fortification on Public Health
面粉强化对公众健康的影响

Impact of flour fortification: Reduced deaths from Pellagra (niacin deficiency) in the USA面粉强化的影响：在美国糙皮病的死亡减少数量图



Benefits to Mills from Fortifying Flour
强化面粉为面粉厂带来的收益

Flour fortification is an opportunity for mills to:
强化面粉为面粉厂带来的机遇：

- improve product quality by adding vitamins and minerals to restore to original wheat levels and improve its nutritional state. 改善产品质量添加维他命和矿物质还原至原始小麦阶段并改善其营养状态
- raise their company's profile helping to create an image as innovative and on the cutting edge of milling technology.
- expand market share and consumer brand loyalty through improved products通过改善的产品来扩展市场份额和建立消费者品牌信誉.
- contribute to the health and productivity of the national population and receive recognition as a good corporate citizen.致力于本国人民的健康工作，并被大家认可

Understanding Fortification Regulations
对强化法规的理解

Explore national status and requirements探寻国民情况和需求

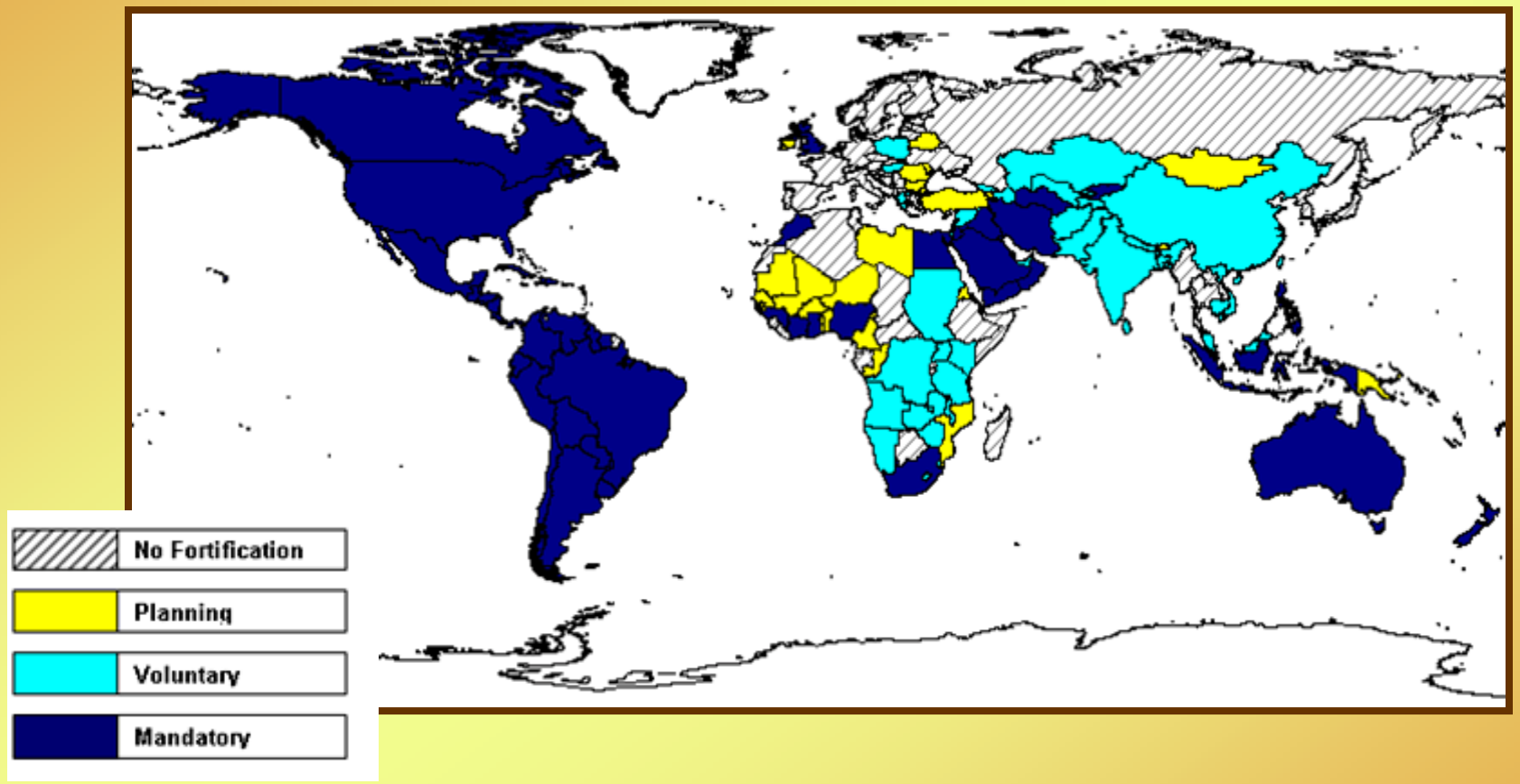
- Mills owners and management need to start by learning the status of existing regulations related to fortification to learn whether or not national authorities have or are planning to introduce fortification regulations.面粉厂厂主和其管理层需要对现有强化制度的情况进行了解，还要了解权威机构是否要计划引进强化面粉的制度。
- Mills owners and management can consult with the government authorities on what is required and what is permitted regarding fortification. 面粉厂厂主和其管理层应与政府部门协商对于什么是强化所需要的和强化所允许的。

General information on flour fortification regulations:强化面粉法规总说明：

- At the beginning of 2006 nearly 50 countries had set cereal fortification standards or customary fortification practices.在2006年初有近50个国家制定了谷类食品强化标准或强化惯例。
- Regulations differ widely by country.国家规章制度大不相同
- Some government require mandatory fortification with certain vitamins and minerals, but others may be allowed on the basis of decisions by the milling companies.一些政府强制要求强化面粉中加入维他命和矿物质，其他一些政府或许同意面粉公司自己的决定
- A government may also decide to prohibit adding certain vitamins and minerals to flour一个政府决定禁止在强化面粉中添加维他命和矿物质. R

Understanding Fortification Regulations
对强化法规的理解

Fortification Status – March 2009



The map indicates countries that have fortification regulations or are working toward implementing regulations. 地图所显示已有强化法规的国家，或要实行强化法规的国家。

Understanding Fortification Regulations
对强化法规的理解

For millers in countries without fortification regulations没有实行面粉强化法规国家的面粉厂主

Setting Standards制定标准

National flour fortification standards are most often generated by technical groups.
国有面粉的标准一般都由技术集团来制定。

They often include技术人员包括:

- government health specialists政府健康专家
- standards specialists标准专家,
- nutritionists营养学家,
- millers and often bakers and major flour product manufacturers.面粉厂主，面包师和面粉产品制造商
- International donors may support work by such groups.
- 国际捐助者能为这些组织提供支持

- In a country without current standards or regulations on flour fortification, a mill wanting to fortify flour needs to determine whether flour fortification is allowed. 对强化面粉没有流通标准或规章制度的国家，面粉厂决定是否需要强化面粉。
- A special permit will need to obtained or the regulations changed in the very few countries that specifically prohibit adding *anything* to flour. 获得特殊的执照，在少数几个明确规定不得在面粉中添加任何东西的国家，其规定要修改
- Millers also need to learn about any *general* fortification regulations (applying to all foods). Such general regulations for all industries fortifying food products should also be observed by a mill fortifying wheat flour面粉厂家需要学习全面的强化规则（适用于所有食物）面粉厂强化小麦面粉也要遵守食品产品强化行业的规则.[R]

Understanding Fortification Regulations
对强化法规的理解

Regional fortification guidelines区域强化指导方针

Some regions encompassing countries with similar basic food consumption practices have set up regional fortification guidelines that serve as a basis for country specific regulations. Such regulations facilitate inter-country active trade of wheat flour. Where the same premix is used nationally or in a region, procurement for mills may be easier and often at lower cost一些有着类似主食消费的地区已制定了地区性的强化方针，作为国家的具体规则的基础。这些规则能推动国家间的小麦面粉主动贸易，在使用同样的预混合料的地区或国家，面粉的购买较方便，成本也更低。

Table C1 Actual or Proposed Regional Flour Fortification Standards

(levels added)

	WHO/EMRO Middle East	*ADB/KAN Central Asia*	*ADB Proposed Southeast Asia*	*Southern Africa*
Iron (ppm)	30/60*	50**	30/60*	35**
Zinc (ppm)		22	30	15
Folic acid (ppm)	1.5	1.5	2	2
Thiamin (ppm)		2	2.5	1.94
Riboflavin (ppm)		3	4	1.78
Niacin (ppm)		10		23.68
Vitamin B_6 (ppm)				2.63
Vitamin A (IU/kg)				5951
Cost ($/MT)[17]	$0.32	$0.69	$0.74	$1.99

*30 ppm iron if ferrous sulfate, 60 ppm if elemental iron powder.
**As electrolytic reduced iron

Ensuring Consumer Satisfaction of Fortified Products
确保消费者对强化产品的满意度

Millers are concerned about customer acceptance and preference for their products including fortified flour 面粉商关心消费者对其产品的偏爱和接受度也包括面粉强化

- In general, any good quality fortified wheat or wheat product should not change consumer acceptability of the fortified food. Ideally, fortification should be invisible to the consumer.任何质量好的强化小麦或小麦产品改变不了消费者对强化食品的接受性。强化对消费者来讲是种完美的隐形。
- If possible, there should be no detectable difference in the appearance, or sensory properties of the fortified product and the price should be not more than marginally higher. 强化产品在外表及感官上看不出不同，价格稍贵一点

Characteristics to be controlled to help ensure consumers acceptance and satisfaction:为帮助消费者接受和满意，其特性需控制：

- Color and Appearance 颜色和外形
- Flavor and Aroma口味和香味
- Shelf Life保存期限
- Taste and Mouth feel味道和口感
- Sensory Testing 感官试验R

Ensuring Consumer Satisfaction of Fortified Products
确保消费者对强化产品的满意度

Color and Appearance 颜色和外形

- The visual appearance of fortified flour and of foods products made from fortified flour make a strong impression on the customer. Any change from unfortified flour should be minimal. 已强化的面粉及强化的食品可看见的外形给消费者强烈的印象。
- At the current fortification levels used in wheat, there is no adverse impact. Although premix is generally a light yellow color, the very small amounts added cause little change in color of flour.在现今小麦中已使用的强化级别，对面粉没有不利影响。通常预混合料淡黄色，少量加入才使得面粉颜色有一些改变。
- Elemental iron powders may cause a slight darkening of flour铁粉末会导致面粉暗色化
- High levels of riboflavin and folic acid can cause a slight yellowing. 太多的核黄素和叶酸导致轻微变黄
- Experience has shown that these changes are accepted when consumers learn that the slight difference is caused by a vitamin or mineral once all flour is similarly treated消费者可接受面粉有轻微改变，是因为被处理的面粉中加入了维他命和矿物质. [R]

Premix预混合料

Fortified flour强化的面粉

Ensuring Consumer Satisfaction of Fortified Products
确保消费者对强化产品的满意度

Flavor and Aroma 味道和香味

- Like color and appearance, the flavor and aroma of fortified flour should not be different from unfortified flour and products.强化面粉和未强化的面粉和产品从颜色及外形上没有什么不同

Texture and Mouth feel 质地和口感

- Product texture and mouth feel should be the same. 产品质地和口感相同。

Shelf Life 保存期限

- Generally, the addition of vitamins and minerals to wheat flour should not reduce the normal or expected shelf life of the flour. 一般情况下，添加了维他命和矿物质的小麦粉的保质期不会减少。
- Any reduction in shelf life can result in lost products and reduced consumer acceptance of the food任何保存期限的减少可导致产品的丢失和降低消费者对食品的接受能力. R Rancid products have a slightly soapy mouth feel and a distinctive unpleasant odor. **腐臭的食品口感轻微滑腻和浓烈的气味使。**

The premix ingredients decided upon should take expected shelf life into account.

决定选用的预混合物成份就考虑到保鲜时间。

Ensuring Consumer Satisfaction of Fortified Products
确保消费者对强化产品的满意度

Sensory properties preserved口感特性的保护

Extensive testing and experience prove that fortification can be done without adversely affecting the sensory properties in final products
广泛的测试和经验证明强化粉不会影响这种产品的感官特性.

These include：包括:

- flour 面粉
- bread 面包
- cakes 蛋糕
- instant noodles速溶面
- pasta通心粉

Unique products should be tested需要测试的独特产品

Flour-based foods products unique to different regions of the world should be tested prior to starting a general fortification program to insure that products are acceptable to consumers
世界不同地区独特的以面粉为基础的产品进行全面的强化计划前需要测试.R

(China has successfully fortified flour for steam bread and home made noodles after initial testing.)

中国经过最初的测试对馒头和家庭制作的面条进行了成功的强化。

Section 1 – Summary 第一部分概要

Compelling reasons to begin fortifying flour: 强化面粉的强制理由：

- Fortifying flour can help improve the health of a national population by providing essential vitamins and minerals lacking in daily diets.每日膳食中提供基本的维他命和矿物质。强化面粉可改善国民健康
- Flour fortification can be beneficial for the miller.面粉强化给面粉商带来的利益
  - Helps to improve product quality帮助改善产品质量
  - May increase market share and brand loyalty 可增加市场份额和品牌忠诚度
- Careful consideration of consumer's expectations can be used to position fortified flour to be accepted by consumers and to become part of their daily diet. 仔细考虑消费者的期望值可以帮助消费者接受面粉强化，使之成为每日膳食的一部分
- The many successful fortification programs implemented around the world offer models on which to base new programs.在全世界实施的许多成功强化粉项目提供了新项目参考的模式。

Fortification Strategies强化战略

The general fortification strategies used in each country should be based on the public health and economic situation at hand. Usually a team of experts will determine which strategy is best. 每个国家使用的总体强化战略应以当前的公共健康和经济形势为基础。通常一个专家团将确定哪一个策略为最佳。

Examples of strategies commonly used:广泛使用的策略的范例

1. Restoration/Enrichment – The level of each nutrient in the unprocessed food must be known if the criteria is based wholly or partially on restoring lost nutrients, which was the original criteria for cereal enrichment in the United States and Canada.
恢复/浓缩-如果指标是部份或全部基于恢复失去的营养物质，那么未加工的食物中的每一种营养物的含量应该知道。这是美国和加拿大最初使用的谷物浓缩标准。

2. Balancing dietary requirements – It is desirable to have a balance in the levels of nutrients contained in the fortified product and the dietary requirements. Folic acid is an exception to this in that higher levels relative to the other vitamins and minerals are normally added in order to insure prevention of neural tube defects.
平衡膳食要求-在强化粉产品中含有一个均衡的营养物含量和膳食要求是大家想要的。叶酸是一个例外，相对于其他的维他命和矿物质通常加入较多的叶酸以确保预防神经系统的故障

3. Making up for dietary deficiencies – This strategy is to make up for all or part of the difference between the dietary requirement for a nutrient and its average consumption by the general or target population. This calculation depends on which dietary requirement values are used. It can also be difficult to find good data on micronutrient intakes for some target populations. [R]
膳食不足的补充-这种策略是全部或部份补充营养物膳食要求和总体或目标人群的平均消耗量的差量，计算取决于采用的膳食要求值，为目标人群找出好的微量营养素数据也是困难的。

Millers' Role in Devising Flour Fortification Standards
作出强化面粉标准中面粉企业的作用

- The process of establishing standards and associated regulations is complex and time consuming. It should always involve representatives from the medical community, the milling and baking industry and the government (usually through the ministry of health and government standards organizations). Others involved may include consumer groups, educational/research institutions, interested NGOs and international and bilateral specialists.建立标准和相关规定的过程是复杂和消耗时间的。这总要涉及到医疗团体、面粉和烘焙行业和政府的代表。（总是通过政府的标准组织和卫生部门），其他需要参与的可能包括消费者团体、教育/研究机构、感兴趣的非政府组织和国际及多方面的专家。

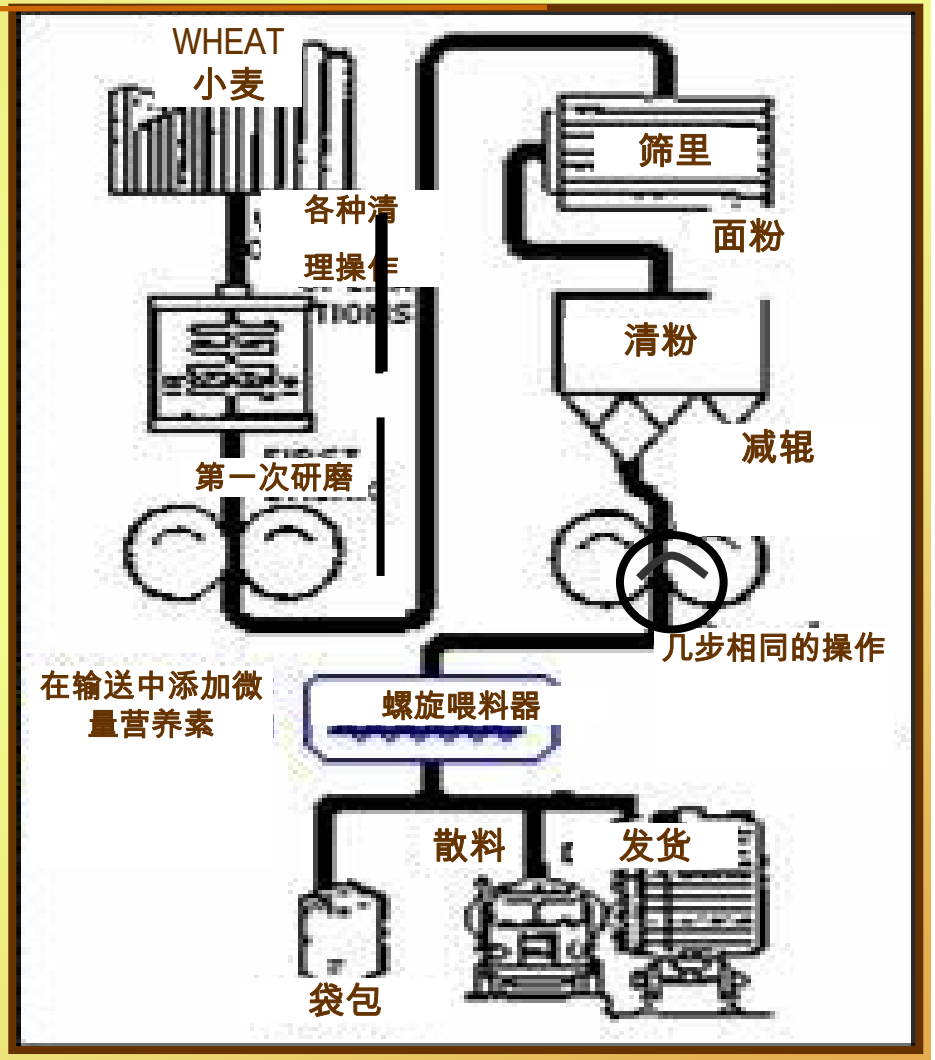
- An alliance of these groups needs to assess what is needed and what is feasible. To assure acceptance of the fortified products and compliance with regulations major stakeholder groups must "buy in" to the final regulations. 这些团队联盟需要评定需要什么和什么是切实可行的。为了确保强化粉产品被接受和与规范相符，主要股东团体必须最终规定来大量买进他们所需要的东西。

- Cost is always a major factor in decision making about standards. Cost often restricts the types and levels of vitamins and minerals to include. High costs make it very difficult to require vitamin A and calcium. Costs also makes it more practical to add a premix of other minerals and vitamins that are needed by the population, because their addition to the premix involves very low additional costs制定标准的决策中成本始终是个主要因素。成本经常制约加入的维他命和矿物质种类和含量.维他命和钙的高成本造成了添加困难。添加了人类需要的其他矿物质和维他命的预混合料也很值得应用，这些添加的东西只造成很低的添加成本 R

Section 2A部分

Procuring Materials & Setting Up the Mill
采购原料和建立面粉厂

- Issues to Consider需要考虑的问题
- Choosing a Micronutrient Premix选择微量营养素的预混料
- Choosing an Addition Method决定添加方法



Issues to Consider
考虑的问题

Choosing high quality wheat ensures that high quality fortified flour will be produced:选择高质量的小麦确保生产高质量的强化粉：

- Nothing added during vitamin and mineral fortification will improve the mixing and baking performance of poor quality wheat. 没有添加维他命和矿物质强化时，可改善低质量小麦混合和烘焙时的表现。
- If low quality wheat is fortified, consumers will likely blame the poor quality of the fortified flour on the added vitamins and minerals. This bad first impression may lead them to reject all fortified flour. 假如强化低质量小麦，消费者很可能会抱怨强化粉低质量时还添加维他命和矿物质。这一不好的印象会让消费者拒绝所有的强化粉。

Issues to Consider
考虑的问题

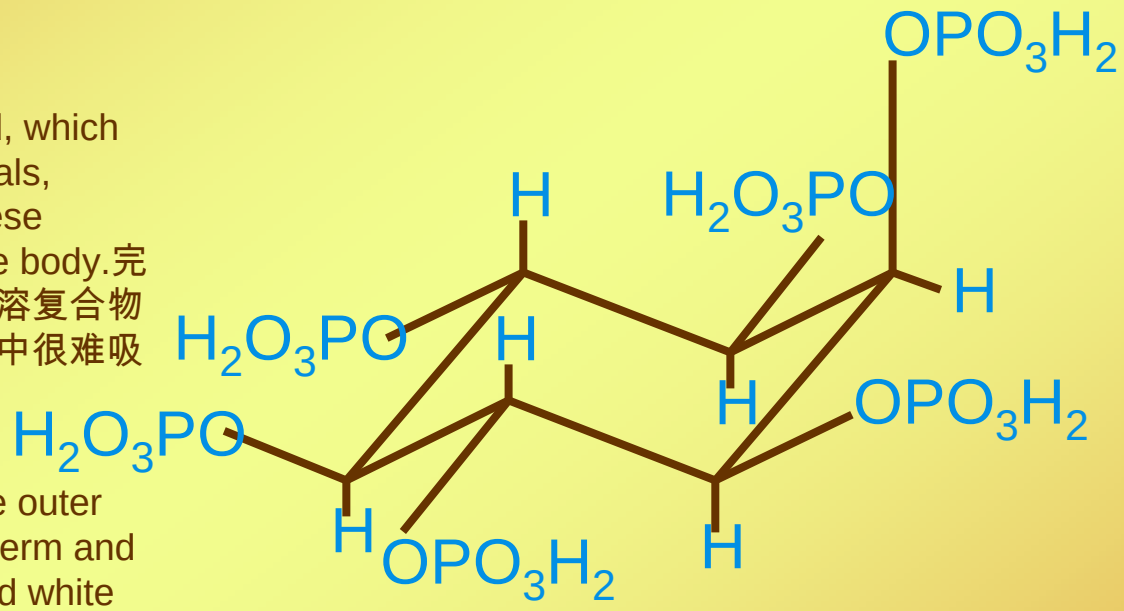
The phytic acid that is naturally present in grains can be a problem because it inhibits the absorption of iron, zinc and other minerals by the human body. 在谷物中自然呈现的---酸，抑制了人类对铁，鋅和其他矿物质的吸收。

- Whole grain wheat contains nearly 1% phytic acid. Milling removes phytic acid in flour by 60% to 90% depending on the extraction rate. These lower levels improve the absorption of minerals. 全谷物粉包含近1%的---酸。制粉时根据萃取率去除面粉中60%至90%的---酸。这些较低的级别改善了矿物质的吸收。
- As a general rule, the lower the level of ash in the flour, the lower the phytic acid content. 作为常规，面粉中较低的灰和较低的--- 酸含量。[R]
- When yeast is combined flour in bread making, it acts to further lower the level of phytic acid. 在制作面包时酵母与面粉结合时，酸表现出更低的水平。
- Vitamins and minerals are absorbed best from white refined wheat flour with an ash content of below .80%, but higher extraction rates of flour *can* and *should* be fortified if consumers prefer higher extraction flours维他命和矿物质在灰含量低于80%的精炼白小麦粉中得到最好的吸收。如果消费者更喜欢高级的面粉萃取，高萃取率的面粉可以和被强化。[R]
- To counteract the effect of phytic acid and maximize the benefits of fortification, flours of different extraction rates need to be fortified with different forms and amounts of premix fortificants. 中和---酸的效果和取强化利益的最大值，面粉不同萃取率需要与不同形式和数量的预混合强化者来共同强化。

Phytic Acid's Effect on Mineral Absorption
植酸对矿物质吸收的影响

Whole cereal grains contain phytic acid, which forms insoluble compounds with minerals, particularly calcium, iron and zinc. These compounds are difficult to absorb in the body.完整的谷物包含植酸，形成含矿物质的不溶复合物特别是钙，铁和锌，这些复合物在人体中很难吸收。

Much of the phytic acid is located in the outer layer of the wheat between the endosperm and the bran. For this reason, highly refined white flour contains lower levels of phytic acid compared to high extraction whole wheat flours.大量的植酸位于小麦的外层在麸皮和胚乳之间，就此原因，精加工面粉与高提取的全麦面粉比植酸含量很低



Phytic Acid's Effect on Mineral Absorption
植酸对矿物质吸收的影响

- Yeast and flour provide the enzyme ***phytase*** which works to destroy most of the phytic acid during dough fermentation in the bread making process. Over 70 percent of the phytic acid can be hydrolyzed; the longer the fermentation and the lower the pH, the more phytic acid is removed. 酵母和面粉提供植酸酶在在面包制作过程中面粉发酵时破坏大部分植酸，70%以上的植酸被水解，发酵越长PH值越低更多的植酸被移出。

- Phytic acid therefore is of most concern when high extraction flour is used to make unleavened bread, or in non-fermented flour products like noodles. This, however, is a common use of wheat in many countries of the world.因此植酸 在高出粉面粉当时备受关注，用于制作不膨松面包，或不发酵面粉产品如面条。但是在世界许多国家对小麦来说是普遍使用的。[R]

Phytic Acid's Effect on Mineral Absorption
植酸对矿物质吸收的影响

- If the ratio is less than 6 for "normal populations", iron will be absorbed. This is the case for yeast leavened bread made from white flour.如果对正常人口比率低于6，铁将易于吸收，这对于用白面粉做的发酵粉膨松面包的情况。，
- If greater than 6 for normal populations, iron will not be well absorbed. This may be the case for noodles made from white (low extraction) flour如果对正常的人口高于6，铁匠不能很好的吸收。这可能是白面粉做的面条的情况（低提取）。
- Ideally, you want a ratio less than 1 to insure absorption by any population. This will not be possible for non-fermented flour products like chapattis, noodles and steamed bread.理想地，你想比率低于1来保证任何人吸收，这对于非发酵的面粉产品如薄煎饼，面条和馒头将是不可能的
- You can lower the ratio by:你可通过如下方式使比率降低：
  - Increasing iron (through fortification) but you can only add so much iron增加铁（通过强化）但是你只能加入这些铁。
  - Lowering phytic acid (through milling, fermentation or adding the enzyme *phytase)*.低植酸（通过制粉，发酵或添加植酸酶）

Phytic Acid's Effect on Mineral Absorption
植酸对矿物质吸收的影响

There are two compounds that prevent phytic acid from inhibiting iron absorption:
有两种复合物阻止植酸从抑制铁的吸收

- **ascorbic acid (vitamin C) and维生素C**
- **sodium EDTA乙二胺四乙酸钠**

Unfortunately, ascorbic acid is destroyed in most baking processes. It is also expensive to add. NaEDTA, however, is not destroyed.不幸的是VC在大多数烘培食品中都被破坏了，添加费用也高，乙二胺四乙酸钠不会被破坏。

The Addition of Ascorbic Acid维生素C的添加

The addition of ascorbic acid to enhance iron absorption from fortified food is a widely-used practice in the food industry for processed foods, but not for staples such as wheat flour, due to stability issues. 从强化食品来说维生素C的添加能提高铁的吸收，在 加工食品的食品行业中广泛使用，但是不是用于主食如小麦面粉，由于稳定性问题。

The main difficulties with adding ascorbic acid as a food fortificant are that substantial amounts can be lost during storage and preparation, and compared to other nutrients, it is relatively expensive.在食物强化中添加维C的困难是在储存和准备期间与其他营养素相比有一定的损失，并且相对的贵一些。

To enhance iron absorption, ascorbic acid should be added in a 6:1 weight ratio. A higher ascorbic acid: iron ration of 12:1 can be recommended for foods with high levels of phytic acid. In most studies, the 6:1 ratio increased iron absorption 2 to 3 fold in adults and children.为提高铁的吸收，维C应按6：1的重量比率添加，较高的维C比定量的铁，12：1可推荐到有较高植酸含量的食品中。在大多数研究中，6：1的比率铁吸收在成人和孩子中增加2-3成。 [R]

NOTE: Many millers add ascorbic acid as a bread improving agent. Unfortunately, it must be oxidized in the dough to the dehydroscorbic acid form for it to function in that manner, but that form does not provide iron absorption enhancement activity.注意：许多粉厂加维C作为面包改良剂 ，遗憾的是在面团中它很快就氧化了，成脱水维C形式，但此种形式不提供铁吸收增强活性。

The Addition of Sodium EDTA乙二胺四乙酸钠的添加

Sodium EDTA is stable during processing and storage. It works by chelating iron at the low pH levels of the stomach to prevent it from binding to phythic acid. It enhances the absorption of both food iron and soluble iron fortificants, but not the relatively insoluble iron compounds such as ferrous fumarate, ferric pyrophosphate or elemental (reduced) iron.乙二胺四乙酸钠在加工和储藏期间是稳定的，在胃的低的PH值水平由螯合铁阻止它从粘合物到植酸，它增强了两者食品铁和可溶铁的强化，但不是相对的不可溶铁复合物例如亚铁酯，磷酸亚铁或电解铁。

It is recommended to use a Na_2EDTA: iron weight ratio of 3.3:1 to 6.6:1 when it is added to foods fortified with soluble iron compounds such as ferrous sulfate to increase the absorption 2 to 3 fold.常推荐使用乙二胺四乙酸钠：当与可溶铁复合物这类硫酸亚铁添加到面粉中进行强化，铁重比为3.3:1 到6.6:1，例如：硫酸亚铁提高吸收2到3成。[R]

Issues to Consider
考虑的问题

Technical experts recommend the following types and amounts of iron in premix based on different extraction rates以下是技术专家建议基于不同萃取率在预混合料中铁的类型和数量 [R]:

Low Extraction Flour (ash content < 0.8%): 低萃取面粉：(灰含量< 0.8%):

- Use small particle size dried ferrous sulfate or small particle size ferrous fumarate. 使用小颗粒干燥含铁硫酸盐或小颗粒含铁延胡索酸盐。
- In populations consuming more than 200 g/day of wheat flour, add 30 ppm iron from dried ferrous sulfate or fumarate. 如人们每天消化多于200克的小麦粉，需从干燥含铁硫酸盐或延胡索酸盐中添加30ppm。
- In populations consuming less than 200 g/day of wheat flour, add 45 ppm iron from ferrous sulfate or ferrous fumarate如人们每天消化少于200克的小麦粉，需从干燥含铁硫酸盐或延胡索酸盐中添加45ppm。
- If cost or other factors (such as the requirement to store fortified flour longer than three months) make it impossible to fortify flour with either ferrous sulphate or fumarate at the levels above, flour should be fortified with electrolytic iron or other iron fortificants with a relative biologic value of at least 50% of dried ferrous sulfate. The level of these iron sources added to flour should be 2X that of ferrous sulfate. 假如成本或其它因素（例如要求存储多于三个月的强化面粉）用含铁硫酸盐或延胡索酸盐都不能强化面粉，用电解铁或其它含铁强化成份带相关生产值至少50%的干含铁硫酸盐来强化面粉。加入到面粉中的铁源标准应是含铁硫酸盐的两倍。
- Sodium iron EDTA (NaFeEDTA) at levels up to 30 ppm is recommended for low extraction flours where there is no fermentation process in food preparation (i.e. in the preparation of unleavened breads such as chapatti or noodles).对于没有发酵的低萃取面粉，30 ppm 的钠铁EDTA是可推荐的。（也就是在准备没有发酵的面包时，例如薄煎饼煌面条）

Issues to Consider
考虑的问题

Technical experts recommend the following types and amounts of iron in premix based on different extraction rates 以下是技术专家建议基于不同萃取率在预混合料中铁的类型和数量 [R]:

High Extraction Flour (ash content > 0.8%): 高萃取面粉（灰含量> 0.8%):

- NaFeEDTA is the preferred fortificant. NaFeEDTA是首选的-----
- NaFeEDTA should also be used in populations where the overall diet is of low iron bioavailability. In these environments, the addition of up to 30ppm of iron from NaFeEDTA is recommended as long as there are no adverse effects on the flour's sensory properties. NaFeEDTA 也可用在每天所吃的食物中含铁较低的人群中。在这种环境下，只要对面粉感官上没有不利影响，推荐从NaFeEDTA中添加至多30ppm的铁到面粉中。

Choosing a Micronutrient Premix
选择微量营养素的预混合料

- Premix Components 预混料成份
- Advantages of Using a Commercial Premix 使用商业化预混料的优点
- Determination of the Premix Formula 预混料配方的决定
- Procuring Premix 采购预混料
- Choosing a Reliable Premix Supplier选择可靠的预混料供应商
- Shelf Life of the Bulk Premix 散料预混料的保质期限
- Considerations When Using Other Flour Additives

  当使用其它面粉添加剂时需考虑的事项
- Addition Rates and Overages添加比率和过量
- Recommendations建议

Premix Components预混料成分

The most common flour fortification practice is to add with multiple vitamins and minerals using a single ingredient- called a ***premix*.最常用的强化粉是利用单一的成份—预混料加入成倍的维他命和矿物质。**

Premixes are produced by large commercial manufacturers and can be purchased in specific blends that meet the production needs of the mill and the dietary needs of the country预混合料由大型商业化生产厂家生产，能够满足工厂生产和国民每日膳食需要的具体配比都能买到. R

A premix is made up of two major elements:
预混合料由两项主要元素组成：

- Fortificants (powdered vitamins and minerals)维他命和矿物质颗粒
- Excipients (carriers, fillers and free-flow agents)赋形剂（载体，填充者和自由流动剂）

Premix Components预混料成分

- Small amounts of concentrated vitamins and minerals on their own are hard to add to flour individually because they are excessively light or dense, tend to clump and difficult to feed in the small amounts required. A larger amount of diluted premix is easier to feed and to obtain uniform distribution in the fortified flour.小数量浓缩的维他命和矿物质或轻或浓密，很难加入到面粉中，成块后很难在小量中喂养。大量冲淡的预混合料在强化粉中容易喂养和得到统一的分配。

- An **excipient** is a material, such as starch or maltodextrin, is often blended into the premix by the manufacturer to dilute the concentration of the vitamins and minerals. Excipients may be referred to as “carriers” or “fillers” by premix manufacturers. After an excipient is added, the bulk density of the premix is lowered brining it closer to the bulk density of the flour. This makes for easier feeding and blending赋形剂是种原料，例如淀粉或---经常被生产厂家混合到预混合料中来冲淡浓缩的维他命和矿物质.赋形剂被预混合料生产厂家认作是“载体”或“填充者”。添加后预混料容重变低接近面粉的容重，使易于喂料和混合。

- In addition to excipients, a **free-flow agent**, such as tricalcium phosphate or precipitated silica (silicon dioxide) may be added to keep the premix from clumping and bridging in the hopper.除赋形剂外，一种自由流动剂，例如三钙磷酸盐或硅的沉淀物（硅氧化物）可以加入使预混料在料斗中不成块和结拱。

Advantages of Using a Commercial Premix
使用商业预混料的优点

Generally, it is NOT recommended for millers to order concentrations of vitamins or minerals individually and add them one at a time or blend them at the mill. The one exception is calcium, which is normally added separately due to the large amount required.通常不推荐面粉厂主定购浓缩的维他命或矿物质，或每次添加他们或将他们混合。钙除外，如有大量要求时，通常单独加入。

Few mills are sufficiently equipped to undertake the complex task of blending their own high quality premix, which requires difficult ingredient procurement and extensive quality control testing少数面粉厂主拥有充足的装备来承担他们自己高质量预混合料的混合工作。获取困难成份和广泛的质量控制测试的需要. R

There are also major advantages to using a commercial premix:使用商业化的预混合料有以下主要优势

1. Easier Feeding: 易于喂料：

   Some of the vitamins and minerals are very dense, (reduced iron) while others are very light (riboflavin). The proper use of excipients by commercial premix manufacturers mixes them into a single ingredient that is much easier to feed and will cause fewer problems on the flour mill's production line. (铁减少的）一些维他命和矿物质很浓，其它的很轻（核黄素）。商业化预混合料生产厂家正确使用赋形剂，将二者混合成一个单一的成份其简易的喂给方式，也给面粉厂商生产线减少了很多的麻烦。

Advantages of Using a Commercial Premix
使用商业预混料的优点

2. Easier Quality Control Testing易于的质量控制试验:

   A properly manufactured premix has verified levels of different vitamins and minerals that will allow testing of a single micronutrient to serve as an **indicator** for the amounts of the others. Most often, iron is used as the indicator nutrient (but others could be used as well). If a mill blended their own premix, they would need to prove that their blend met required specifications. Very few mills have the lab facilities or staff needed to carry out such quality control procedures. It is much easier and less expensive for the premix manufacturers to carry out this task. *See Section 4 for more information quality control testing.*正确生产的预混合料可以验证不同级别的维他命和矿物质。允许测试单一的微量营养素做为其它数量的指标。绝大多数情况下铁做为营养指示器（其它的也可使用）。如果面粉厂混合自己的预混合料，他们需要证明他们的混合与需要的规格相符。只有少数面粉厂有实验室设备来完成这样的质量控制程序。这对于预混合料厂商来完成此项工作相对简单和便宜。更多关于质量控制的测试信息请见第四部分。

3. Feed Rate Adjustments/Weighing: 喂料率调整/称重：

   A single premix requires only one feed rate adjustment for continuous flow systems or one weighing for batch systems. This reduces labor requirements and lessens the chance of error. See *Section 3* for more information on feed rates单一的预混合料仅需要为连续流动系统或批量系统的称量计量做单一的喂养值调整.这样即减少了劳动力，也减少了发生错误的机会。关于喂养值的更多信息，请见第三部分 R

Determination of a Correct Premix Formula
决定正确预混料配方

As noted in Section 1, determining the standards (which vitamins and minerals will be added and in what amounts) for fortified flour in a country is a complex process that may require the expertise of health specialists, nutritionists, millers, bakers and food manufacturers, international donors and the national government.如第一部分中所述，一个国家面粉强化标准的决定（添加维他命和矿物质和添加的数量）是个复杂的过程，决定人员由健康专家，营养专家，面粉厂主，面包师和食品厂商，国际捐赠人和当地政府组成。

In most countries, the government has the final say about the fortification standards, which sets the levels of vitamins and minerals that should be present in the flour after it has been fortified. 在大多数国家，政府关于强化标准有着最终发言权，在面粉被强化后，维他命和矿物质在面粉中存在的标准的规定。

However, the *premix's* specific composition is not normally regulated. Usually, it is determined by the experience of the premix manufacturer and the needs of the miller to ensure that the flour produced meets a regulated minimum standard set by the government. 预混合料的具体成份没有明确规定。通常情况下，由富有经验的预混合料厂家和面粉厂家的需要来决定成分，以确保生产出的面粉来满足政府设定的最小标准。

Premix manufacturers have extensive experience calculating premix formulas and can work with each mill to provide the proper premix for that mill.预混合料厂家有广泛的预混合料计算经验，也可与每个面粉厂家工作为其提供适当的预混合料 R

Determination of a Correct Premix Formula
决定正确预混料配方

The following factors are considered by the premix manufacturers when determining a premix formula:预混料厂商在决定预混料配方时，以下这些因素是需要考虑的：

1) **Micronutrient concentration of the different forms of fortificants:强化的不同形式的微量营养素浓缩**

   Some vitamins and minerals are available in multiple forms, and the concentration of vitamins and minerals varies among these different forms. This variation must be accounted for in determining how much of each micronutrient to add. **多种形式的维他命和矿物质在多重形式下可供利用，其浓度也因这些不同形式而改变。在决定每个微量元素添加多少时，这些变化需要考虑进去。**

2) **Premix addition rate and bulk density: 预混料添加率和容重：**

   The bulk density of the premix will affect the addition rate and vice versa. Both of these factors need to be considered together.预混合料的堆积密度会影响添加比，反之亦然。两种因素需同时考虑。

3) **Overages过量:**

   Commercial premixes may have extra amounts of fortificants added in to control for losses in nutrients throughout the fortification process.在强化过程中，商业化的预混合料添加额外的强化值来控制营养的遗失。

Preblends预混合
Preparation of Diluted Premix稀释预混料的准备

- Ideally, the feeder should be set so that it operates between 20 and 80% of full capacity. In some cases mills may find that the flow of flour to be fortified is so slow as to require operation less than 20%, even when using all the adjustments available in screw size and gears available. In that case the mill may want to consider making a dilution of the premix.理想地，喂料器应设定好在总能力20-80%间运行，在一些情况下你可能会发现要强化的面粉流的太慢，要求在20%的状况下运行，甚至在螺旋规格和齿轮有的时候用所有的调节，在那种情况下工厂应考虑预混料的稀释。

- A diluted premix, called a *preblend*, may also be needed if the more premix is not feeding uniformly or properly for some reason.
  稀释的预混料，叫预混合的，也可以如果某些原因多数预混料没均匀或恰当的喂入。

- To make a preblend the premix is mixed in a batch mixer with flour or semolina (granulated flour). An example would be 1 part premix and 4 parts semolina. The resultant preblend would then be used at 5 times the addition rate of the original premix (or 1000 grams/MT if the premix was specified at 200 g/MT). 制作预混的预混料是用面粉或颗粒粉在一批量混合机中混合（颗粒状面粉）例如一份预混料和4份颗粒粉，合成的预混合物将使用5倍原始预混料的添加量（或1000克/公吨，如果预混料规定在200克/公吨）

- Preblends have a limited shelf life of only a couple weeks, so the amount produced or delivered to a mill should not exceed a two week supply.与混合物保质期有限，仅几周，所以所生产的数量或发货到工厂的不能超出两周。

Addition Rates and Overages加入率和过量

The addition rate of the premix is needed to determine the final formulation of the premix. Ideally, the addition rate is set to be in whole units, and typically added at a rate between 50 and 300 grams per metric ton of flour. Rates lower than this may be too difficult to control accurately. 预混料加入量需决定最后预混料的配方，理想地说加入量在整个单元内设定，通常每公吨面粉加入50到300克。如果加入量低于此将很难控制精度。

Small mills may require a more dilute premix that can be added at rates higher than 300 g/MT. In that case the mill may mix the premix with flour to create a *pre-blend* that is more dilute and that can be added at higher addition rates.小厂需要一更稀释的预混料可在每公吨高于300克添加，在那种情况下，粉厂可以混合预混料入面粉进行预混，更稀释，可加入更多的量。 R

Addition Rates and Overages加入率和过量

Some level of added vitamins and minerals may be lost during the milling because of exposure to heat, oxygen and light. Some very light or small particle size materials with large surface area may be physically removed with the dust to include in the premix to meet a minimum standard in the final product.一些添加的维生素和矿物质的量在加工期间可能损失掉，因为暴露于热，氧和光下。有些满足最终产品的最低标准的在预混料中轻或小颗粒物料但表面区域大可能在处理过程中随灰尘去掉了。R

“Manufacturing维生素和矿物质的标准在制粉是损失掉了，因为暴露在热，氧化和光下。有些非常轻或小during pneumatic suction. Larger particles may be removed during sieving. Such milling losses need to be factored in when calculating how much of each nutrient颗粒但大的表面区域在气力输送中可能随灰尘一起被带走，大颗粒在筛选时损失掉，所以应计算多少营养素含Overage” 制造过剩

- Premix manufacturers usually include individual premix fortificants at levels approximately 2% to 5%. 预混料的生产商通常包括单独预混料强化在约2-5%的水平下，比商标上列出的高来保证预混料满足标签上的要求。

“Mill Overage” 粉厂过剩

- Millers usually add extra amounts of the premix or individual nutrients to the flour to ensure that the final fortified flour meets the label claims. This is done to account for variation in the natural level of vitamins and minerals in the flour and it makes up for any processing or storage losses粉商通常添加额外数量的预混料或单独添加营养素到面粉中确保最终强化的面粉满足标签的要求。这是为了解释维生素和矿物质在自然状况里的higher than are listed on the label to ensure that the premix meets the label claims变化。
- As an example, to fortify wheat flour, that naturally contains 12 ppm iron to the U.S. standard of 44 ppm, 35 ppm iron is typically added, (This is the target level minus the natural level plus 10.)作为一个例子，强化小麦粉，天然的包括百万分之12的铁，美国标准为百万分之44，通常加百万分之35（这是目标值减天然值加10）R

Recommendations for Fortification强化的推荐

Based on these and other studies the following recommendations have been made:依据这些和其它的研究作如下推荐：

- For low extraction flour (ash content < 0.8%)从低提取面粉（灰分含量低于0.8%）
  - Add ferrous sulfate if possible如果可能添加硫酸盐亚铁
    - 30 ppm if flour consumption > 200 g/day如果面粉消耗大于每天200克加30 ppm
    - Higher levels if lower consumption如果消耗低，较高标准
  - If ferrous sulfate not possible because of extended shelf-life requirement (over 3 months) use electrolytic (reduced) iron powder at twice the level you would have used with ferrous sulfate.如果硫酸亚铁不可能因为延长其保值期要求（超过三个月）用电解铁粉在两倍的标准，你将和硫酸亚铁一起用。
  - If flour is used in non-fermented baked goods (e.g. noodles) use NaFeEDTA at an iron level half that of ferrous sulfate (e.g. 15 ppm)如果面粉用于非发酵烘培食物（例如面条），用乙二胺乙四酸钠铁在硫酸亚铁一半的铁量
- For high extraction flour (ash content > 0.8%)高提取率面粉（灰含量大于0.8%）
  - Use NaFeEDTA if low or no fermentation (such as making chapattis from atta flour) at 15 to 30 ppm depending on consumption.用乙二胺乙四酸钠铁如果低或没发酵（如从玫瑰油面粉制薄煎饼）在百万分之15到30情况下，取决于消费量。
  - For whole wheat bread do not add iron.对全麦面包不用加铁。
- If there is a question determine the phytic acid to iron molar ratio of the major wheat based foods as consumed. If over 6 use NaFeEDTA.如果有问题决定于作为消费以食品为基础主要小麦的植酸到铁的摩尔比率

Recommendations for Fortification强化的推荐

- Always include Iron, Folic Acid and Zinc in any wheat flour or maize meal fortification program.在小麦面粉或玉米粕强化项目上总是包括铁，叶酸和锌。
- Addition of riboflavin is recommended.核黄素的添加需推荐
- Addition of thiamin in rice consuming countries and niacin in maize consuming countries is recommended在大米消费的国家维生素B1和在玉米消费的国家烟酸的添加需推荐
- Addition of other micronutrients (vitamins and minerals) are optional.其他微量营养素（维生素和矿物质）的添加可选。

How to Procure Premix 如何采购预混料

Normally, a mill will purchase premix from one supplier who will provide all the premix for a set amount of time.正常情况下，在预定的一段时间内，面粉厂从供货商那里购买所有的预混合料。

The Mill Purchasing Department should keep the following information about the supplier on file:面粉厂采购部需对其供货商保存以下信息：

- The name and address of the supplier's company or organization.供货商或机构的名称及地址
- The name and phone number of the principal contact to whom the order should be directed.
- The name or type of the premix to order定购的预混料的名称及类型
- The standard amount of the premix that is ordered已订购的预混料的标准数量
- The price history of the premix预混料的价格记录
- The method and time of delivery **交货期和方法**

Mill staff should meet with the suppliers' agent at least once per year to review premix performance with respect to timeliness of delivery, quality, and price.面粉厂员工至少一年一次与供货商代理见面，回顾预混合料的性能及有关预混合料的交货期，质量和价格等问题。

Sufficient stocks of premixes should always be maintained. Therefore, premixes should be purchased well in advance of their running out. A reordering point in inventory levels should be specified in the mills Quality Assurance plan to trigger the purchase order, but production schedules should also be regularly consulted充足库存的预混合料也要经常保养。因此，购买好的预混合料是很重要的。详细的记录值应列入面粉厂质量保证计划中，这样才能带来购买订单，生产进度表也要定期参考. [R]

How to Procure Premix 如何采购预混料

As countries come closer to creating fortification regulations, it is more likely that premixes may be available from suppliers within their own country. However, in most cases premix will need to be imported. 很多国家建立了强化规定，预混合料有很大可能性从自己国家内的供货商处购买。但大部分的预混合料需要购买进口设备。

Smaller mills may find it more convenient and less costly to obtain premix through a centralized, cooperative purchasing group, either through a local millers association, a private enterprise or a government run operation. It may be possible for these groups to obtain competitive bids from approved suppliers for a specified premix through an internet bidding system being set up by the World Bank and GAIN. 小型的面粉厂会从集中和合作的集团来购买相对方便和便宜的预混合料，或从当地的面粉厂商协会，或私人企业或政府性质的地方购买。

The reliability of premix suppliers remains an issue of concern that many organizations are working to address. Organizations such as the Micronutrient Initiative of Canada (http://www.micronutrient.org) maintain lists of premix manufacturers.许多机构都在从事调查有关预混合料供货商是否可靠的工作中。例如象加拿大微量营养素这样的组织就保存预混合料生产厂家的名单。

How to Procure Premix 如何采购预混料

Some countries, such as South Africa, have gone as far as to create approved lists of premix-suppliers that must be used.一些国家，像南非，已经建立了被核准的必须使用的预混合料供货商的名单。 [R]

(http://www.grainmilling.org.za/ - click Vitamin Suppliers)

Click here for an additional list of known premix suppliers

Please note that no specific supplier is specifically endorsed by this toolkit, and all potential suppliers should be thoroughly investigated prior to purchasing premix. 请注意在这个工具箱背面没有详细的供货商，在购买预混合料之前，要彻底调查所有的潜在供货商。

Premix Receiving Procedures预混料接收程序

In order to ensure that the received premix is correct and of good quality, the mill purchasing or receiving department should be responsible for inspecting premix upon delivery. A premix receiving procedure including the steps listed below should be implemented to ensure thoroughness:为确保购买的预混料是准确和优质的，面粉厂购买或接收部门在发货前要负责检查预混合料。彻底完成预混料接收程序包括以下所列步骤：

1. Check the boxes for any damage and record if there is some. Mild damage to the cardboard box is acceptable, but severe water damage and tears in the inner bag are not. 检查包装箱是否损害，如有记录下来。纸板的轻微损害是可接受的，但严重的水渍和袋子内部的破损是不能接受的。

2. Record date received and who is recording this data.记录接收日期及谁记录的数据。

3. Record type or name of product and number of boxes or total weight and check against what was ordered. 凭订单记录产品的类型或名称，箱子的数量，或总重量。

4. Record the lot numbers.记录批号

5. Check for COA and put in fortification file. This may be on one of the boxes or send separately (fax or email).COA的检查并放入强化档案。这些有可能在一个箱子内或单独发送（通过传真或电子邮件发送）

Record all of this information on a “Premix Receiving Report”
“在预混合料接收报告”中记录所有这些信息 R

Premix Receiving Procedures预混料接收程序

Check the contents of one box of each lot received to see if the appearance is normal. The premix should be free flowing with no lumps, white spots or specs, and no off-odor. Run a (gloved) hand through the premix to check this. This is optional since the operator will do the same thing when he uses it. By then, however, it may be too late to register a complaint if something is wrong.检查收到的每批每箱的物品，外观是否正常。预混合料应是自由流动，无块状，无白斑点，无异味的。需戴上手套检查以上这些问题。操作工在使用时也可以做同样的检查工作。如果发现有些是不对的情况，投诉也是太迟的事情了。

Premix Suppliers Should Provide
预混料供货商须提供的信息

A label firmly affixed to every box.
每个箱子须粘有牢固的标签 R

The label should show:标签须有以下说明：

a) The name of the product产品名称
b) The intended use of the product
c) The manufacturer with contact information生产厂家的联系信息
d) Handling precautions if any操作注意事项
e) The date of manufacturer or “use by” date. (This is sometimes imbedded in the lot number)生产日期或使用日期。（在生产批号下可找到）
f) The lot number生产批号
g) The recommended application rate推荐应用的比率
h) The net weight净重
i) A list of ingredients.成分表

Premix Suppliers Should Provide
预混料供货商须提供的信息

A Certificate of Analyses (CoA) on each lot of premix for all micronutrients in the premix预混料中所有微量营养素的每批预混料的分析证书

The CoA (sometimes referred to as a “Certificate of Quality”) is the official documentation of premix quality. This certificate should be provided for each lot of premix in the shipment. The CoAs for all premix batches received should be kept on file and made available for any inspections that may be required. COA（有时被认做“质量证书”）是预混料质量的官方文件。是为已装船的每批预混料提供的证书。每批收到的所有预混料的COA须存放在文件中，等到需要时可随时查看。

The CoA should indicate:

- Chemical assay of the premix batch for each micronutrient contained (except for vitamin B12 if present, whose level can be verified by audit rather than actual assay). It may indicate the minimum and maximum assay standards for that premix as reference.每批预混料化学化验，每个微量营养素的含量（除了维他命B12，维他命B12的检测由审计部门检测）这个化学试验显示了供参考的预混合料最小值和最大值的化验标准。
- Batch or lot number批号或箱号
- Date of manufacture or expiration date or “use by” date if not imbedded in the lot number如未找到制造日期，产品有效期限，“使用日期”等，这些信息可在批号下找到 R

Premix Suppliers Should Provide
预混料供货商须提供的信息

A Product Information Sheet or Fact Sheet产品情报资料或情况说明书

This document should be kept on file at the mill and made available to all operating and QC personnel.
以上文件须保存在档案中，所有操作及质量控制人员都要了解。

Information provided in this document should include:文档包括以下信息：

- The name of the premix.预混料的名称
- The name and contact information of the manufacturer制造商的名称及联系方式
- The intended use of the premix.预混料的预期使用效果
- The ingredient composition of the premix – usually in descending order预混合料的成分组成-通常按降序排列.
- The food grade status of the ingredients used, (i.e. Food Chemicals Codex (FCC) grade) 使用的成份中食品等级情况分布（食品化学法规等级（FCC）
- The recommended addition rate of the premix to flour and the levels of micronutrients added at that rate.加入到面粉中预混料的被推荐添加率及微量营养素的添加等级率
- The minimum assay standards for the premix, and maximum assay standards if any exist.预混合料的最小值和最大值化验标准
- Storage and handling instructions.贮藏和操作说明
- Allowable storage periods or shelf life of premix 预混合料允许的贮藏期或保质期限

Shelf Life of the Bulk Premix
散装预混料的保质期限

Vitamins in the fortificant premix have a limited shelf life. Over time their biological effectiveness is reduced. Most premixes not containing vitamin A or C will last up to 3 years if stored properly. [R] Minerals are particularly stable and the vitamins shelf life usually determines the shelf life of the premix overall. Premix manufacturers should always provide shelf life information for their specific premixes. Millers should not expect premix manufacturers or distributors to accept return of premix that has exceeded its shelf life period.---预混料中的维他命保质期有限。过期后，他们的生物有效性就会减少。大多数预混料不包含维他命A或C，在保存好的情况下可延长至3年。矿物质明显稳定，维他命的保质期通常决定整个预料的保质期。预混合料生产厂家应经常给他们具体的预混料提供保质期信息。面粉厂主不应期待预混料厂家或中间商来接受已超过保质期的返回的预混料。

Vitamin A is the only fortificant normally added to flour that is very perishable. Premixes containing vitamin A may have a shelf life of as little as 6 months. 维他命A是唯一通常加入到面粉中的强化物质，很容易腐烂。预混合料包含维他命A可能有六个月的保质期。[R]

These shelf-life specifications were taken from information provided from premix manufacturers, but shelf-life may be further reduced if premix is stored incorrectly at the mill. 这些具体的保质期限是由预混合料厂家提供的，如预混合料在面粉厂不能正确贮藏，其保质期就会减少。

Section 3: On the Production Line, includes specific information on the conditions premix should be stored under. 第三部分：在生产线上，包括具体的预混料在何种条件下贮藏的信息。

Mill Storage of Premix面粉厂存储预混料

- Premix boxes should be kept somewhere in the mill that is handy but not exposed to sunlight, not excessively hot (i.e. next to a boiler) and safe from getting wet or hit by lift trucks. The boxes can be piled on top of each other, but it should be so arranged that a FIFO system of use could be easily accomplished. 包装预混料的箱子应保存在方便，避光，不是很热的地方（避开锅炉）避开潮湿或与起重机碰撞。箱子可在顶部堆积放置，使FIFO系统的使用能容易地完成。

- One or two working boxes of premix can be kept near the feeders, as shown in the picture. 一到两个预混料的工作箱子可靠近喂料器，象图中所示。

Handling Premix预混料的处理

- Normally, one box at a time is brought to be adjacent to the feeder for filling. The box and the inner bag is opened. A scoop can be placed inside the opened bag for convenient use. Care should be taken that a paper, a piece of plastic or some other contaminate not be in the bag, as this may get in the feeder causing its malfunction. (ideally, the inner plastic bag should be of a colored material so this would be more noticeable to the operator.) 通常，每次一箱被带到邻近的喂料器进行填充。箱和内袋是打开的。为方便使用，铲子放在打开的袋中。注意袋中不要放入纸和塑料或其它可导致污染的东西，这些东西有可能进入喂料器引起故障。（内部塑料袋最好是彩色的，可使操作者显示而易见）

- When filling the feeder hopper it is recommended that the operator wear a long sleeve shirt, gloves and dusk mask. He may also wear safety goggles, a hair net, safety helmet or other protective devices depending on the policies of the mill. (Since the filling of the hopper may take less than a minute, it is recognized that the operator may not always choose to do this.) 当给喂料器料斗填充时，操作工须空长袖衬衫，戴手套和面罩。还要依据面粉厂的规定戴上安全护目镜，发网，安全帽或其它保护装置（料斗的填充需要将近一分钟的时间，

- Once the hopper has been filled the operator should put the scoop back in the bag or at some other designated location. The inner bag should be twirled close and the cardboard flaps folded over. This “operating” box should be left in a location that is convenient for future use but not exposed conditions that could damage it. 一旦漏斗填充完毕，操作工要将铲子放回袋中或其它指定位置。内部袋旋转关闭，纸板折叠。这个“操作”箱须放在方便下次使用的地方，但不要放在暴露的地方，以免遭到损害。

- Operators may make spills of premix as they are filling the hopper. These spill should be cleaned up immediately afterwards, preferable by putting some flour on them prior to sweeping them up. 料斗填充时预混合料会溢出。填充后，要立即将溢出物清理干净，最好先将面粉倒在溢出物上再将其扫掉。

Considerations When Using Other Flour Additives
使用其他面粉添加剂的注意事项

Some flour mills add small amounts of bleaching agents and improvers to flour, such as enzymes and oxidants. Azodicarbonamide, benzoyl peroxide, potassium bromate and ascorbic acid are commonly added oxidants. [R]

有些面粉加工厂在面粉中加入少量的漂白剂和改良剂，如酶和氧化剂，偶氮二异丁晴，苯酰过氧 化氢，溴酸钾，抗坏血酸维生素是常添加的氧化剂。

Even though it might be tempting to add improvers and fortificants with the same feeder, this is NOT recommended, for the following reasons.

即使用同样的喂料器加入改良剂和强化粉是诱人的，这是不被推荐的，基于如下原因

1. Improver addition rates need to be adjusted frequently to ensure that different flours all meet commercial specifications. 改良剂加入比需要不断调整以确保所有不同的面粉都达到商品规格

   - Combining improvers and fortificants makes changing the addition rate of the improvers more difficult. [R]组合的改良剂和强化粉使调整改良剂的添加量更为困难

2. There are also safety reasons for avoiding combining improvers and fortificants.

   也有安全方面的原因避免使用组合改良剂和强化粉

   - Some fortificants can react with improvers. For example, concentrated forms of potassium bromate and benzoyl peroxide (“flour bleach”) should NEVER be combined with fortificants because there is a danger of combustion.

     某些强化粉能与改良剂发生反应，例如，浓缩的溴化钾和苯酰过氧化氢（面粉漂白剂）因有燃烧的危险任何情况下都不就与强化粉混合。

   - There is some concern that the shelf life of vitamins might be altered if combined with improvers.

     如果与改良剂混合，一些维生素的保存期限将发生改变值得关心

Considerations When Using Other Flour Additives
使用其他面粉添加剂的注意事项

It is helpful to “segregate” boxes of premix and improvers. This could be done with color coding or clear labeling.

设立预混物和改良物的隔离箱是有益的，这可以通过颜色编码或者清晰的标签来实现

The container storing the premix as well as the feeder being used to add a particular premix or improver should be well identified to prevent accidental replacement with any other flour additive or premix.

贮放预混物的容器以及用于添加预混物或改良物的喂料器应该清楚地标识，防止任何其他的面粉添加物或预混料的意外更换。

When multiple feeders are installed in a row, it is referred to as a “feeder bank”. These photos show various sizes of feeder banks. [R]

当多重喂料器安装成一排时，被称为喂料台，这些图片展示了不同规模的喂料台

(Source of photos: Research Products Company)

Section 2B部分

Choosing an Addition Method选择添加方式

- Taking Inventory of Equipment Already in the Mill准备好粉厂所用设备
- Methods Used to Add Premix to the Flour 用于添加预混料到面粉中的方法
- Information on Premix Feeders在预混喂料器上的信息
- Considerations Regarding the Size of the Mill粉厂规模的考虑
- Types of Delivery Mechanisms 交付机械装置的类型
- Ensuring Adequate Mixing确保足够混合
- Equipment Suppliers 设备供货商
- Lessons Learned from Other Millers从其它厂家学到的教训
- Information on Specific Nutrients Added特殊的营养添加信息

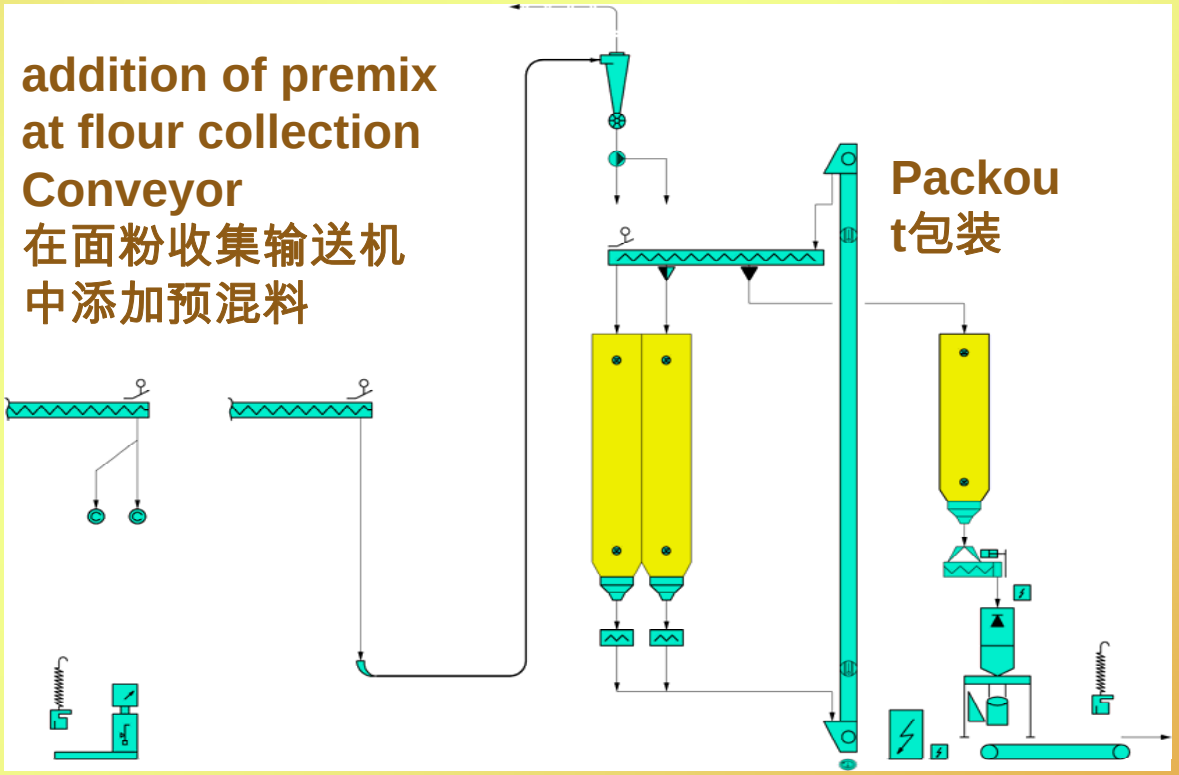
Mill Requirements for Proper Fortification
粉厂对正确强化的要求

1. A **premix feeder** to measure out the correct dose of premix and its placement at a point in the production line where if delivers the premix into the production line to mix with flour

   Sometimes a small shoot or tube is fabricated and installed to carry the premix from the feeder to flour line. This should be at a steep angle to insure it drops down cleanly without stoppage.预混料喂料器测出正确预混料剂量，放置在生产线的一个点上与面粉混合。有时安装制成小射门或管子将预混料从喂料器加入面粉线上。其角度要大确保能全部落入而不滞留。

Mill Requirements for Proper Fortification
粉厂对正确强化的要求

2. Mechanisms to assure that the premix is uniformly mixed into the flour after the point of addition and before packout. This can involve mixing during the normal transport of flour from the conveyor to packout, or insertion of special mixing equipment.此机构确保在添加点后预混料均匀的混入面粉中，



Methods Used to Add Premix to the Flour
用于添加预混料到面粉的方法

Once the premix formula is determined the best method to add the premix to the flour needs to be selected一旦预混料配方确定，最好的添加预混料到面粉中的方法需要选择。

There are two main delivery systems:有两种主要系统

- **batch批量**

- **continuous连续**

There are different requirements for each method.对不同的方式有不同的要求。

Methods Used to Add Premix to the Flour
用于添加预混料到面粉的方法

Batch Systems批量:

The premix is measured out and is put into a batch of flour and blended with a mixing device. Fortifying within a batch system can be slower and more labor intensive than other methods but it can be very accurate when a precise scale is used and can be made automated.测出预混料放入这一批面粉用混合装置混合用批量系统强化比其他方法较慢，更大劳动强度，但当用精确的秤非常精确可是全自动的。

(Source of photos: Buhler Company照片来源：布勒公司)

Batch Systems批量喂料系统

In-line batch mixers在线批量混合机

- Some mills have batch mixers as part of their normal milling process (such as that shown in the picture to the right). This is to blend flours or add vital wheat gluten.一些粉厂有批量混合机作为其粉厂工艺的一部分（例如在右边展示的图片）这是混合面粉或添加谷沅粉。
- A fortification premix can be added to these mixers, either manually or automatically using standard microfeeders.强化预混料可添加到这些混合机中，用标准微量喂料器或手动或自动方式。

Separate mixers分离混合机

- It is possible to use a separate mixer to fortify flour, but it is very inconvenient to do so and only small batches of flour can be processed, so it is not recommended except for very small mills where continuous fortification is not feasible.可以用分离混合机强化面粉，但是这样做不太方便，仅能用于小批量面粉，所以不推荐除小型粉厂进行连续强化不可行。

Methods Used to Add Premix to the Flour
用于添加预混料到面粉的方法

Continuous Systems连续系统:

Most larger and newer mills operate within a continuous system. The premix is continuously metered or fed into the flour flow using a precision micro ***"feeder"*** (also referred to as a **dosifier**). The dosage rate is controlled and depends on the rate of flour production of flour flow. R 大多数大型和新的粉厂采用连续系统。预混料连续的计量或喂入到面粉流采用精确的微量元素喂料器（以后称为添加筛）。添加率依面粉生产中的面粉流量大小来控制

Methods Used to Add Premix to the Flour
用于添加预混料到面粉的方法

The vast majority of flour and maize mills use continuous processing systems incorporating a collection conveyor (shown on right) where premix can be continuously and easily added. This is particularly true for all new mills.大量的面粉和玉米厂用与输送机（见右图）相配的连续加工系统，在这预混料能连续地和方便的添加。这对所有新的粉厂来说尤其重要。

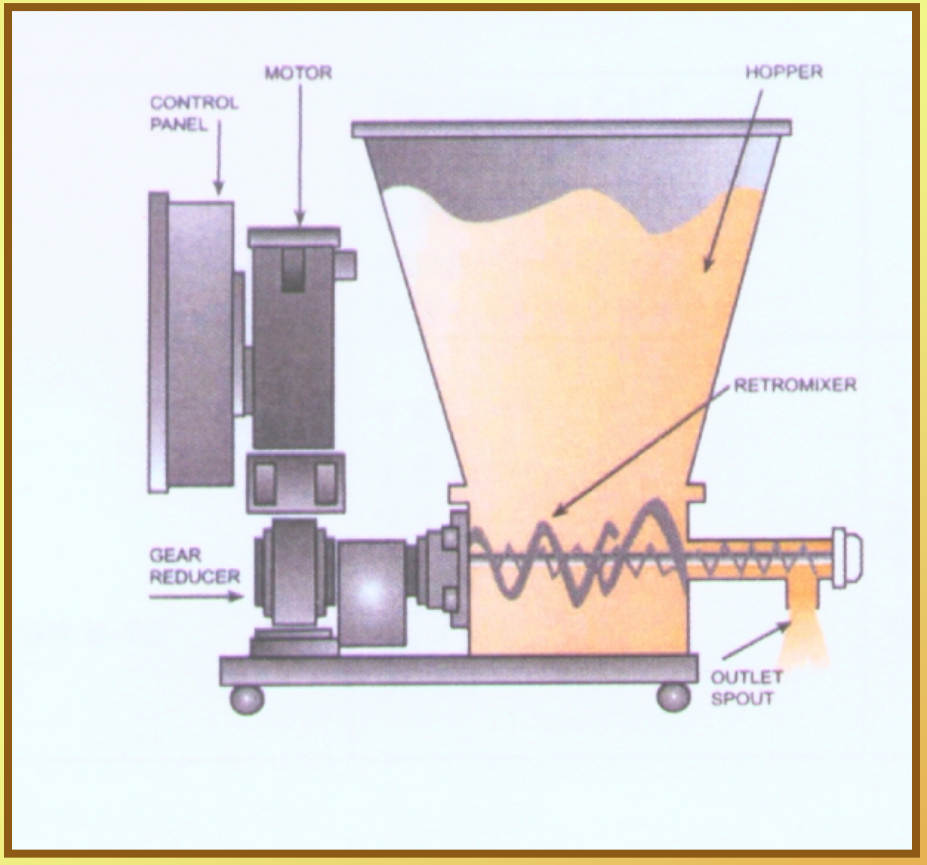
The majority of the information presented here refers to such milling systems. However, additional information about alternative fortification systems is also provided.

Click here for more information about batch systems.
参照这样的粉厂系统大量的信息呈现出来。但是选择性的强化系统的补充信息也能提供。

Feeders喂料器

Information on Premix Feeders

- To prevent premix from bridging in the hopper, a large conditioning screw, flexible pulsating plates on the bottom of the hopper, or a vibration device may be installed in the hopper. 为阻止预混料在料斗内结拱，大的调质螺旋，在料斗底部装灵活的震动板或振动装置可安装于料斗内。
- A low-level detector may be installed on the bottom of the hopper to indicate when the premix is close to running out.低料位检测器可以安装在料斗底部当预混料接近输出时指示。
- The outlet spout of the feeder should be covered but afford easy access to inspection and check weighting.喂料器出口管应有盖，但是装一观察口来检测和检查重量。



Feeders喂料器

- Feeders should be set up with an electrical interlock system that prevents the flow of premix when flour flow is stopped.喂料器应装有电子互锁系统当面粉流停时阻止再喂入预混料流
- The on/off switch, speed controller and low- level indicator light can be located near the feeder or at a remote location. 开/关，速度控制和低料位显示器开可位于喂料器附近或在较远的位置，
- Some installations may need a voltage regulator to ensure proper performance of the feeder and controller. 有些安装有可能需装电压调节器确保喂料器和控制器的性能。R

Electrical Interlock System
电器联动系统

- An interlock causes the feeder to stop if the flour collection conveyor stops. This will prevent the inadvertent over-treatment of the flour, if there is a mechanical breakdown in the mill. 如果收集输送机停，互锁导致喂料器停，这将阻止面粉无意中过度处理，如果有机器出故障。

- It is highly recommended that an electrical interlock system be installed between the feeder motor and the motor driving the flour collection conveyor. 强力推荐一点互锁系统安装在喂料器电机和驱动面粉收集输送机的电机间。

- In pneumatic delivery systems an interlock should be made between the feeder and the blower to insure that the feeder cannot be turned on without the blower operating. This will prevent buildup of the premix in the pneumatic lines followed by over-treatment of flour once the blower is turned on.气力输送系统互锁应在喂料器和风机之间以保证喂料器不能因落此风机没开就开，这将阻止预混料在气动管中堆积，紧接着一旦罗茨风机开面粉被过量处理。

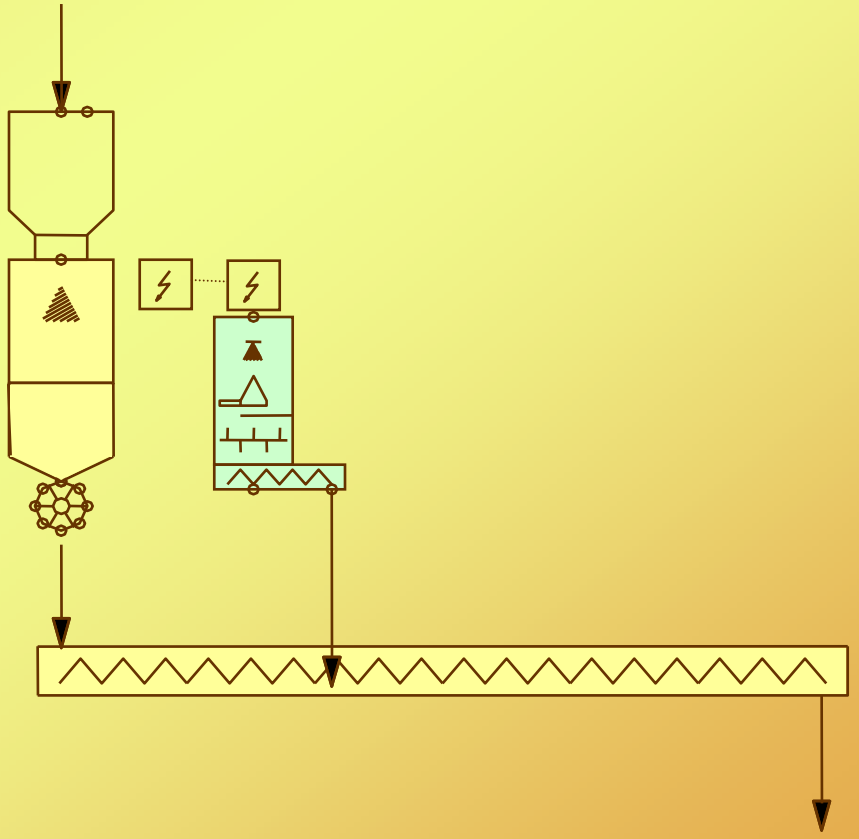
- An alternative approach is to have an automatic shut off switch on the feeder that is hooked up to a flour flow indicator or a pressure indicator in a pneumatic system. 一个可选择的方法是在喂料器上有一自动关闭阀，钩上装面粉指示器或装一压力指示器于气力系统内。R

Electrical Interlock System
电器联动系统

Interlocking (slaving) premix addition to flour flow:

预混料添加到面粉流的联动

- The most accurate method of flour fortification is to continuously interlock the addition rate of the feeder with the measured flow rate of the flour. 大部分面粉强化准确的方法是在测定面粉量后连续联动进行喂料器添加量的控制。
- This requires equipment for measuring the flow rate of the flour and computerized mill control allowing the interlock.这些设备来测出面粉的流量和允许计算机进行粉厂联动控制



Feeders喂料器

Premix Feeder Mechanisms预混料喂料机构

There are three main types of premix feeders available to fortify flour. They differ in terms of the mechanism used to deliver a constant rate of premix powder. There are also differences in cost. See *Section 6* for more information about the cost of feeders. 有三种主要类型用于强化面粉的预混料喂料器，他们的机构不同用于连续输送预混料粉料，成本也不同。有关喂料器的成本见第六部分详细信息。[R]

Type one类型1:
Screw Feeder螺旋喂料

Type two类型2:
Revolving Disk旋转盘

Type three类型3:
Drum / Roller筒/辊式

Mechanical Principles of Feeders
喂料器机械原理

There are three general principles by which feeders control the amount of premix added to flour:通过那种喂料器控制预混料添加到面粉中的量有三个总原则：

1) Volumetric addition *(most commonly used via screw feeders):容积式添加（用螺旋喂料器较普遍使用的）*

Volumetric addition is similar to using a cup or spoon to measure out ingredients. This is based on the principle that the volume of the material being added has a set weight when handled in a uniform manner. The minimum error of measurement for volumetric addition is ± 2%. 容积式添加类似于用一个杯子或勺测量成分。这是依据要添加的原料的容积为原理均匀的原则设定一重量，容积式添加测量的最小误差为± 2%.

2) Gravimetric addition: 重量式添加

Involves measuring the weight of material to be added on a continuous basis. There are weigh belt feeders for use in continuous systems that can give direct weightings of the material being dispensed, but they usually require a greater volume of material than used in most fortification operations. 包括在连续基础上测量原料的重量。有重量皮带喂料器用于连续系统中能提供直接的要分配的原料的重量，但是他们通常要求比用于大多强化操作中较大量的原料。

Loss in Weight Feeders减重喂料器

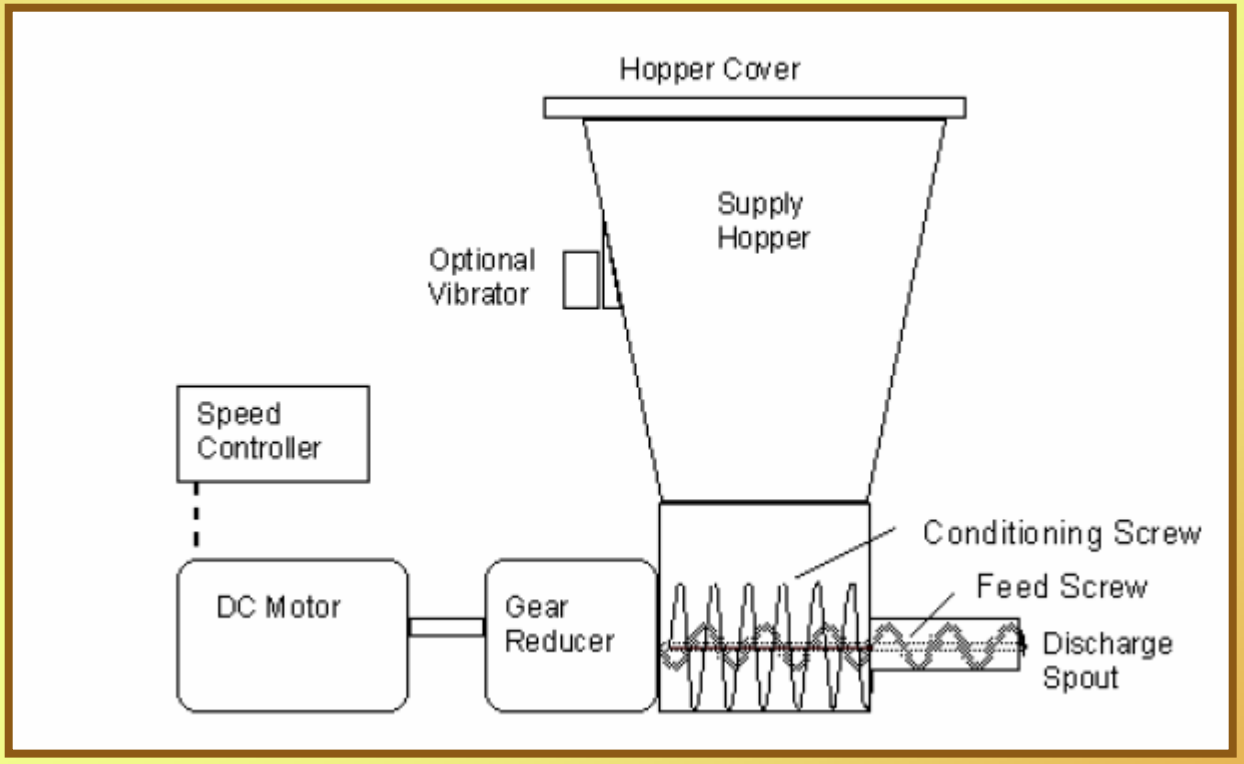
Gravimetric Addition重力式添加

- All three types of feeders can be made into “loss in weight” feeders by mounting them on *load cells* that send out an electronic signal proportional to the total weight. The rate at which this weight drops with time indicates the true addition rate. 所有三种喂料器可作为减中式称量喂料器通过装于其上的传感器发出按比例的电信号到总重。此重量的比率按时间落入显示真实的添加率。

- This system is somewhat more complex and expensive than is required in most cereal milling operations but it allows greater accuracy of addition and continuous traceability on the amount of premix used.此系统较 大多数制粉操作的要求复杂并昂贵，但是在于混合使用中添加的准确度高，连续可跟踪。

Screw Feeders螺旋喂料器

Volumetric screw feeders that dispense a set volume of a premix at a constant rate are the most commonly used machines to fortify flour at the mill. They are powered by a variable speed direct current motor with a controller that is used for fine adjustment of the feed rate of the powder. 容积式喂料器将一预混料，按设定的容积按持续的比率添加是粉厂中最常用的面粉强化设备，他们是粉料通过一带控制器的可变速直流电机来完成，通常用于粉料喂料率的微量调节。R



Screw Feeders螺旋喂料器

Screw feeder *(continued)*

螺旋喂料器（连续式）

The size of the feed screw determines the feed rate capacity. Large capacity feeders may also use a gearbox to increase and adjust the feed rate capacity. 未了螺旋的尺寸决定于喂料产量。大产量喂料器可用齿轮箱增加和调节喂料量。

Screw Feeders螺旋喂料器

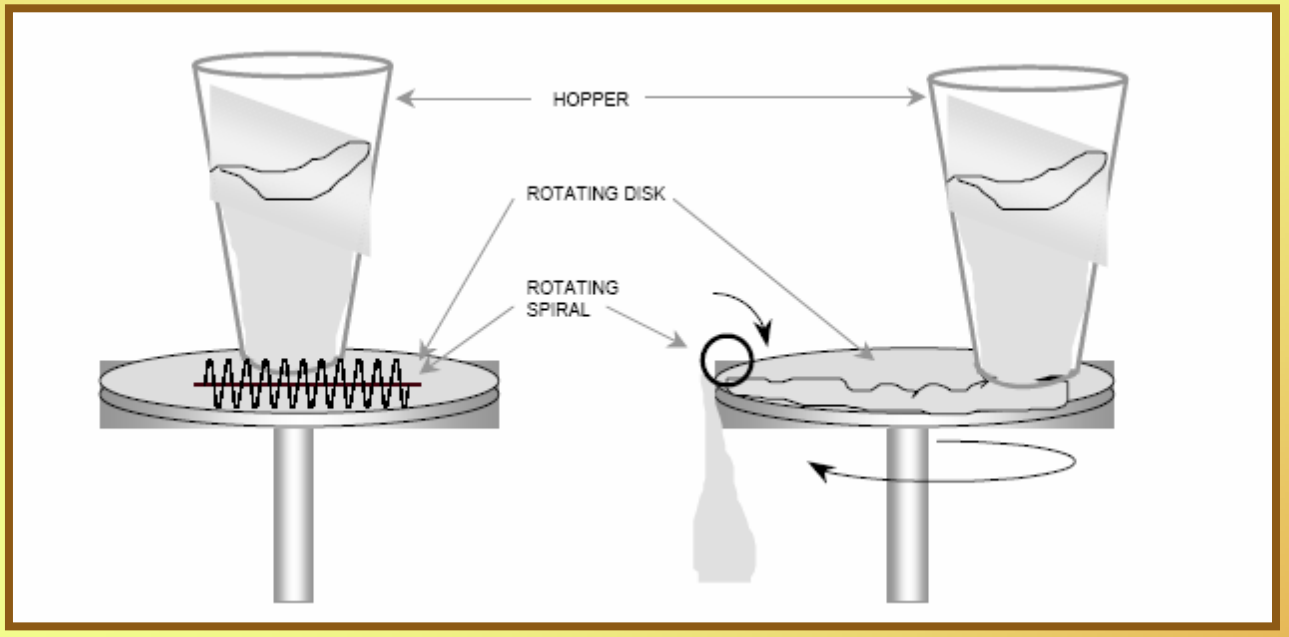
Advantages of screw feeders:螺旋喂料器优点：

- It is better able to sustain a constant addition rate for a longer time 能得到较好长时间连续的添加
- Has a wider range of delivery rates 喂料量范围宽
- Has fewer mechanical parts很少的机械部件
- Breaks down less often so has fewer repairs故障少少维修
- Less expensive to build. 建造费用低
- They can be more sanitary 较卫生
- Easier to maintain than the other types of feeders. 较其他喂料器易维修
- Screw feeders are now the most common type of microfeeders and are produced by a larger number of manufacturers.是最常用的微量喂料器 ，**由大型制造商大量生产**. R

(Source of photo: Buhler Company图片来源布勒公司)

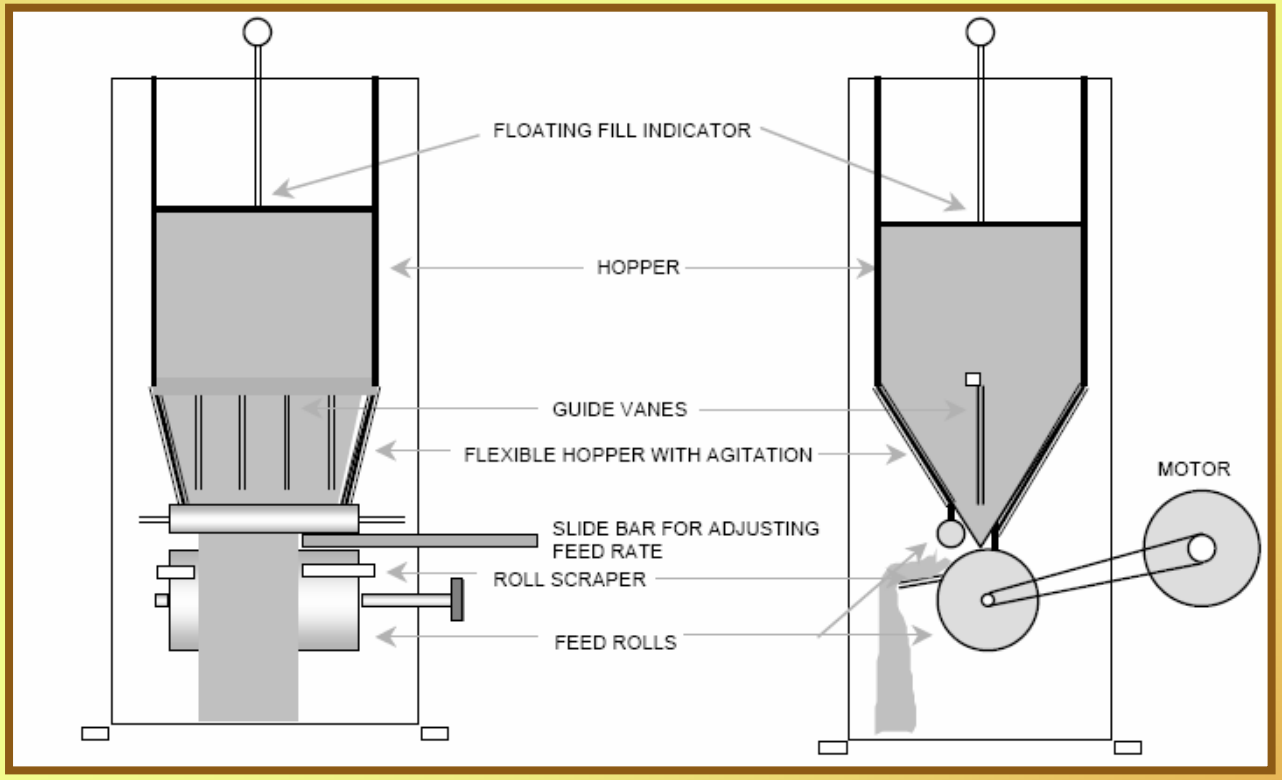
Revolving Disk Feeder
旋转盘喂料器

This is an older type of volumetric feeder that uses a revolving disk equipped with a slide mechanism to control the rate of powder discharge. The disk revolves at a constant speed powered by either an AC or DC motor. The hopper size is usually smaller than in other types of feeders, and must there fore be refilled more frequently. This can be a disadvantage for larger flour mills. This type of feeder also has more mechanical components than the screw feeder. 这是一种老式的容积式喂料器用装有下料机构的旋转盘控制料的卸料量，在连续速度的盘片旋转下通过或AC或DC电机。料斗尺寸比其他形式的喂料器小需频繁的回填，对大型面粉厂可能是缺点，此种喂料器叫螺旋喂料器机械部件多。[R]



Drum or Roll Type Feeders 筒或辊式喂料器

Drum or Roll type feeders have been used for decades and many thousands are still in use. They can be set up as volumetric, gravimetric or loss of weight feeders. They operate by allowing the premix powder to pass between two closely set revolving cylinders. 筒或辊式喂料器已用数十年，输千台还在使用中，可设定为容积式和重力是或减重式喂料器。预混料通过设定的两个盘片筒操作。[R]



Drum or Roll Type Feeders 筒或辊式喂料器

- Either a DC or AC motor can power the drum and a gearbox and a pulley system controls the rotation speed. Pulleys and wheels of differing diameters are used to make gross adjustments in the feed rate. An adjustable gate is used to make fine adjustments. 用一DC或AC电机提供给筒和齿轮箱，皮带系统控制旋转速度。不同直径的皮带和轮子在喂料率上用作粗调，可调节门用作微调。

- Drum of Roll type feeders require more parts to operate and higher maintenance. Shear pins in the drive mechanism break if large objects (bolts, plastic) get stuck between the rolls and the feeder will stop working until a new pin is installed.辊形喂料器筒需更多件来运行，并且维修高，如果大型杂物（螺栓，塑料）夹在辊和喂料器间安全销在驱动机构中易损坏，势必需停止工作知道新的安全销装上才能重新开机。

- In some newer drum feeder models, a variable speed DC drive motor is used to allow the addition rate to be adjusted electronically rather than mechanically. Variable speed AC drive motors are also available. 有些新的筒式喂料器，可变速DC驱动电机用作添加率需电动的调整而不是机械的，可变速AC驱动电机也有。R

Considerations Regarding Sizing Feeders to the Capacity of the Mill
喂料器大小对粉厂规模的考虑

- Mills generally need one feeder per flour or meal line to be fortified. Larger milling units with multiple products may require additional feeders including spares每条制粉线和豆粕线通常需要一台喂料器进行强化。大型粉厂生产多种产品须额外的喂料器包括备件。

- Feeders used for flour fortification need to deliver only relatively small amounts of material. The size and number of feeders will depends on the hourly throughput of flour in the mill or “load-out system.” Hopper size on the feeder is also an important consideration, since you do not want to filling it constantly, nor do you want to let it go for many days without filling.用于面粉强化的喂料器仅需喂入少量的相关量的原料。喂料器的规格和数量取决于粉厂小时产量或发货系统。在喂料器上的料斗规格也非常重要，由于你不想连续的进料，也不想让其存很多天而不进料。

*(Source of photos: Research Products Company*图片来源研究产品公司)

Feeder Sizing喂料量

- Powder premix feeders are available in different sizes. 粉料预混料喂料器有不同的规格
  - A small feeder may discharge premix at levels as low as 25 g per hour (0.4 g/min) 小喂料器可以在每小时低于25克水平下卸预混料。
  - The largest can discharge up to 32 kg per hour. This would only be needed with calcium fortification. 最大的每小时能卸32克。这仅在与钙强化时需要。
- Volumetric feeder and hopper capacity are normally given in Liters/min and Liters. This can be converted to weight units by knowing the bulk density of the premix (in g/cc)容积喂料和料斗产量通常以升/分钟和升提供。这可通过知道预混料（克/立方米）的比重转化为重量单元。

Mill Capacity (MT/day)产量（吨/天）	Flour flow rate* (kg/min)面粉喂料率（公斤/分钟）	Premix** Add rate (g/min)预混料添加率（克/分钟）
5	2.5	0.4
20	10	1.5
50	25	3.8
100	50	7.5
200	100	15
400	200	30

*** At 72% extraction rate在72%的提取率**
**** At 150 g/MT在150克/公吨**

Delivery Mechanisms 送料机构

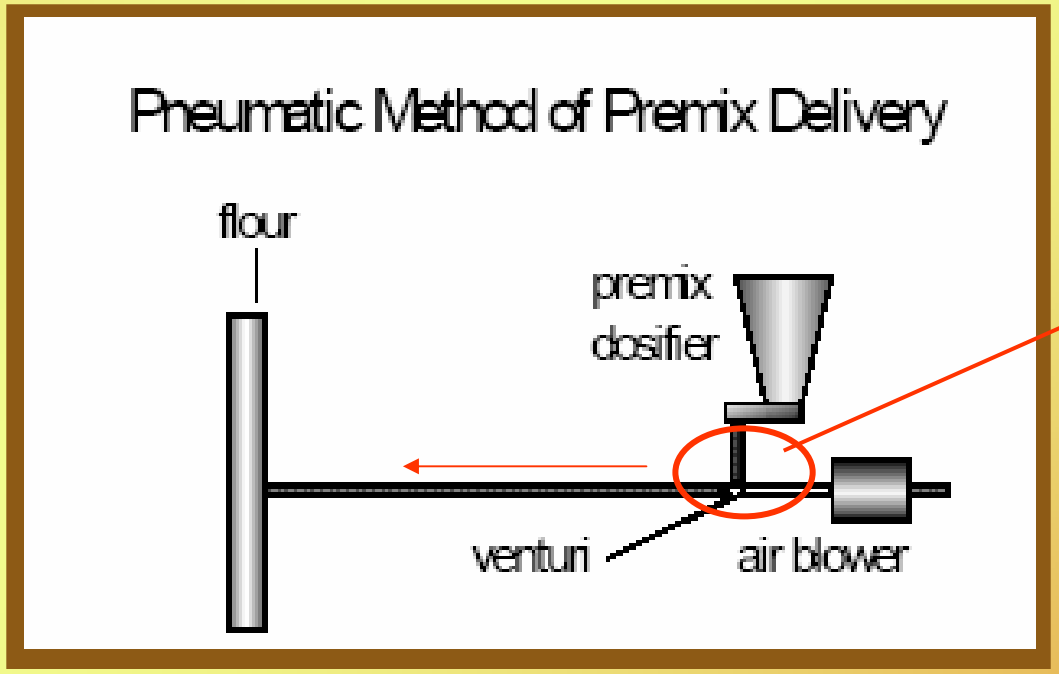
There are two main ways to deliver the premix to the flour: 有两种主要方法送预混料入面粉中

- pneumatic and 气力
- gravity feed重力

Pneumatic System气力系统

In a pneumatic system the premix drops into a venturi tube, that injects the premix into an air stream. The material is blown by positive pressure or sucked by a vacuum through a pipe into the flour collection conveyor. 在气力输送系统中预混料落入文氏管，注预混料入气流中。原料在正压下吹入或真空吸入通过管路到面粉收集输送器中。

If this can not be set up, some downstream location in the flour flow can be used to add premix provided it will be well mixed with the flour. 如果这不能安装，面粉流下游 可用于添加预混料，将很好的与面粉混合。R

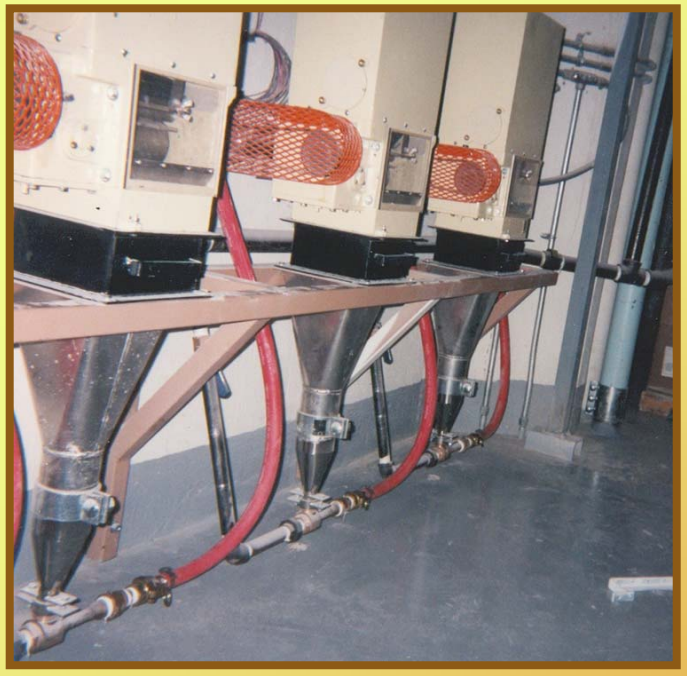


venturi tube文氏管

Pneumatic System气力系统

Advantages of the pneumatic method 气力方式的优点

- The feeder can be located at several places in the mill, allowing it to be added to existing mills. 喂料器可装于几个位置在粉厂中，便于加入现有的厂中。



Things to Consider: 要考虑的事宜

- Pneumatically conveyed flour does not provide much mixing with the premix. Premix should be blown in before flour reaches a mixing (collection) conveyor or sieve rather than directly into a flour holding bin.气力输送的面粉无太大的提供预混料混合，预混料需在入混合输送机前吹入或直接筛入面粉仓。R

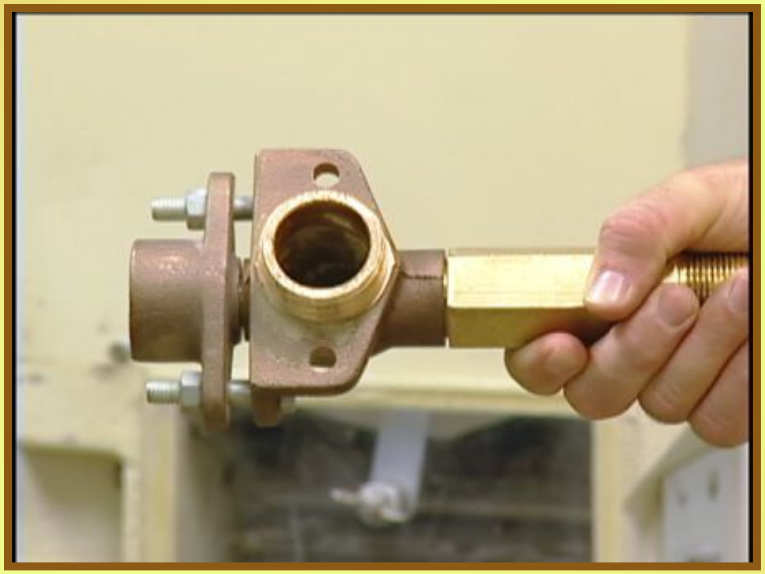
- Pneumatic addition requires some investment on additional equipment such as blowers, valves and piping. 气力添加要有一些投资，添加一些如风机，阀门，管路。

- The pipes used to convey the material should have a minimum number of sharp bends and twists to prevent the possibility of blocking of the pipes and of clumping by the flour fortificant. 用于输送原料的管路应尽可能少的弯路和盘旋以防可能的堵塞和强化粉的堆积。

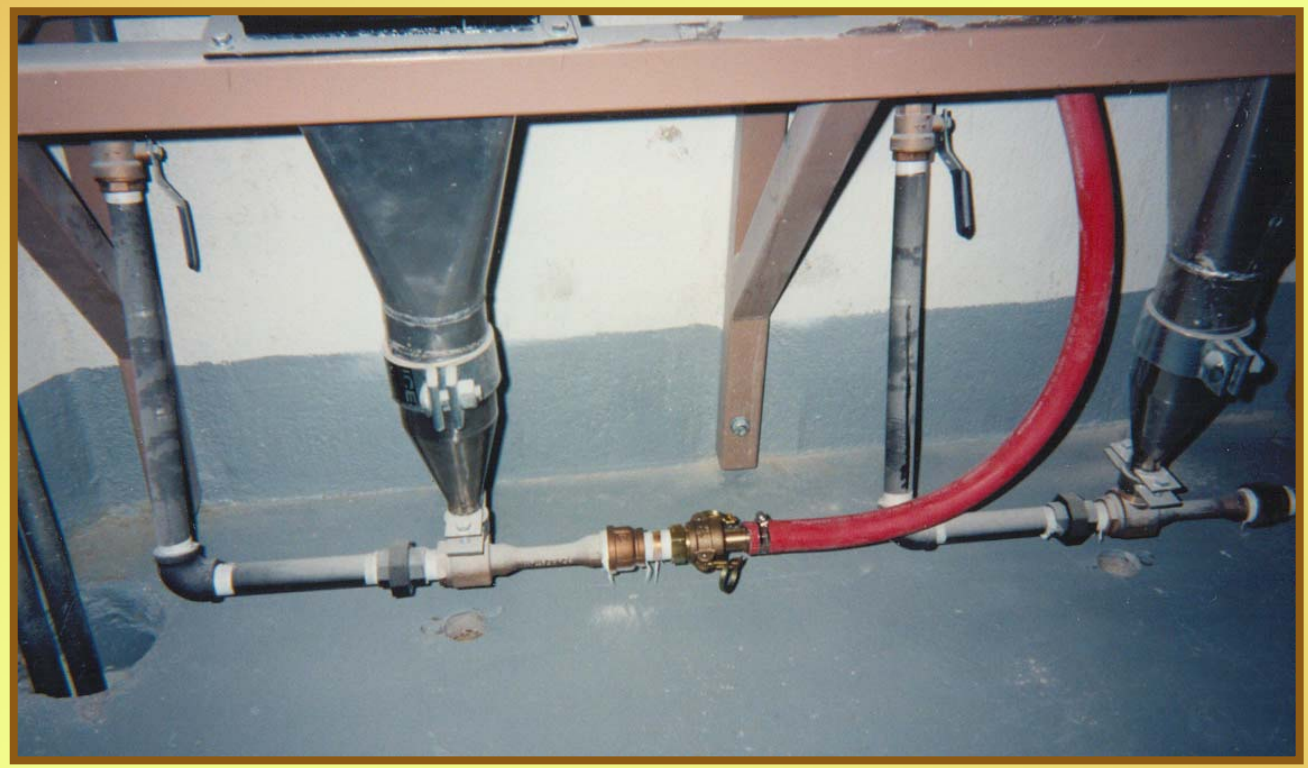
- The venturi tube should be checked occasionally to see if there is any build up of the premix, and cleaned when necessary. 文氏管应 偶尔检查看看是否有预混料堆积，若需要清理干净。

Venturi Tubes文氏管

A venturi tube is a simple piece of equipment that connects the premix feeder and the pneumatic delivery pipes. Venturi tubes are used to deliver the premix into the flour stream in an entirely closed pneumatic system. 文氏管是一种简单的设备连接预混料喂料器和气力输送管。用于输送预混料入整个封闭的气力系统面粉流中。



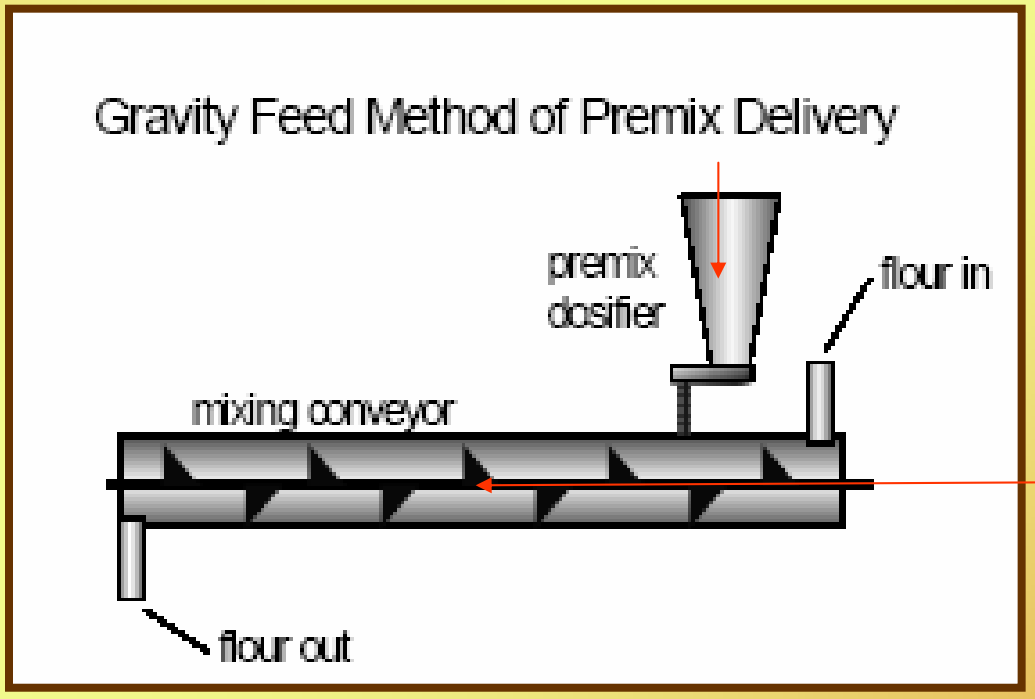
Venturi tube arrangement at discharge from feeder
文氏管安置于从喂料器出来的卸料处



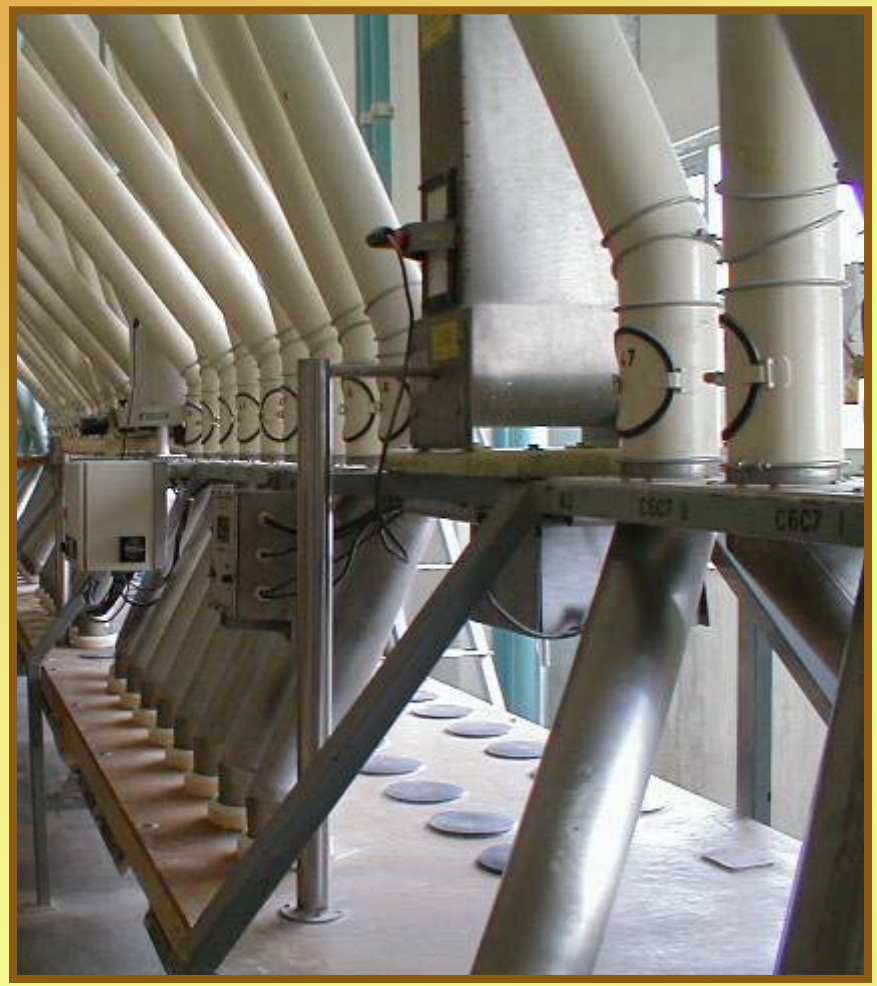
Gravity Feed System重力式喂料系统

With this system, the feeder is placed above a flour conveyor. The premix is dropped directly into the flour as it flows through the conveyor. Most often the feeders is placed above or near the flour collection conveyor that blends the various flour streams. **R**

采用此系统，喂料器放置在一面粉输送机上。预混料直接落入通过输送机混入面粉中，大多数情况喂料器被放置在收集螺旋的上方或附近混合各种面粉。



Gravity Feed System重力式喂料系统



Advantages of the Gravity Feed System重力式喂料系统优点:

- Requires less equipment than pneumatic conveying比气力输送要求设备少.
- The feeder can sit directly on top of a flour collection conveyor, on a platform. 喂料器可直接坐在面粉收集输送机的上部或在平台上
- It can be installed on floor directly above the collection conveyor with the discharge spout feeding into a mostly vertically tube dropping down onto the conveyor.可直接安装在收集面粉输送机的楼层上，通过卸料溜管垂直的落入输送机。

Gravity Feed System重力式喂料系统

Considerations when using Gravity Feed Systems当使用重力喂料系统要考虑的:

- New mills are can be designed or adapted to allow easy installation of gravity feeder locations. Older mills may be configured in ways that makes installation of this type of system difficult.新厂应设计和适用于易于重力喂料器位置的安装，老厂可以成形使这种类型的系统安装困难。
- Installation locations: 安装位置
  - *Above collection conveyor: This may require building a platform or purchasing additional equipment. 可在收集螺旋上方：这种方式需建筑平台或采购额外的设备。*

Examples of Gravity Field Setup

Mixing screw flour conveyor
混合螺旋面粉输送机

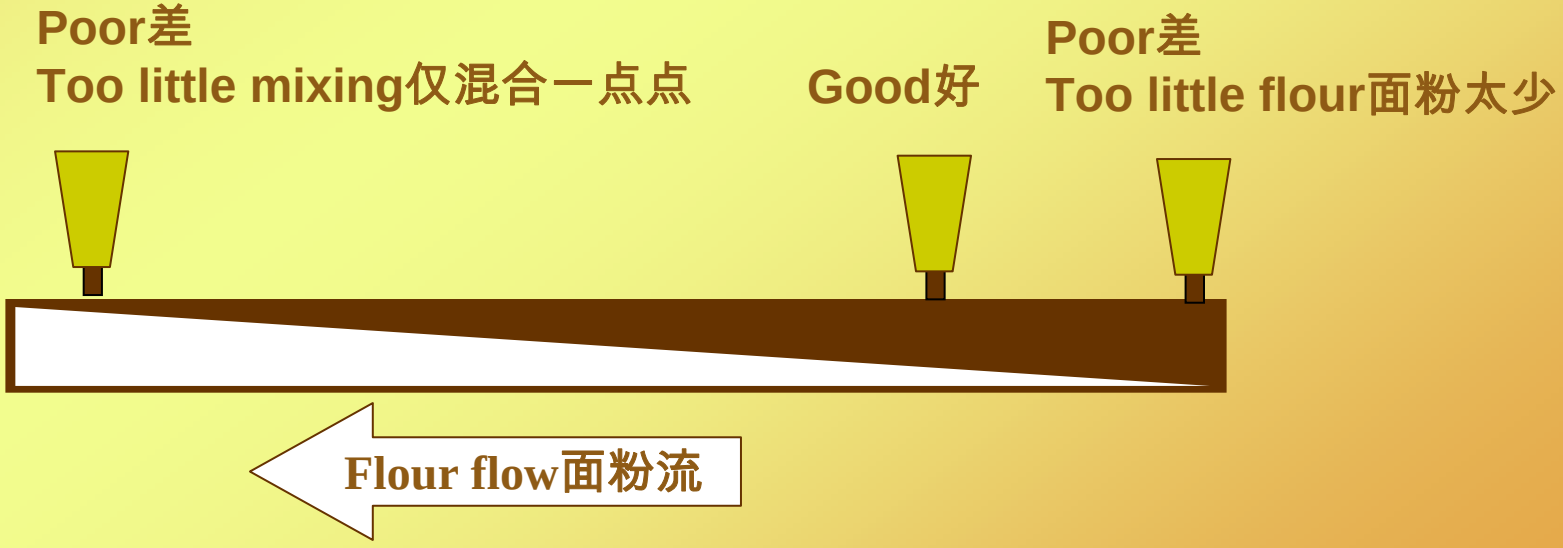
Flour collection conveyors for three different lines of flour.
面粉收集输送机用于三条不同的面粉线

Section 2C部分

Ensuring Adequate Mixing确保充分的混合

Location of feeder on flour collection conveyor喂料器在面粉收集输送机的位置

- At the front half of collection conveyor above the blades of the mixing screw, 在混合螺旋刀片上方收集输送机一半的前部
- At least 3 meters of conveyor length is normally needed to ensure adequate blending. 至少输送机长度上三米的位置以确保充分的混合R



Ensuring Adequate Mixing确保充分的混合

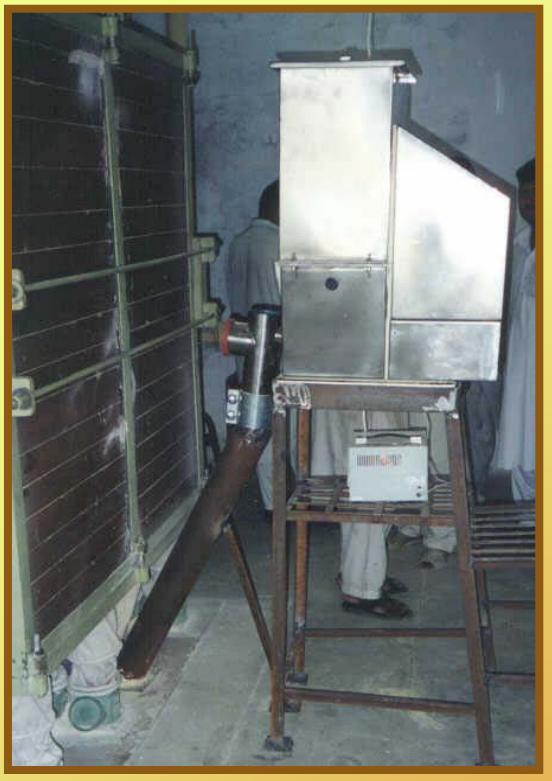
Another option for feeder location另一种喂料器位置的选择

Where it would be difficult to install the feeder at the beginning of a conveyor:在输送机头部安转喂料器是很难的。

Feeder can be connected to the flour discharge spout of a plansifter:喂料器可连接在高方筛下面粉卸料管处。

- The sifter flour spout must have a significant amount of flour entering into the flour collection conveyor on the floor below. 高方筛面粉溜管必须有大量的面粉流入位于楼板下的收集输送机内。

- The sifter flour spout must enter the flour stream at least three meters from the discharge end of the collection conveyor to ensure adequate blending.高方筛面粉溜管需从至少输送机卸料末端长度上三米的位置进入面粉流以确保充分的混合[R]



Ensuring Adequate Mixing确保充分的混合

The three meter distance can be shortened in mills where the flour is:在粉厂三米的距离也可短些，面粉是

- pneumatically blown from the collection conveyor to either a packing bin or flour storage bin, 气力地从收集输送机吹入包装仓或面粉储藏仓。

- the flour collection conveyor discharges into another conveyor and the total length of the mixing distance after the premix is added is at least three meters. 面粉收集输送机卸料入另一个输送机，预混料加入后混合距离的总长度至少三米。R

Ensuring Adequate Mixing确保充分的混合

In the case of erratic flour flow万一面粉流量不稳定

Install mixing conveyor:安装混合输送机

- One solution for small, older mills without a point of a known, constant flow of flour is to install a mixing conveyor running from a flour holding bin to the packout bin. The feeder would drop or blow the premix into the start of the special conveyor. 对小型和老的粉厂没有接口能知道流量，只能从面粉仓到包装仓安装一混合输送机保证连续面粉流量。喂料器将喂入或吹预混料如特殊的输送机开始端。R

Slave feeder output to flour flow喂料器输出到面粉流:

- If the flow of flour is erratic through a conveyor but its flow rate is measurable by some devise that gives a proportional milliamp signal, that signal can be used to control the output of the feeder.如果通过输送机的面粉流量不稳定，但是喂料量可通过一些装置测出，给出一定比例的信号，此信号可用作控制喂料器的产量。

Equipment Suppliers设备供应商

- There are many companies that sell fortification equipment. The link below provides a list of equipment suppliers.有许多公司销售强化设备，如下链接提供设备供货商名单

- **Please note注意:** this list is not comprehensive and no endorsement or recommendation is implied for listed companies. All suppliers should be well investigated prior to purchase.此清单不是全部的无备书或推荐暗示使用单中公司的作用。所有公司设备需在调查了解后优先采购。

- Mills should ensure that directions for installing and maintaining equipment are available in the national language, or make arrangements to have them translated. 工厂应确保安装和维修设备指南为本国语言，或安排翻译为本国语言。

Equipment Suppliers设备供应商

Example of a Feeder Tender喂料器投标的例子

- **Feeder specifications:喂料器规格**

  - Screw type feed mechanism.螺旋型喂料机构
  - Automatic shut off capability.自动切断性能
  - All surfaces in contact with the premix of sanitary of stainless steel or non-corrosive material.与预混料接触的面需用卫生的不锈钢或非腐蚀材料。
  - A manually adjustable delivery control, calibrated from 0 to 100% of feeder capacity that can be mounted separate from feeder.一可手动调节输料控制，从0-100%设定喂料器产量，可以喂料器分开安装。
  - 220 volt ± 10% 50/60 Hz single phase power.单级电源
  - Agitation mechanism to prevent bridging or tunneling of premix in hopper.搅拌机构阻止预混料在料斗中结拱。
  - Capable of delivering from 0.04 to 8 L/hr with ± 5% accuracy over full range through the use of different size screws, gears or belts supplied with feeder. 可从0.04 到8升/小时正负5%的误差，通过用与喂料器相连的不同的喂料螺旋，齿轮或皮带输送
  - Hopper capacity of 8 liter minimum.最小8升料斗产量
  - A device to allow operator to easily check if hopper is empty or near empty.如果料斗空了或接近空了需有装置让操作人员便于检查。

Equipment Suppliers设备供应商

Example of a Feeder Tender喂料器投标的例子

- Vendor must provide two references of maize or flour mills where this feeder has been in operation for at least one year. 卖主需提供两种参考，玉米或面粉，喂料器需运行至少一年。
- Vendor must agree to provide:卖主需同意提供：
  - Spare parts of gears, belts, screws, fuses or other parts that the manufacturer is aware of possible replacement in the first 3 years of operation.齿轮，皮带，螺旋，燃料或其它备件，制造商知道的在三年内需更换的。
  - A technician to help install X number of feeders in X number of mills and to conduct workshops for miller groups on the installation, calibration and maintenance of the feeder. 技术员帮在数个粉厂安装数个喂料器，在安装设定和维修上指导车间人员。，
  - Operating instruction book that explains in English and with diagrams the installation, calibration and maintenance of the feeder.操作手册由英文解释，有安装流程图，设定和维修信息。
  - A price list of spare parts.备件价格单

Lessons Learned from Other Millers When Ordering Mill Fortification Equipment
当采购强化设备是从其它厂家学到的经验

- Motors with incorrect voltage or numbers of phases supplied (110v vs. 220v; single vs. 3-phase, etc)电机电压或电极数量提供不正确（110v，vs，220v，单级和三级等）
- Required or expected components were optional and not ordered or substantially increased the cost of equipment. 要求的或预期的成分是备选不是订好的或大量的增加设备成本。
- No spare parts ordered and no mechanism for quickly obtaining spare parts (brass gears, belts, etc).没备件预定和无机构快速获得备件（铜齿轮，皮带等）
- Feeder designed for use with a specific premix, which did not work well with other premixes due to different flow and packing properties.喂料器设计用于特定的预混料，与其它预混料使用状况不佳因不同的流动和包装特性。
- Feeder placement may need to be located some distance from the flour line so that a tube/shoot needed to be fabricated to carry the premix to the conveyor (via gravity).喂料器放置需离面粉线一定的距离，以便管子/射口需制作输预混料到输送机（通过重力）
- When donor ordered equipment there is seldom detailed expertise. Milling specialists MUST liaise closely and carefully review order details.当捐赠人购买的设备，很少有专家的意见，制粉专家MUST担当联络官来审核订单细节。
- Equipment manuals may come in a different language than that of mill specialists (correct language version of manual must be specified). 设备手册可是不同的语言，正确的语言版本手册需特订。

Nutrient Specific Information营养素详细的信息

- **Iron铁**
- **Zinc锌**
- **Folic Acid叶酸**
- **B vitamins/VB**
- **Vitamin A/VA**
- **Calcium钙**

Each of the vitamins and minerals that can be added to flour has it's own issues surrounding which forms of the vitamin can be added, how much to add, etc… 每种维生素和矿物质都能添加到面粉中都有其本身的一些问题围绕其中哪种形式添加，加多少等。

For more information on the specific nutrients and their fortificant forms, choose from the list to the left. 要获取营养素强化形式可从左边单子中选择。

For information on health concerns regarding the over-consumption of any of these nutrients, please see Section 4: Assuring Quality Control. 要获取有关健康的信息任何营养素过量消费请见第四部分，精确的质量控制。

For information on what these nutrients do for the body, please see Section 1: Introduction to Flour Fortification.要获取这些营养素在体内的情况请见第一部分，面粉强化的介绍。

Iron铁

“The bioavailability of iron from fortificants is dependent on both their solubility, and on the binding of the iron with inhibitors of iron absorption in the diet, such as phytates and phenolic compounds (found in tea, coffee and other foods). Approaches to reduce the effect of the inhibitors can be particularly effective for increasing the total amount of iron absorbed from iron fortified foods. These include the addition of ascorbic acid, sodium EDTA and the removal of phytates.” [R] Unfortunately, these methods do not work well in wheat based foods.从强化的铁的生物药效率取决于两者他们的可溶性，和在食物中铁吸收的带抑制剂的铁粘合剂上，例如肌醇六磷酸，石碳酸复合物（在茶，咖啡和其他食物中能找到），降低抑制剂的效力能有效地增加铁强化食品吸收铁的数量。这些包括抗血酸维生素C，硫酸盐乙二胺四乙酸和肌醇六磷酸的分离，但是这些方法在以小麦做食品中情况并不好。

The goal of fortification should be to use the iron compound that has the greatest relative bioavailability compared to ferrous sulfate, yet does not cause unacceptable properties in the flour. Cost is also an important consideration. 强化的目的应用铁的复合物与生物药效有极大相关性的与亚铁硫酸盐比较，在面粉中不会带来不能接受的特性，费用也是要考虑的重要因素。[R]

Types of iron compounds used in cereal fortification
几种铁的混合物用于谷物强化

- Elemental iron powders (Reduced (Fe^0) Iron) 铁粉
  - Electrolytic iron电解铁
  - Hydrogen reduced iron氢化铁
  - Atomized iron分解铁

    (all water insoluble都为不溶水型)
- Ferrous (Fe^{2+}) Sulfate (moderately water soluble)亚铁硫酸盐（适量溶于水）
- Ferric (Fe^{3+}) Phosphates (water insoluble)亚铁磷酸盐（不溶水）
- Sodium Ferric (Fe^{3+}) EDTA (water soluble)亚铁硫酸盐乙二胺四乙酸（水溶性）
- Ferrous (Fe^{2+}) Fumarate (nearly water insoluble)亚铁酯（接近不溶于水）

Insoluble Iron Compounds that are Soluble in Stomach Acids不可溶铁复合物在胃酸中可溶

These compounds (**Ferrous Fumarate**) are reasonably well absorbed because they are soluble in the stomach of healthy adults and adolescents. There is some concern regarding absorption levels in infants who may secrete less acid, but absorption is expected to be similar to water soluble compounds in most people.这些复合物（亚铁酯）易于吸收因为它们在健康成年人和青少年胃里是可溶的，在婴儿中有些吸收的问题收关注但是在大多数人中吸收水可溶混合物是类似的。

Water insoluble compounds cause fewer sensory problems in foods and should be the fortificant of choice if the water soluble forms cause unacceptable changes. Ferrous fumarate is the most commonly used iron compound in this group.在食品中，水不溶复合物为引起些微感官问题，如水可溶型式引起不可接受的变化应有选择的进行强化，[R]

Water Soluble Compounds水可溶复合物

Ferrous sulfate is the most frequently used water soluble iron fortificant because it is inexpensive. The water soluble iron compounds have the highest relative bioavailability because they are very soluble in the gastric juices. They should be the iron fortificant of choice whenever possible.硫酸亚铁是经常使用的水溶性铁强化物又不贵。水溶性铁复合物有较高的相对的生物药效因为它们在胃液内非常易溶。当可能时是铁强化可选物。

However, these compounds are most likely to have adverse effects on the color and flavor of foods during prolonged storage accelerating rancidity. The free iron can also oxidize some vitamins in the food if they are supplied in the same premix. 但是，这些复合物很可能由于延长的储存期加速变质在食品的颜色和口感上有反作用。

The water soluble forms of iron can be useful for fortifying cereal flours that have a relatively fast turnover. But, because ferrous sulfate can cause rancidity dependent on the climate and the fat content of the flour, its suitability as a fortificant should be considered before use. 铁的水溶形式对强化谷物面粉将是有用的，有相对快速的流通量，但是因为硫酸亚铁因天气和面粉的脂肪含量会导致腐烂，作为强化的适用性在使用前需考虑。[R]

Sodium Iron EDTA铁化钠乙二胺四乙酸

Iron is two to three times better absorbed from FeNaEDTA than from ferrous sulfate or ferrous fumarate in foods high in phytic acid. FeNaEDTA does not accelerate rancidity in stored cereals. However, it is more expensive and may cause color changes in some foods as it is not very soluble in water.

在食品里植酸钙镁高从铁化钠乙二胺四乙酸从亚铁硫酸盐或亚铁酯铁一般是两到三次有较好的吸收，铁化钠乙二胺四乙酸不会加速谷物储存期的变质，但是昂贵，会对食品产生颜色的变化因在水中不太溶解。[R]

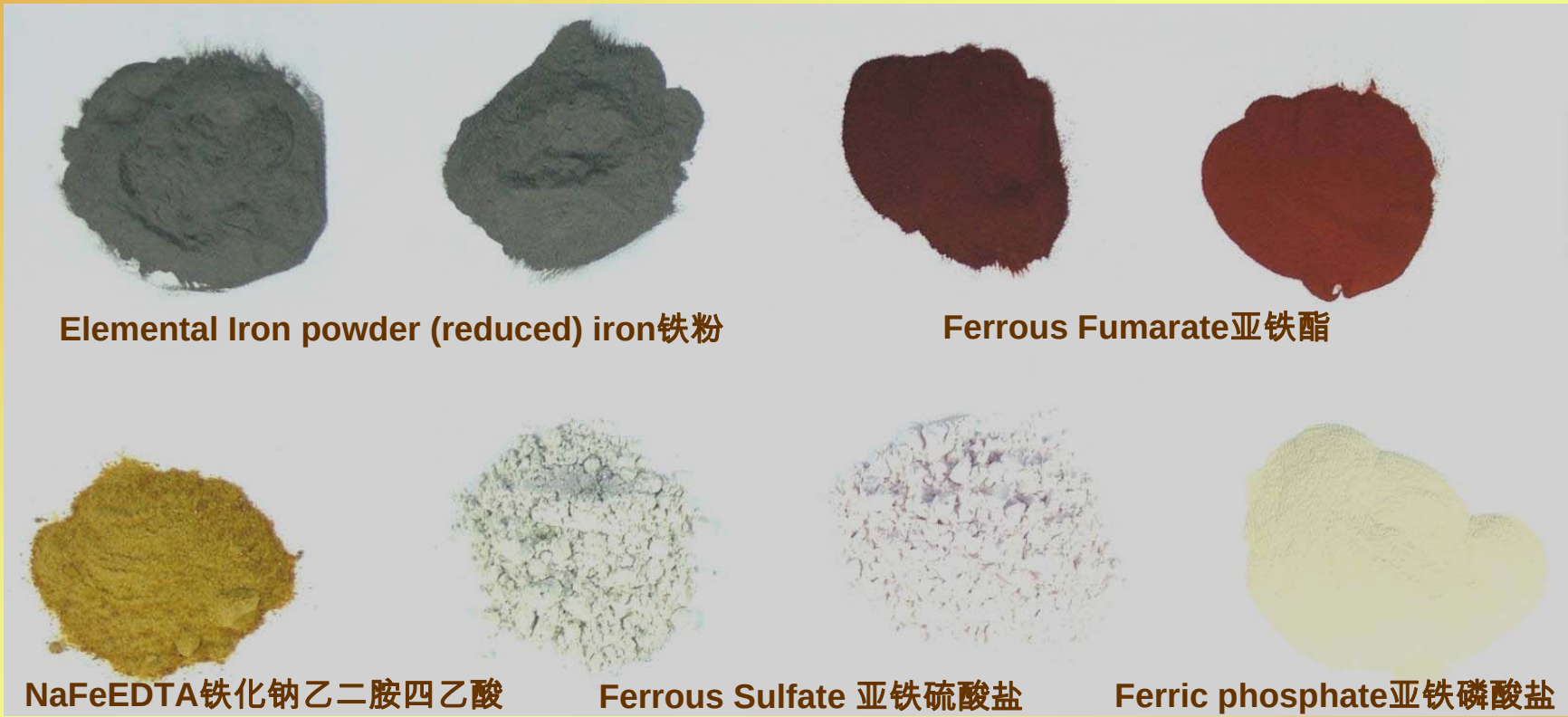
Insoluble Iron Compounds that are Insoluble in Stomach Acids 不可溶铁复合物在胃酸中不可溶。

These compounds (Elemental or reduced iron powders) have a relative bioavailability of approximately 20 to 75 percent of ferrous sulfate iron. However, they have been widely used in the food industry because they have a lesser affect on the sensory properties of the foods. These compounds are relatively inexpensive, but should be used as a last resort in areas where the diets are high in iron absorption inhibitors. If used, they should be added at a level twice that of ferrous sulfate. 这些复合物（铁元素或铁化粉）有约20-75%硫酸亚铁的相对的生物药效，但是它们在食品工业中被广泛的使用，因为它们在食品的感官特性上影响较小，这些复合物便宜，但在有些区域食物中铁吸收较高的将作为最后选用品，如果用的话，他们应加入硫酸亚铁两倍的水平。[R]

Elemental iron powders are used widely to fortify cereals, but the bioavailability of the several different types is very dependent on the size, shape and surface area of the iron particles, as well as the composition of the foods to which they are added.元素铁粉广泛的用于谷物强化，但是几种不同形式的生物药效取决于铁颗粒的大小，形状和表面区域，甚至于它要添加食品的成分。

Only electrolytic iron has been proven to be sufficiently bioavailable for humans, but recent data indicate that carbonyl iron and some H-reduced iron may have a comparable bioavailability to electrolytic iron.仅仅电解铁被证实对人类有充足的生物药效但是近期的数字显示碳酸铁和一些氢氧化铁与电解铁可能有可比的生物药效。[R]

Types of iron compounds 几种铁的混合物用于谷物强化 used in cereal fortification



Elemental Iron powder (reduced) iron铁粉

Ferrous Fumarate亚铁酯

NaFeEDTA铁化钠乙二胺四乙酸

Ferrous Sulfate 亚铁硫酸盐

Ferric phosphate亚铁磷酸盐

Comparison Chart of Iron Compounds铁混合物图表比较

Table 2.2: Potential use of different iron forms in the fortification of wheat flour[6]

Product	Extraction rate (%)	Ferrous sulfate	Ferrous fumarate	Ferric ortho-phosphate	Reduced iron	Electro-lytic iron	Iron EDTA
All-purpose flour	75	O	O	O	O	R	O
Bread flour	75	R	O	O	O	O	O
Whole wheat flour (atta)	97	N	N	O	O	O	R
Pastry flour	45	O	O	O	O	R	O
Cake flour	50-55	O	O	O	O	R	O
Semolina	60-65	R	O	O	O	O	O

R = Recommended; O = Optional; N = Not Recommended

Zinc锌

Zinc Compounds Used 锌混合物的利用

- **Zinc oxide** is the most commonly used zinc source for the fortification of cereals. It is also the least expensive and the source that causes the least problems with flavor and other organoleptic properties. [R]
  锌氧化物是最普遍谷物强化的锌的来源。它也是最不贵，在风味和其它有机特性上问题最少的资源。

Zinc Level 锌标准的添加

- The level of zinc added is normally about half that of iron. This is the same ratio of zinc to iron naturally found in wheat and flour and is considered best for optimum absorption.锌添加的标准通常是铁的一半，这是和小麦，面粉中自然含有的锌铁比率一样的。面粉被认为是最适宜吸收的。

Zinc Bioavailability 锌的生物药效

- Zinc absorption depends primarily on the amount of zinc consumed and the amount of phytic acid present in the food. According to the International Zinc Nutrition Consultative Groups (IZiNCG), when consuming just enough zinc to meet physiological needs, about 27 to 35 percent is absorbed from diets with a relatively low amount of phytic acid, while 19 to 26 percent is absorbed from diets with relatively higher amounts. [R]
  锌的吸收取决于最初其消费的数量和在食品中植酸的数量。根据国际锌营养素咨询集团（ IZiNCG ），当有足够的锌消费来满足生理需要，大约27-35%从食物中吸收其相关的植酸量低，当植酸量高其吸收率为19到26%。

Folic Acid叶酸

Folic Acid Compound Used 叶酸复合物的使用

- Pteroyl monoglutamic acid is the form of folic acid used in fortification. It is light yellow in color, but this does not affect the sensory aspects of the food because of the small amounts added. The compound is relatively stable with some loss from exposure to light and food preparation.维生素Bc是用在强化中叶酸的一种形式，为淡黄色，但是在食品感官上没影响，因为添加量小，相对稳定，在食品的准备，有光和暴露的情况下有些损失。

- Pteroyl monoglutamic acid is only slightly soluble in water, but is easily soluble in the low pH of the stomach.叶酸轻微水溶但是在胃的PH值低得环境下易溶。[R]

Folic Acid Bioavailability 叶酸的生物药效

- Folic acid provided in fortified foods is more readily absorbed than natural food folate. On average 1.7 times more is absorbed.在强化食品中强化的叶酸比天然叶酸易吸收。[R]

B Vitamins B类维生素

- Thiamin (B1)维生素(B1)
- Riboflavin (B2)核黄素
- Niacin (B3)烟酸
- Pyridoxine (维生素B6)
- Cobalamin (维生素B12)
- Folic Acid叶酸

Thiamin (vitamin B1)硫胺（维生素B1）

Thiamin Compounds Used 维生素B1复合物的使用

- For flour fortification thiamin mononitrate is the preferred fortificant compound as it is less soluble in water than thiamin hydrochloride. Both compounds are white or almost white in color and thus do not affect the color of the flour product.面粉强化叶酸是较好的强化复合物比硫胺氢氯化物少溶于水，两种复合物是白的或全白，所以不影响面粉产品的颜色。

- Both thiamin compounds are susceptible to losses from exposure to light and heat and alkaline conditions (pH over 7).两种维生素B1复合物易受暴露在光线下和受热和在碱性（PH值超过7）条件的影响而损失。[R]

Riboflavin (vitamin B2)核黄素（维生素B2）

Riboflavin Compound Used核黄素复合物的使用

- The only vitamin B2 source used in cereal fortification is riboflavin. It is soluble in water. The compound is yellow in color.仅用作维生素B2使用在谷物强化中的核黄素是水溶性的，符合无颜色是黄的。

- Riboflavin preparations differ in their physical properties and crystalline structure, which influences its color, solubility and particle size. Only products designated by the manufacturer for flour fortification should be considered for use.核黄素的准备与他们的物理特性和晶体结构不同，影响其颜色，溶解性和颗粒尺寸，只有由制造商指定的面粉强化产品考虑使用。

- Riboflavin compounds are highly unstable when exposed to light.核黄素复合物当暴露在光下非常不稳定。 R

Niacin (vitamin B3)烟酸（维生素B3）

Niacin Compounds Used 烟酸复合物的使用

- There are two niacin compounds commonly used in fortification: **nicotinic acid** (normally just called niacin) and **nicotinamide**. Nicotinamide is soluble in water, while nicotinic acid is relatively insoluble in water but soluble in alkaline environments. Niacin does not cause color changes to the flour as it is white in color.通常有两种烟酸复合物使用到强化中：尼克酸（通常叫烟酸）和烟碱。烟碱是溶于水的，烟酸相对不溶于水但是溶于碱性环境。烟酸在面粉中不影响面粉的颜色因是白色。

- Nicotinic acid is a vasodilator and can cause a flushing reaction (reddening) in the skin on exposure.尼克酸是一种助血管扩张的，暴露时在皮肤内会有发红反映

- Both niacin compounds are very stable in heat and light. 两种烟酸复合物在光热下都稳定[R]

Pyrodoxine (vitamin B6)维生素B6

Pyrodoxine Compounds Used 核黄素复合物用于

- Pyrodoxine hydrocloride is the pyrodoxine fortificant of choice for flour fortification. It is water soluble. The compound is white in color and thus does not affect the color of the flour produced.面粉强化核黄素是首先，是水溶性的。复合物在颜色上是白的因此不影响面粉颜色。

- The pyrodoxine compound is stable to heat, but sensitive to UV light. 核黄素复合物对热是稳定的，但是对紫外光敏感。[R]

Cobalamin (vitamin B12)钴胺素（维生素B12）

Cobalamin Compounds Used 钴胺素复合物

- Cyanocobalamin is the cobalamin fortificant used in flour fortification. Dilute forms of the compound are usually used because of the extremely small amounts of the vitamin needed. Cyanocobalamin is dark red in color but does not adversely affect the color of the flour because of the minute amounts added.氰钴维生素是核黄素强化使用在面粉强化中，通常要使用稀释形成的复合物，因为维生素需要的量很小。氰钴维生素是黑红色的但是相反不影响面粉颜色因添加的量很少。

- Cyanocobalamin is relatively stable in heat, but unstable in alkali and strong acidic environments. 维生素B12在热的状态下相对稳定，在碱性和很强的酸性环境下是不稳定的。[R]

Analytical Testing分析实验

- It is very difficult and expensive to test for the small amounts of vitamin B12 used in fortification. A microbiological test method is normally employed.在强化中使用少量的维生素B12是非常难测试的并且很贵。

Cobalamin Bioavailability钴胺素生物药效

- The formulation of cobalamin in fortified foods is absorbed two times more readily than natural cobalamin occurring in foods. 在强化食品中钴胺素的配方通常比天然的吸收率高两倍。[R]

Vitamin A维生素A

Vitamin A Compounds Used 维生素A复合物的使用

- Several forms of vitamin A are used in fortification: retinyl acetate, retinyl palmitate and beta-carotene. Beta-carotene has an orange color that makes it unsuitable for the fortification of flour.几种形式的维生素A用于强化：醋酸盐，棕榈酸盐，贝它胡萝卜素。贝它胡萝卜素是橘黄的不适合面粉强化。

- The retinyl esters are available in a protected, spray-dried form for use in flour fortification, sometimes referred to as SD-250 or SD-250S, since they contain 250 IU/mg. These forms do not affect the sensory properties of the flour. 在保护,喷雾干燥形式下的。。在面粉强化中使用，有时参考SD-250或 SD-250S，由于他们包含250国际单位i/毫克。这些形式不影响面粉的感官特性。

- Different commercial products can vary in their stability, both in the concentrated product and in a premix. Significant losses can occur on storage if the encapsulation and antioxidant protection system is poor. A standard stability test at 45° C on the raw material should show losses no greater than 20% after 21 days. 不同的商业产品在其稳定性上有变化，两者在浓缩产品和在预混料中，在储藏中有大量的损失如果包装和抗氧化系统不好的话。标准稳定性试验在45度用原料应显示21天后不大于20%的损失。 R

Calcium钙

Calcium Compounds Used钙混合物的使用：

- The most common calcium fortificants used in flour fortification are **calcium sulfate** and **calcium carbonate**. Both compounds are white in color and have a bland taste resulting in no significant changes to the flour product. 在面粉强化中最常用的钙强化是硫酸钙和碳酸钙。[R]

Levels added添加标准

- The level of calcium added ranges from 1.1 to 2.1 grams/kilogram.钙的标准添加范围从1.2 到2.1克/公斤

- Because these levels are far higher than the premix addition calcium is always added separately.因为这些标准比预混料添加钙的量高许多，所以总是分开加。

Level of the calcium salts needed (in grams per kilogram flour) To be added at the two most common Levels of calcium fortification**钙盐的标准需要（克/每公斤面粉）在两个最普遍的钙强化水平下添加。**

Ca level 钙的标准:	**1.1 g/kg 1.1克/公斤**	**2.1 g/kg 2.1克/公斤**
Ca Sulfate 硫酸钙	**4.8**	**9.1**
Ca Carbonate 碳酸钙	**2.8**	**5.3**

Studies on Iron Bioavailability 铁生物药效的研究

- The following studys show the relative benefit of different iron sources.随后的研究显示不同铁来源相关的好处

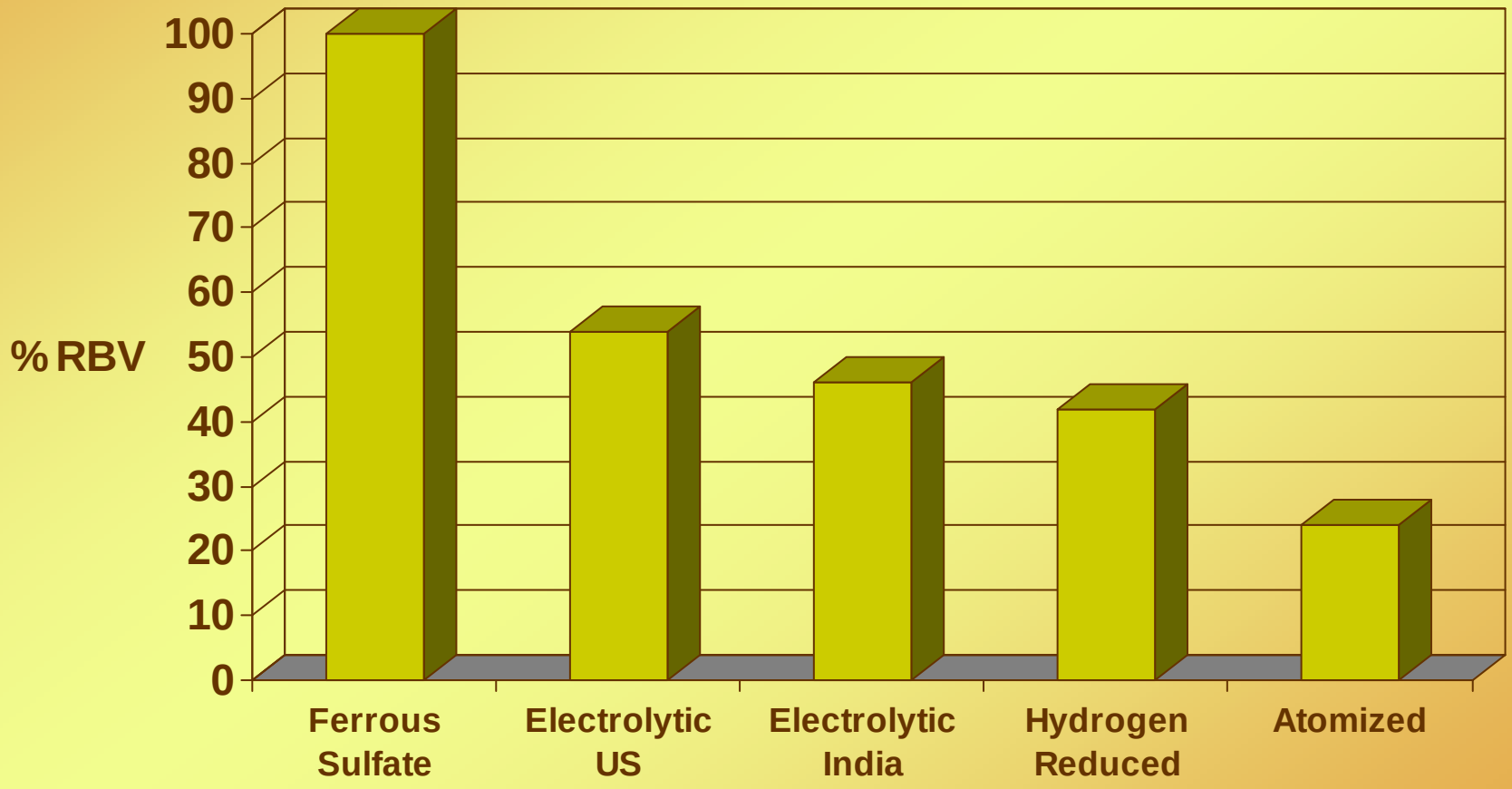
- Relative Biological Value (RBV) is the comparison in bioavailability (ability of the body to utilize the added iron) of different iron sources to that of ferrous sulfate, which is 100% by definition. The absolute absorption of ferrous sulfate can vary from 5% to 30% depending on the iron status of the individual and the composition of the diet.相关的生物功效价值是在不同铁来源的生物功效（机体使用添加铁的能力）到亚硫酸铁的比较是100%定义的。亚硫酸铁的完全吸收可从5%变化为30%，取决于每个人和食品的成分的铁的状况。

- *Efficacy* studies involve a select population that was given a known, controlled diet to see if their nutritional status improves.有选择的人群其知道，通过控制饮食看其营养状况的改善功效研究

- *Effectiveness* studies determine how well the general population, or a large segment of the population, benefits from flour fortification. 功效的研究决定总的人群如何好或大量的人群从强化面粉中受益。

Studies on Iron Bioavailability 铁生物药效的研究

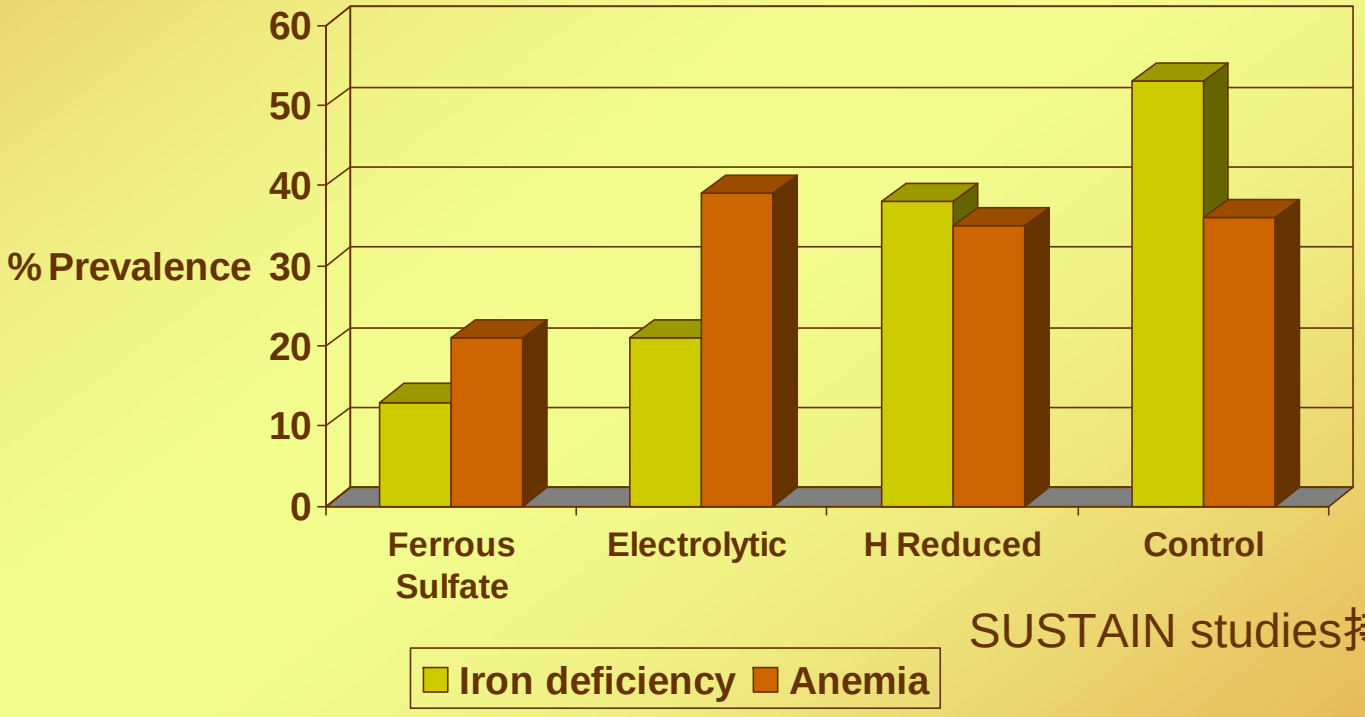
Relative Bioavailability of iron sources – Rat studies
铁来源的相关生物功效—老鼠研究



SUSTAIN studies持续研究

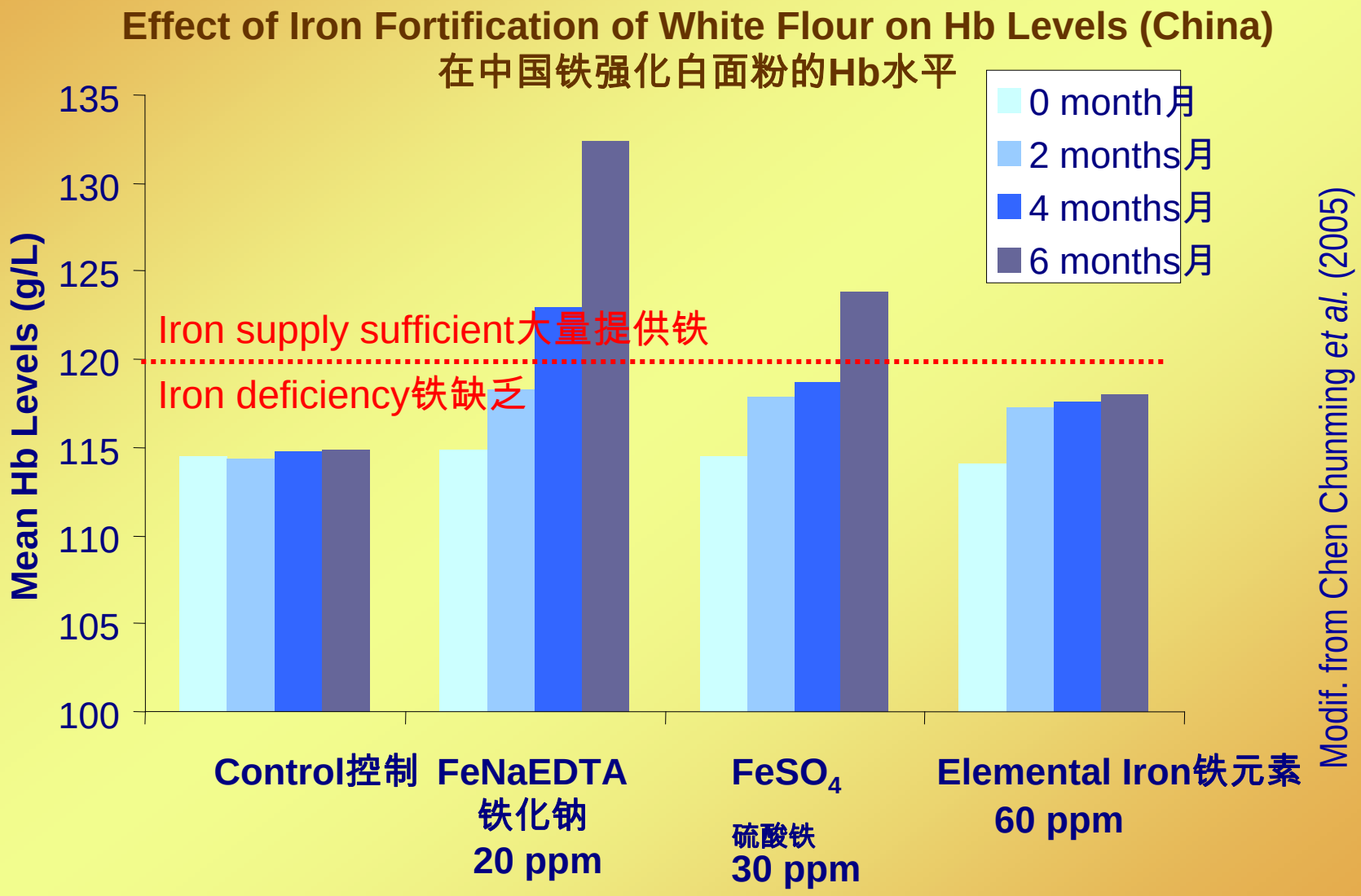
Studies on Iron Bioavailability 铁生物药效的研究

Effect of different iron sources on iron status – 36 week human efficacy trial
不同铁来源在铁状况上的结果—36周人的功效实验



SUSTAIN studies持续研究

Studies on Iron Bioavailability 铁生物药效的研究



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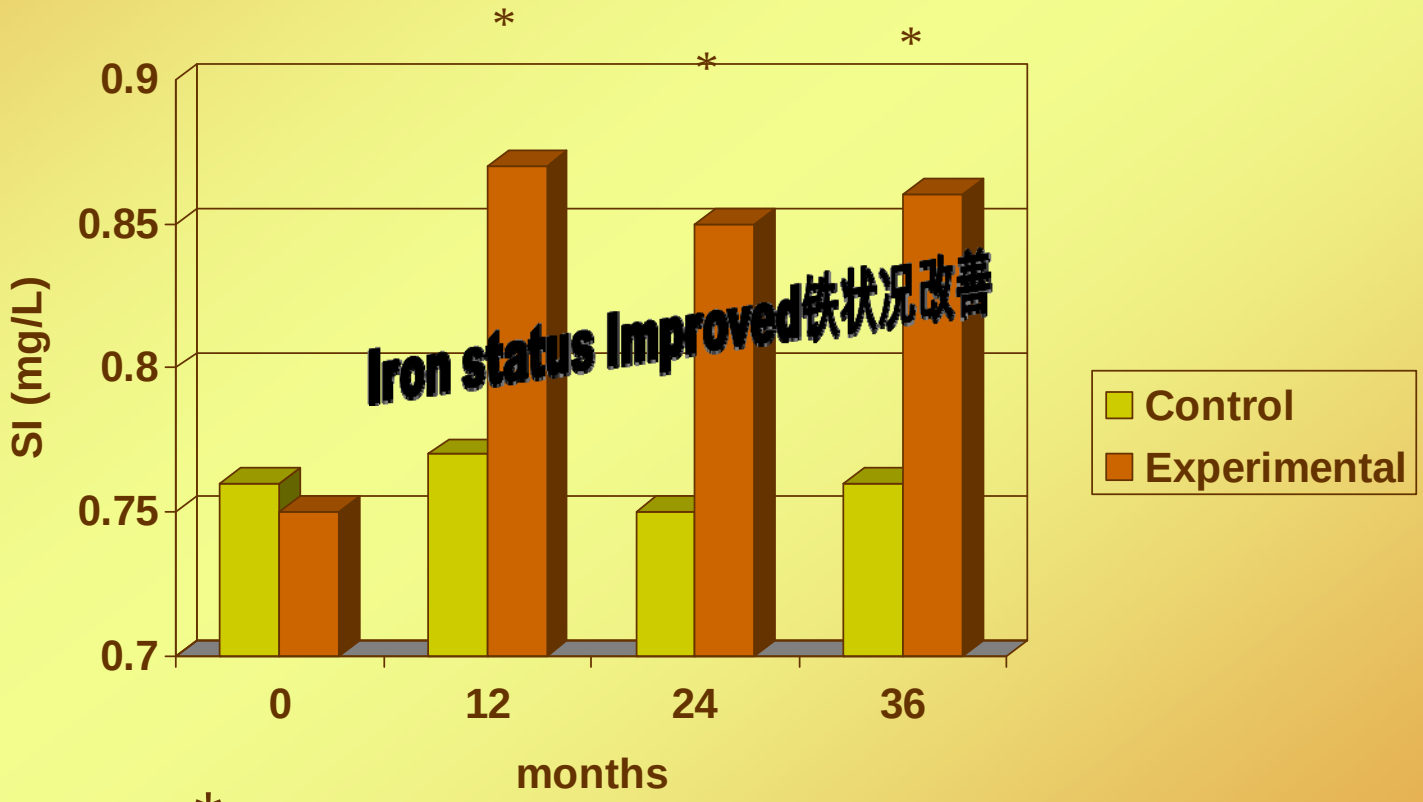
Studies on Iron Bioavailability 铁生物药效的研究

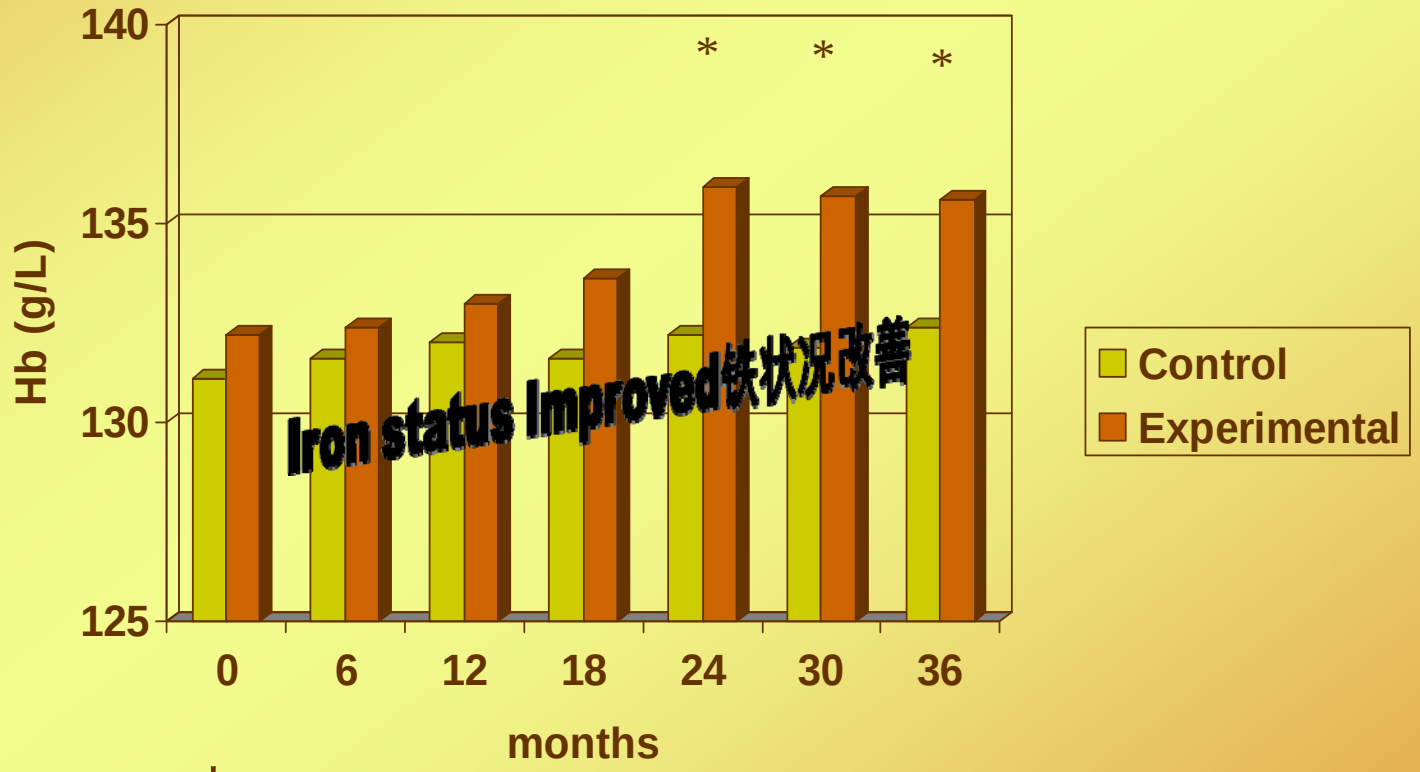
Effect of 24 ppm Fe as NaFeETDA Flour Fortification on Serum Iron Levels in Weichang, China
在中国围场百万分之24的铁作为亚铁化钠面粉强化血清铁水平



* Significant difference from control从控制看有较大的不同

Studies on Iron Bioavailability 铁生物药效的研究

Effect of 24 ppm Fe as NaFeETDA Flour Fortification on Hemoglobin Levels in Weichang, China
在中国围场百万分之24的铁作为亚铁化钠面粉强化血色素水平



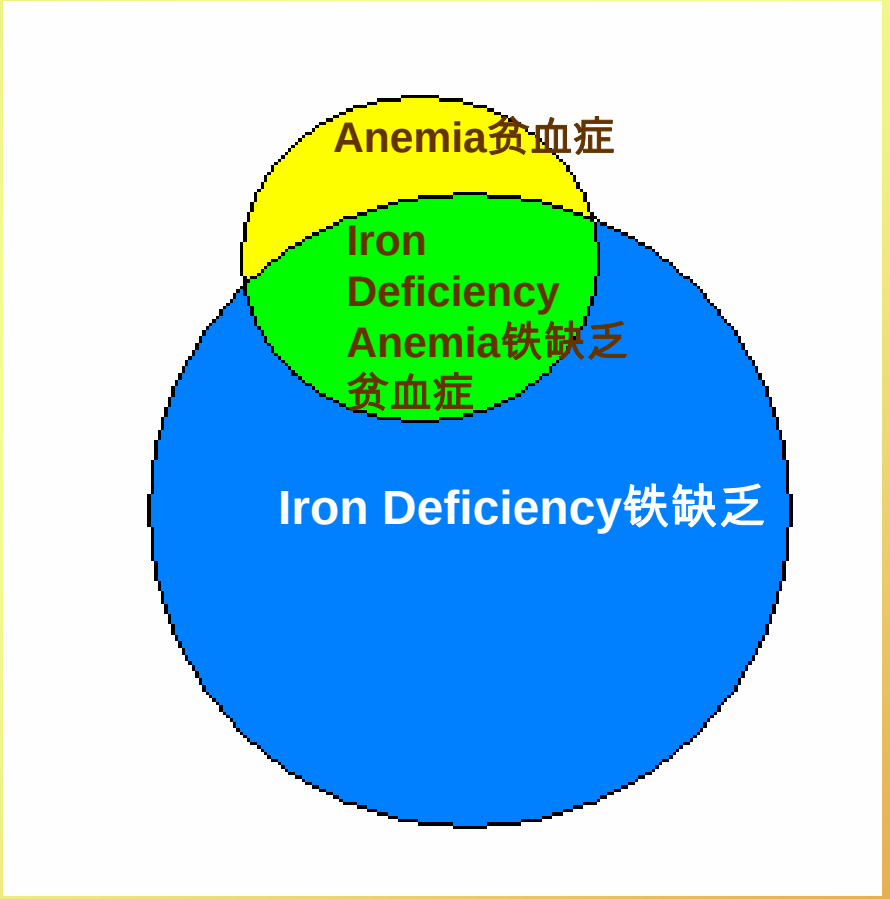
* Significant difference from control从
从控制看有较大的不同

Iron Deficiency Anemia铁缺乏贫血症

- Anemia is measured by serum hemoglobin levels. There are multiple causes of anemia, but iron deficiency is the primary one.贫血症是通过血清血色素水平来测定的。有多种情况的贫血症，但是铁缺乏是第一位的。

- Iron Deficiency is measured by indices of body iron stores such as Ferritin. It can cause a number of health problems besides anemia.
  铁缺乏是通过机体中铁储存的指数例如铁蛋白来测量的，能导致出贫血外的各种健康问题。

- Iron Deficiency Anemia (IDA) is indicated by the presence of both low hemoglobin and low iron stores.
  铁缺乏贫血症是通过血清和铁储存低两种指标来体现的。



Section 3: On the Production Line 生产线上

- Installation & Calibration of Premix Dosing Machinery
混和机定量给料机械的安装和校准
- Premix: Handling, Storage & Management
混和机：操作，贮存和管理
- Equipment: Maintenance & Troubleshooting
设备：保养和修理故障
- References相关内容

Installation & Calibration of Premix Dosing Machinery
预混料配料机械的安装和校准

- Location of Premix Feeders混合机喂料器的安装位置
- Feeder Set-up喂料器的开机
- Feeder Calibration喂料器的校准
- Fortification Operation Guidelines 强化的操作指导

Location of Premix Feeders
预混料喂料器的位置

- Place feeders in a dry location and away from sunlight. Vitamin A, riboflavin and folic acid are sensitive to light and atmospheric oxygen. 将喂料器安置在干燥的地方，避开阳光照射。维他命A，核黄素，和叶酸对光和空气很敏感。

- Ideally, place feeders in an area of the mill easily accessible to the operators. Controller should be handy to the miller's office or flour testing station. 放置喂料器最好的位置是最接近操作员的位置。控制器最好紧靠厂里办公室或面粉测试站。

- There should be room adjacent to the feeders for having a supply of the premix ready to add (a box or two depending on use rates rates). 一个房间紧邻喂料器，为混和机准备添加提供供给（根据使用率决定一个盒或两个盒）

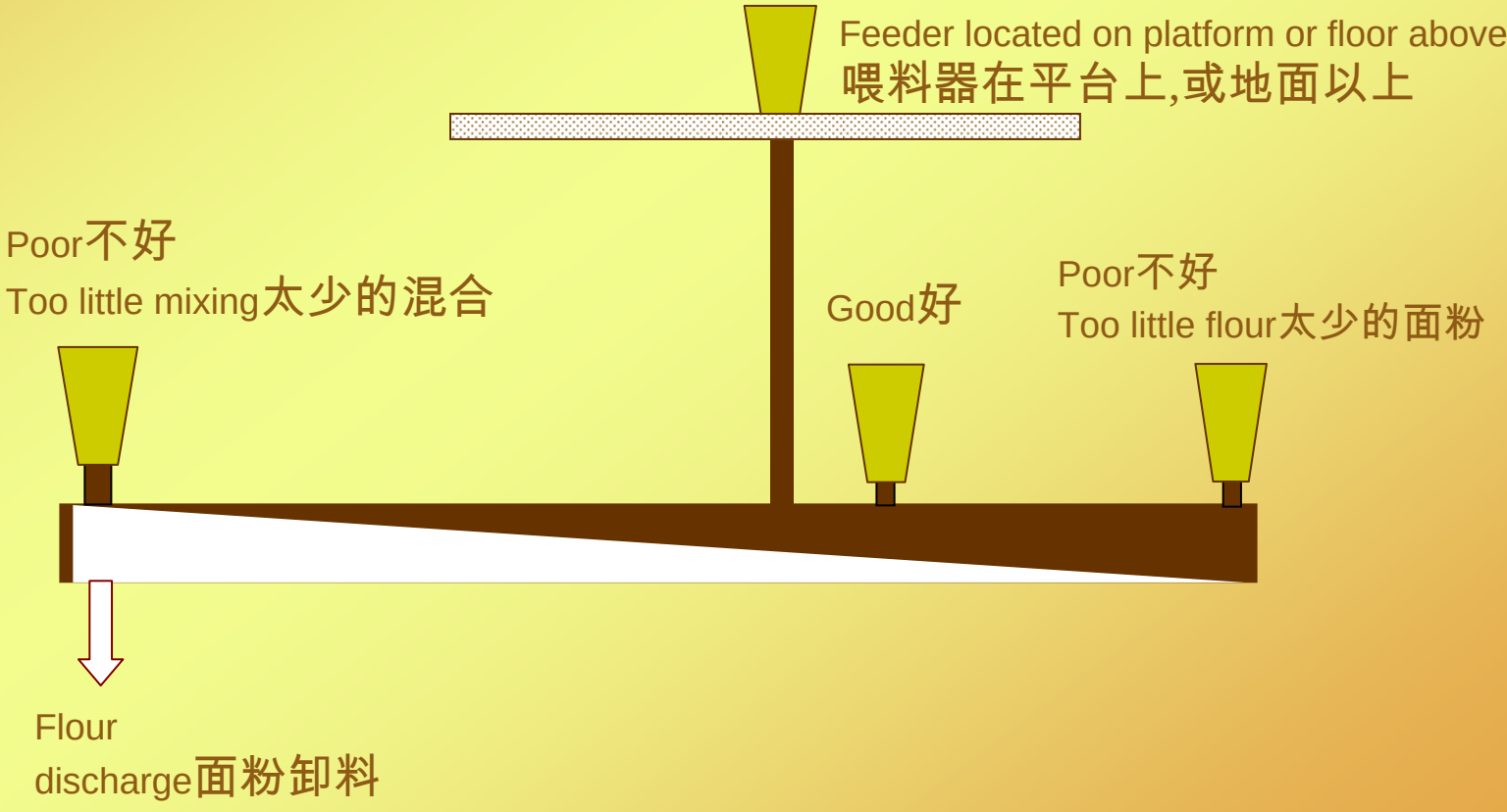
- Feeders should be located near the beginning of the conveyor to assure good mixing with the flour after it is added. 喂料器应位于输送带开始，以确保添加后的面粉与喂料器有好的搅拌R

Feeders Details with Premix Box预混料箱喂料器细节

Feeder Details 喂料器细节

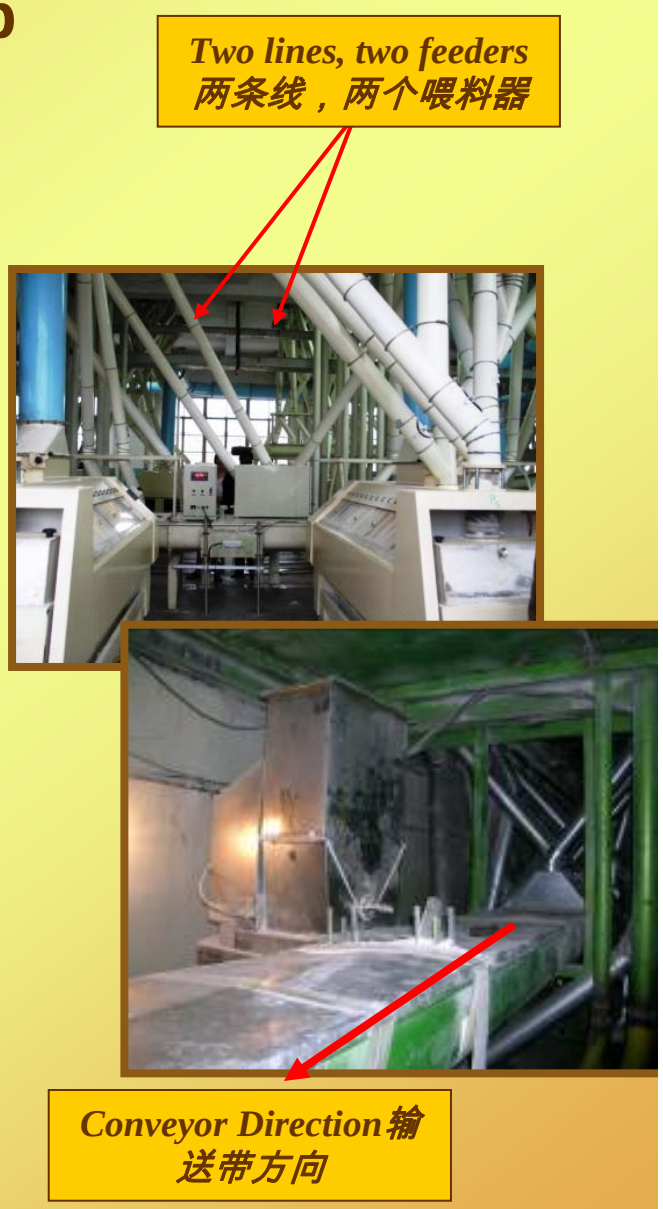
Location of feeder on flour collection conveyor面粉收集输送机上的喂料器的位置

- At the front half of collection conveyor above the blades of the mixing screw, 收集绞龙前半段，在螺旋混合器刀片上
- At least 3 meters of conveyor length is normally needed to ensure adequate blending.至少3米长的输送带来确保足够的搅拌 R



Premix Feeder Set-up
预混料喂料器安装

- In general, one feeder is needed for each production line of flour to be fortified.通常，每条需要强化的面粉生产线需要一个喂料器
- Locate feeders to allow adequate mixing with flour after point where premix is added.
- Speed controller and low level indicator light should be in readily visible, convenient and easily accessible location.速度控制器和低液面指示器灯应放在显而易见，便利和容易接近的地方
- Feeder hopper should be convenient for filling.喂料器料斗应便于存档。
- Install voltage stabilizers whenever electrical voltage fluctuates more than ± 20%. 安装电压稳定器只要电压波动高于± 20%.
- Install electrical interlock systems directly to either the flour collection conveyor motor or the mill control panel. 安装电气与锁系统。直接与地面收集绞龙电机连接或控制面板连接。
- Check low premix level indicator lights to assure hopper is operating correctly检查低预混料料位器灯以确保料斗正常操作。 R



Feeder Controller喂料器控制器

Feeder Details (Ulaanbaatar, Mongolia)喂料器细节

Feeder Calibration喂料器校准

Mills may know their flour production rate (kg/hr) for each production line but it is not a bad idea to check it. This can be done with the following procedure
面粉厂或许知道每条生产线的面粉生产率（公斤/小时）。这也不是个坏想法去检查它。可通过下列程序来完成：

- While the mill is running count number of bags packed per 60 minutes or use on-line flour scale (if one is installed). 每60分钟面粉厂数包装袋或使用在线面粉刻度（如果安装了）

- Calculate the flour production rate using the following formula. This is the actual production rate per minute and not rated capacity.使用下列公式计算面粉生产比率。这是每分钟实际产量比率，而不是额定功率。

$$\frac{\textit{(weight of bags in kg) x (number of bags per 60 minutes)(袋子的重量以公斤计算) x (每60分钟的袋子的数量)}}{60} = \textit{kg flour per minute.} = \textit{每分钟的面粉公斤数}$$

Feeder Calibration喂料器校准

Premix Feed Rate Determination:预混料喂料量的确定

Next you need to determine the premix feed (discharge) rate at different speed settings on your feeder.

下一步，根据喂料器不同速度的设置，需要测定混和器喂料（卸料）比率

1. Fill hopper half full with premix to be added.填充料斗------
2. Set feeder to maximum discharge. 设置喂料器至最大卸货量
3. Run feeder for two minutes. 运转喂料器两分钟
4. Weigh the premix that has been discharged. 为已卸货的混和机称重
5. Calculate maximum discharge per minute.计算每分钟最大量的卸货
6. Optional: Repeat at different speeds or percent settings.选择的：不同速度的重复或百分比设置
7. Graph paper or a spreadsheet program can be used to make a chart that shows the premix discharge rate per minute at different speed settings from 0 to 100% of maximum discharge. This should be displayed near the feeder.使用方格纸或电子数据表来做出图表，显示每分钟混和机卸货比率，和不同速度的设置从0 至100% 最大的卸货比率。R

Feeder Calibration喂料器校准

Individualized Premix Feed Rate Determination to Fortify at Set Levels:在设定标准下强化的预混料喂料量确定：

Finally, you need to take both the ***flour production rate*** *measure* and the ***premix feed rate measure*** you calculated previously and use them to determine the feed rate of premix in grams per minute required to fortify the flour at the recommended level. 最后，需要将面粉生产率测量和先前测量的混和机饲料率测量，来决定在推荐的层次中，每分钟需要强化的面粉的混和机的饲料率。

Determine the recommended addition rate of premix (from supplier specifications on the package)

1. Calculate the required premix feed rate per minute using these formulas: 计算每分钟需要的混和机饲料率需使用以下公式：
2. Adjust the control/dial on the feeder to deliver the calculated weight of premix per minute. You should now be ready to begin fortification. 调整喂料器上的控制/刻度盘，交付已计算的每分钟的混和机重量。现在你已做好了准备，可开始强化了。

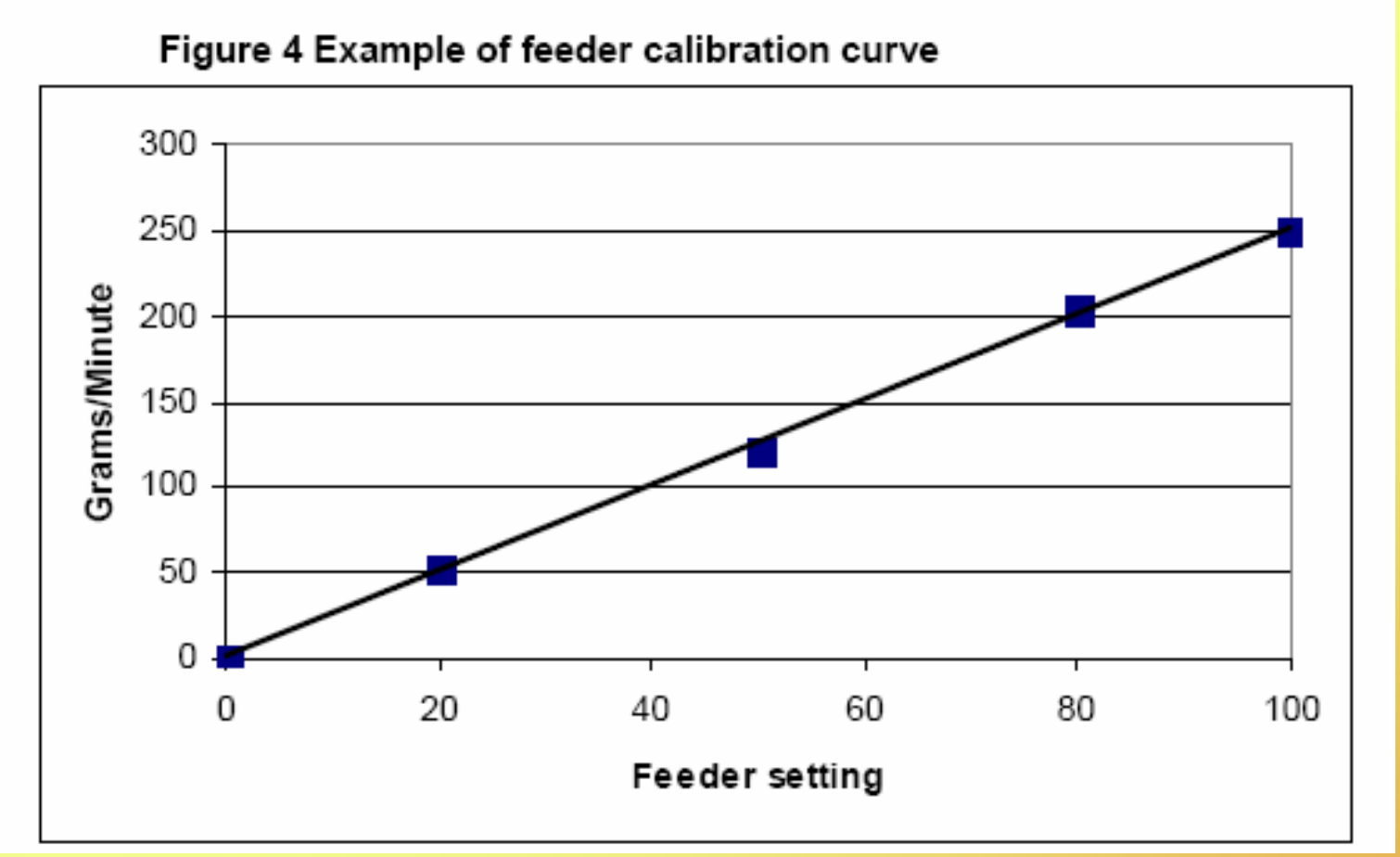
$$\frac{\textit{premix weight in grams per ton预混料重量-克/吨}}{1000} = \textit{grams per kg flour克/公斤面粉}$$

(premix weight per kg) 每公斤预混料重量) X (production rate per minute in kg) 每分钟生产量公斤计) = *premix weight required per minute每分钟要求的预混料*

Feeder Calibration Chart 喂料器设定图

Prepare and post near feeder

R



Fortification Operation Guidelines
强化操作指导

1. Be sure feeders are calibrated and actual production rate of mill has been measured.确保喂料器已校准，面粉厂的实际产量已测量。

1. Ensure feeder hopper contains premix. 确保喂料器料斗包含混和机

2. Start mill up and let run for at least 15 minutes to reach normal production rate.启动面粉机至少15分钟，使之达到正常生产率

3. Start feeder at required setting as determined by the feeder calibration process. 根据喂料器校准程序，按照规定的设置启动喂料器。

4. Conduct *check weighing* at start of mill production run and every TWO hours to verify correct addition rate. Adjust if addition rate is greater than 10% above or below target. Recheck addition rate using check weigh procedure. Try to maintain check weight within 5% of target. Check weights should be run at the start of every shift or every 8 hours of operation.行为检查称重：面粉厂开始生产运转时每两小时验证正确的添加率。添加率高于或低于10%的目标要调整。利用检查称重程序再检查添加率。设法将重量保持在目标5%以内。每班开始工作时或每操作8小时要进行重量检查。 R

Fortification Operation Guidelines
强化操作指导

5. Each premix feeder should be checked routinely during production run to ensure there is sufficient premix in the hopper and that feeder is operating properly.生产过程中，每个预混料喂料器都要检查以确保料斗中有足够的混和机，喂料器操作准确。

6. *Note: To add an extra quality control measure, mills may require premix feeder hoppers to be filled on a regular basis and the weight of the material left in the premix carton recorded. If the amount used between weightings is compared with the flour production during the same period, a measure of addition is obtained. 注意：添加额外的质量控制措施，面粉厂要求预混合料喂料器料斗根据基础粉填充，材料的重量记录在预混和料 中。*

7. The most important check on the production line is to ensure that the feeder does not run out of premix. Many feeders have a low level indicator that can be checked.生产线上的最重要的检查是确保喂料器没有离开混和机的运转。

8. At the end of a production run, the premix feeder should be turned off before shutting down the mill.生产运转结束时，混和机喂料器在面粉厂关机前先关机。

9. Production records need to record the following: 生产记录需要记录以下信息：
    - The lot number of the premix used使用的混和机批号
    - Check weights检查重量
    - Feeder adjustments if made喂料器调整
    - Times of check weighing 检查称量的次数R

Check-Weighing Procedure检查-称量程序

Premix: Handling, Storage & Management
预混料：处理，贮藏和管理

- Safe Premix Handling 安全预混料处理
- Maintaining Premix Shelf Life保持预混料的保 质期
- Premix Delivery and Receiving Procedures预混料的发送和接收程序
- Management of the Premix Supply提供预混料的管理方法

Storage and Handling of Premix
预混料的贮存和处理

Premixes are concentrated sources of vitamins and minerals and small doses over a prolonged period can be harmful. Some workers may have a mild allergic skin reaction to some premix ingredients. 预混合料是由维他命和矿物质浓缩而成，小剂量过了延长期的会受到损坏。一些工人会对预混合料配料起反应，有轻微的皮肤过敏症。[R]

The following worker precautions should be used when handling premix: 以下是工作处理预混合料时应做的预防工作：

1. The premix boxes may have a *Warning Label* and handling precautions that should be followed.装预混合料的盒子应有警告标签，应有以下字样：

1. Premix is never for direct use in foods: **IT IS TOO CONCENTRATED FOR DIRECT CONSUMPTION** and workers at the mill **MUST BE INFORMED** of and understand this safety precaution. 预混合料永远不能直接放在食品中：--------**面粉厂的工人必须要知道和理解这个通知。**[R] Materials safety data sheet (MSDS) or a product information sheet with handling instructions should be distributed or made known to all workers that will come into contact with the premix.原料安全数据单(MSDS)或产品信息单带操作说明应发给所有与预混合料有接触的工人或让他们都知道。

Storage and Handling of Premix
预混料的贮存和处理

3. When filling the feeder hopper it is recommended that the operator wear a long sleeve shirt, gloves and dusk mask. He may also wear safety goggles, a hair net, safety helmet or other protective devices depending on the policies of the mill. (Since the filling of the hopper may take less than a minute, it is recognized that the operator may not always choose to do this.)当填充喂料器料斗时，操作工要穿长袖衬衫，戴手套和面罩。戴风镜，发网，安全头盔或面粉厂规定的其它保护装置。（由于填充料斗是不到一分钟的工作，操作工没必要经常去做这项工作）

4. Workers handling premix should wear *long sleeve shirts and gloves* if possible when handling the product. Some people have an allergic skin reactions to flour fortificants such niacin. A common reaction is skin reddening caused by the vasodilatation effect of niacin. This effect is not dangerous and is transitory, but it can be annoying.工人处理预混合料时要穿长袖衬衫和手套。一些工人由于接触面粉强化剂如尼亚新有过敏性皮肤症状。一个共同的反应就是皮肤变红，是由于尼亚新的原因造成的血管舒张。这个症状虽不危险而且是短期的，但是很烦人的。

5. After filling hoppers workers should *wash their hands and skin* areas that were exposed to premix.当料斗填充后，工人应洗手和洗与预混合料接触过的皮肤。[R]

6. Premix boxes should be kept somewhere in the mill that is handy but not exposed to sunlight, not excessively hot (i.e. next to a boiler) and safe from getting wet or hit by lift trucks. The boxes can be piled on top of each other, but it should be so arranged that a FIFO system of use could be easily accomplished.包装预混合料的箱子应保存在方便，避光，不是很热的地方（避开锅炉）避开潮湿或与起重机碰撞。箱子可在顶部堆积放置，使FIFO系统的使用能容易地完成。

Storage and Handling of Premix
预混料的贮存和处理

7. Normally, one box at a time is brought to be adjacent to the feeder for filling. The box and the inner bag is opened. A scoop can be placed inside the opened bag for convenient use. Care should be taken that a paper, a piece of plastic or some other contaminate not be in the bag, as this may get in the feeder causing its malfunction. (ideally, the inner plastic bag should be of a colored material so this would be more noticeable to the operator.)通常，每次一箱被带到邻近的喂料器进行填充。箱和内袋是打开的。为方便使用，铲子放在打开的袋中。注意袋中不要放入纸和塑料或其它可导致污染的东西，这些东西有可能进入喂料器引起故障。（内部塑料袋最好是彩色的，可使操作者显示而易见）

8. Once the hopper has been filled the operator should put the scoop back in the bag or at some other designated location. The inner bag should be twirled close and the cardboard flaps folded over. This “operating” box should be left in a location that is convenient for future use but not exposed conditions that could damage it. 一旦漏斗填充完毕，操作工要将铲子放回袋中或其它指定位置。内部袋旋转关闭，纸板折叠。这个“操作”箱须放在方便下次使用的地方，但不要放在暴露的地方，以免遭到损害。

9. Operators may make spills of premix as they are filling the hopper. These spill should be cleaned up immediately afterwards, preferable by putting some meal on them prior to sweeping them up.当填充料斗时，操作工会将预混合料溢出。填充后，要立即将溢出物清理干净，最好先将米粒倒在溢出物上再将其扫掉。

Premix Box “Warning Label”预混料箱“警示标志”

Maintaining Premix Shelf Life
维持预混合料的保质期

1. **Ideal storage Conditions:** Stored in well-ventilated rooms at low or mild temperatures (preferably not higher than 25°C), and avoid humid conditions. Where humidity cannot be controlled, vapor barrier packaging should be used.理想的贮存条件：贮存在容易通风的房间，且温度保持在低温或适度的温度（最好不超过 25°C ），避免潮湿的环境。如果不能控制潮湿，可使用水蒸汽来避免潮湿。[R]

2. **Purchase in Small Quantities:** The amount of commercial premix needed should be estimated and obtained in quantities small enough so that it does not need to be stored for long periods of time. 小数量的购买：小数量的商业化的预混合料是事先估计到的和可获得的。所以不需要贮存太长时间。

3. **Stock Rotation:** Upon receipt of the shipment, the production lot number(s) should be recorded and retained. A first-in, first-out (FIFO) system of stock rotation should be used. 存货周转：装船后，生产批号应已记录和被保留焉。------（FIFO）存货周转系统应使用。[R]

4. **Use of Open Containers:** Once a premix bag has been opened, it should be kept closed when not in use and protected from heat and light. 一旦预混和料袋子被打开，要将其关闭避免受到热力和灯光的照射。[R]

Premix Receiving Procedures预混料接受程序

1) Assess condition of the packaging包装评估条件

2) Ensure that you receive what you ordered保证收到你所订购的

3) Record Lot # and type of premix记录数量和预混料类型

4) Remove certificate of analysis and keep on file取出证书存档

Management of the Premix Supply
预混合料的供给管理

Responsibilities for mill staff for each aspect of premix supply needs to be clearly assigned at the mill. The major assignments include the following:有关预混合料供给的面粉厂员工的责任分工明确。分配包括以下几点：

- Stock control and ordering (ordering times need to take into account usage rates and the time it take to process, ship and receive a shipment) 库存控制和订购:(订购时间需要考虑到使用率中，还有加工时间，上船及收到货物的时间）
- Mill handling to include storage, movement to the production line and addition to the feeder(s).面粉厂处理包括贮存，移到生产线上和添加到喂料器中
- Premix quality control on arrival at the mill and periodically in storage and on the production lines. This function is different from quality control of the fortified flour. 预混合料到达面粉厂，及定期的贮存和在生产线上的质量控制。这个功能不同于强化面粉的质量控制。

Equipment: Maintenance & Troubleshooting
设备：维修和故障排除

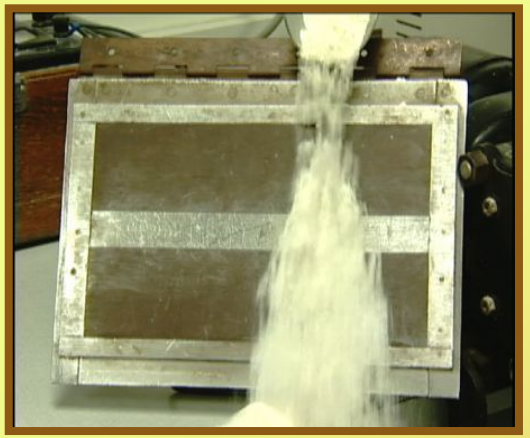
- Routine Inspection & Maintenance常规检查和维修
- Problems with Magnets磁选问题
- Troubleshooting 故障排除

Routine Inspection & Maintenance
常规检查和维修

- Typically, inspection and maintenance of premix feeders and control equipment is minimal, but will vary depending on feeder type.通常，预混料喂料器和控制设备的检查和维修工作是不多的，但是取决于喂料器类型。
- Manufacturers should provide specific inspection and maintenance information with the machines (check on delivery). 制造商应提供一定的检查和维修信息对相关设备。
- Instructions may need to be translated into national language if not done by manufacturer. 如果制造商没翻译指导手册，手册需翻译成本国语言。
- Manufacturers can be consulted to learn what parts may wear out and how they can be obtained. 向制造商咨询那些备件是易磨损件，他们如何获得。
- A stock of high turn over spare parts should ordered and kept on hand. 需有一定的备件存储R

Problems with Magnets磁选的问题

Magnets on the production line may cause minor problems by attracting the elemental (reduced) iron forms used in some premixes. 中磁选在生产线上通过吸引一些用在预混料中的铁元素可能产生一些小问题。



- **Iron salts** (ferrous sulfate, ferrous fumarate and iron EDTA) used in some premixes WILL NOT be attracted to magnets intended to remove tramp iron.铁盐（硫酸亚铁，亚铁酯和乙二胺四乙酸铁）

Where premixes contain **elemental iron** powders, the iron may be attracted to magnets… BUT…预混料包括铁粉元素，铁可能被磁铁吸住，但是。

- Only rare earth magnets are strong enough to actually pull elemental iron powders out of flour as it passes by the magnet. These magnet quickly becomes saturated with the iron powder and a state of equilibrium is reached causing no additional iron to be removed. 仅稀土元素氧化物磁力足够强通过磁选能从面粉中吸出铁粉。这些铁很快变成饱和铁粉，达到平衡的状况，没多余铁能去掉。
- Extensive experience shows that magnets will generally remove tramp iron but little to no iron powder because the tramp iron is thousands of times larger and much more strongly attracted.大量的经验显示磁选总的来说去除重铁，但是仅一点，每铁粉，因为重铁有上千次大有很强的磁力。 R
- If a problem is suspected, it can be checked by inspecting the surface of magnets to see if they hold large amounts of iron powder. 如果怀疑有问题，应检查磁铁的面看看是否吸有大型铁块。

Problems with Magnets磁选的问题

(Slide 2 of 2)

If magnets have a manual cleaning system, as do most of the new tube magnets, check the amount of iron powder that is removed on cleaning.

如果磁铁有自清理系统，就如大部分新的管道磁选，检查铁粉数量清理干净。

- If there does seem to be a problem, there my be are alternative solutions.
  如果似乎是问题，选择更换方案。R

Fixes for Problems with Magnets 解决磁选问题

Actions to correct magnets causing problems with iron separation:

- Install magnets in a location so that the flour stream acts as a continuous cleaning mechanism as it passes over the magnet. 安装磁铁在连续清理面粉中的磁性物质。
- If the iron powder bridges between the magnet tubes, use a magnet system with a larger distance separating the tubes. 如铁粉在磁性管道上接拱，用磁体系统大距离分开管道。
- Place magnets prior to the addition of the premix and rely on sieves to remove tramp iron after that point. 优先 放磁铁到预混料中，从那一点用筛子筛出。
- Use a non-magnetic iron source, such as iron salts.用非磁性铁，如铁盐 R

Troubleshooting故障排除

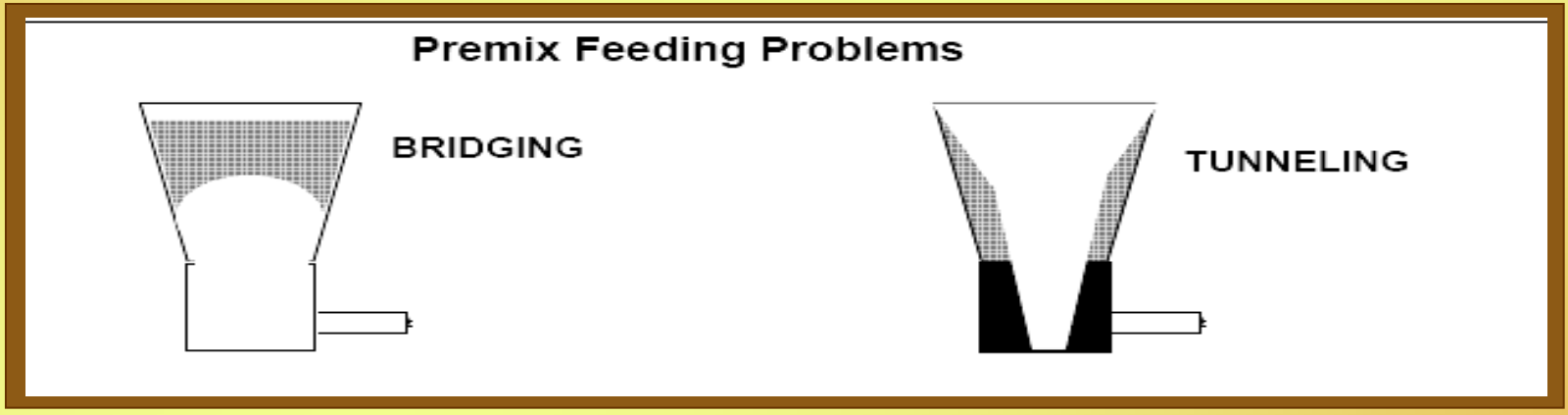
- The best way to prevent and easily fix production problems is to be prepared and know what to expect. 最好的办法阻止和便于解决生产问题已准备，并知道期望什么。

- The links below are for troubleshooting information and action steps regarding the following problems*:链接如下有关问题故障排除信息和行动步骤*

    - Trouble with Premix and Feeders 预混料和喂料器的问题
    - Electrical Power Supply Variations 供电变化
    - Segregation and Loss of Vitamins and Minerals维生素和矿物质的隔离和损失

Trouble with Premix and Feeders 预混料和喂料器的

- Frequent, visual inspections of the premix feeder are important, especially after it is newly installed.频率，视觉检查预混喂料器是非常重要的，特别是新安装的系统。
- Compaction and stickiness of the premix may cause it to ball-up, bridge or tunnel in the feeder. A loose material will feed slower in weight per unit time than the compacted material. Thus, compacted premix can cause problems because it results in feed rate variability.预混料的压紧和粘附在喂料器内会产生球状桥或通道，松的物料在每单元时间内称重喂料比紧密的物料慢，因此紧密的预混料因为在喂料率变化上会产生问题。

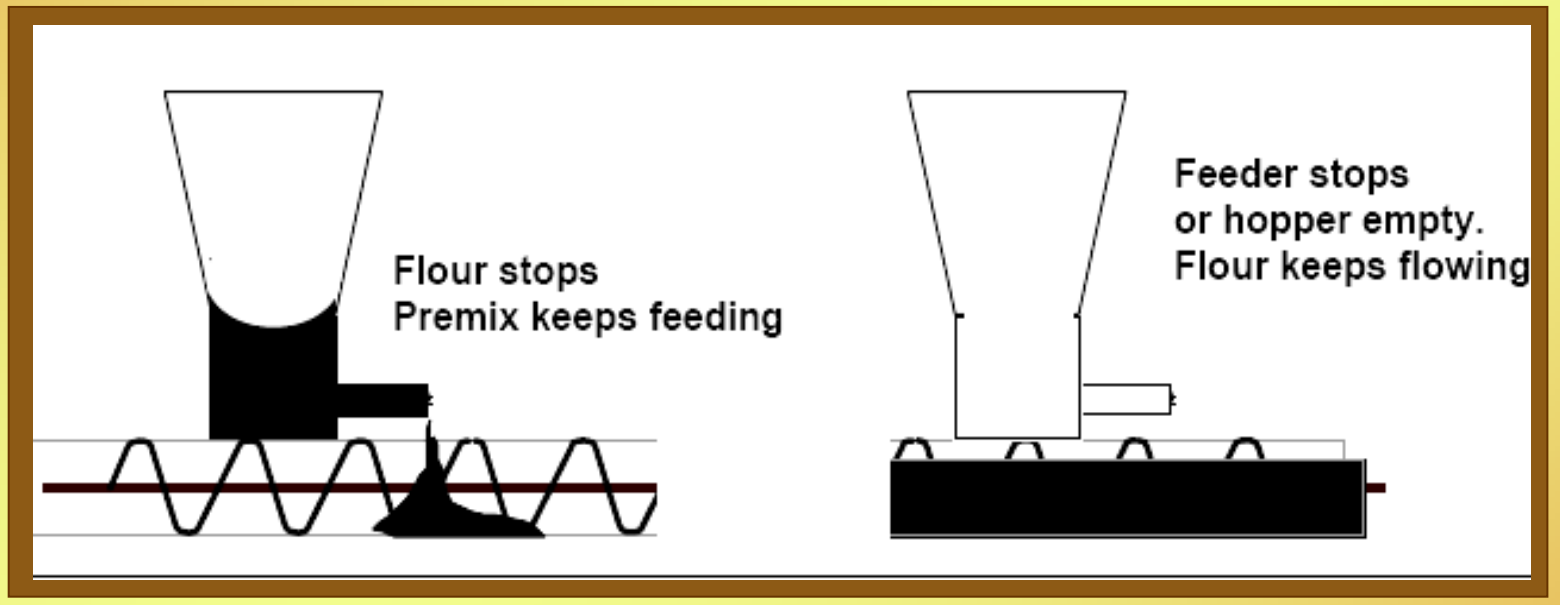


ACTIONS: 措施

1. Have premix supplier change the levels of excipients and free-flow agents. 让预混料供货商改变赋形剂和流动剂的标准
2. Install mechanical agitation in premix feeder hoppers.安装机械搅拌器。
3. Empty feeders that will be unused for any length of time.清空喂料器在一段时间内不用。

Trouble with Premix and Feeders 预混料和喂料器的

- If there is problems with the flour flow or the premix flow, the level of premix added to the flour will be incorrect. 如果有问题，面粉流或预混料，预混料添加到面粉中的量将不正确。



ACTIONS行动:

1. Make frequent inspections of the feeder经常的检查喂料器
2. Install low-level alarm or indicator light on hopper在料斗上安装低料位报警或显示灯。
3. Install electrical interlock system between the mill and feeder controls. 在工厂和喂料器控制处。安装电流互锁系统R

Section 3: Excipients and Free Flow Agents

- An **excipient** is a material, such as starch or maltodextrin, is often blended into the premix by the manufacturer to dilute the concentration of the vitamins and minerals. Excipients may be referred to as “carriers” or “fillers” by premix manufacturers. After an excipient is added, the bulk density of the premix is lowered bringing it closer to the bulk density of the flour. This makes for easier feeding and blending赋形剂是种原料，例如淀粉或---经常被生产厂家混合到预混合料中来冲淡浓缩的维他命和矿物质.赋形剂被预混合料生产厂家认作是“载体”或“填充者”。添加后预混料容重变低接近面粉的容重，使易于喂料和混合。

- In addition to excipients, a **free-flow agent**, such as tricalcium phosphate or precipitated silica (silicon dioxide) may be added to keep the premix from clumping and bridging in the hopper.除赋形剂外，一种自由流动剂，例如三钙磷酸盐或硅的沉淀物（硅氧化物）可以加入使预混料在料斗中不成块和结拱。

Mechanical Agitation机械搅拌

- Installing a mechanical agitator in the hopper will help prevent the premix from bridging, clumping and compacting. Some models of feeders may automatically come with an agitator device already installed. 在料斗内安装机械搅拌器将帮助阻止预混料结拱，堆积，有些喂料器安装有自动搅拌器。[R]

Electrical Interlock System
电器联动系统

- An interlock causes the feeder to stop if the flour collection conveyor stops. This will prevent the inadvertent over-treatment of the flour, if there is a mechanical breakdown in the mill. 如果收集输送机停，互锁导致喂料器停，这将阻止面粉无意中过度处理，如果有机器出故障。

- It is highly recommended that an electrical interlock system be installed between the feeder motor and the motor driving the flour collection conveyor. 强力推荐一点互锁系统安装在喂料器电机和驱动面粉收集输送机的电机间。

- In pneumatic delivery systems an interlock should be made between the feeder and the blower to insure that the feeder cannot be turned on without the blower operating. This will prevent buildup of the premix in the pneumatic lines followed by over-treatment of flour once the blower is turned on.气力输送系统互锁应在喂料器和风机之间以保证喂料器不能因落此风机没开就开，这将阻止预混料在气动管中堆积，紧接着一旦罗茨风机开面粉被过量处理。

- An alternative approach is to have an automatic shut off switch on the feeder that is hooked up to a flour flow indicator or a pressure indicator in a pneumatic system. 一个可选择的方法是在喂料器上有一自动关闭阀，钩上装面粉指示器或装一压力指示器于气力系统内。R

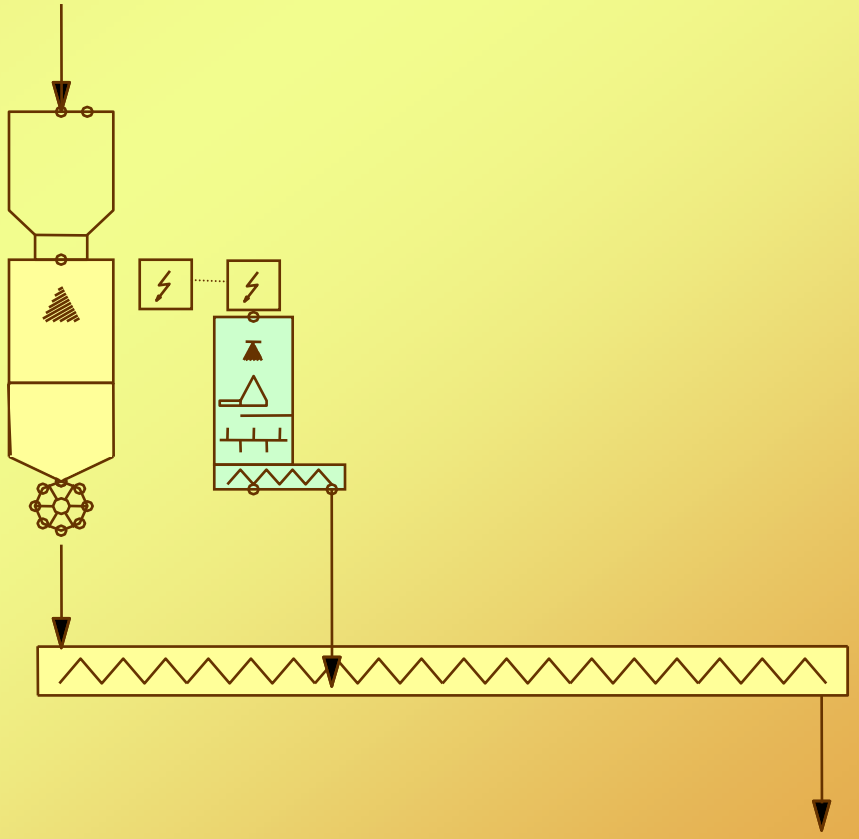
Electrical Interlock System
电器联动系统

Interlocking (slaving) premix addition to flour flow:

预混料添加到面粉流的联动

- The most accurate method of flour fortification is to continuously interlock the addition rate of the feeder with the measured flow rate of the flour. 大部分面粉强化准确的方法是在测定面粉量后连续联动进行喂料器添加量的控制。

- This requires equipment for measuring the flow rate of the flour and computerized mill control allowing the interlock.这些设备来测出面粉的流量和允许计算机进行粉厂联动控制



Electrical Power Supply Variations供电变化

- Electrical voltage power fluctuations may occur in your mill, due to national grid supply problems and generator variability. 电压波动可能导致粉厂问题，由于国家电网供电问题和发电机的可变性。

- This can cause a problem because feeders and controllers must operate in a consistent, uniform manner to ensure adequate fortification. 因为喂料器和控制器需在连续，均匀的以确保足量的状况下运行，这将会产生问题，

- Variations in voltage can alter the flour production rate and the premix feed rate, which will cause the flour to be fortified incorrectly.电压的变化能改变面粉生产量和预混喂料量，这将造成面粉强化不准确。

ACTIONS:措施

1. Use voltage regulators when you are working with single voltage feeder motors. 当在单电压喂料电机下工作时，使用电压调整器

2. Use *3 phase motors*. 用三级电机。[R]

3 Phase Motors三级电机

- Three phase motors are more reliable and generally run cooler and last longer than single phase motors. But they also require three phase electricity and are a higher initial investment.三级电机较可靠，总的进行冷却，较单极电机用的长，但是他们也要求三级电流和较高的启动投资R

Segregation and Loss of Vitamins& Minerals维生素和矿物质的隔离和损失

There is a chance that some of the added vitamins and minerals may be destroyed, segregated or removed due to other parts of the production line, such as pneumatic suction or sieving. This may be discovered upon quantitative testing. Vitamin A and riboflavin are particularly vulnerable. 一些添加的维生素和矿物质有时可能被损坏了，隔离或去除，由于其它生产线，例如气力吸风或筛选，这可以通过数量实验发现。VA和核黄素特别易受损害。

ACTIONS:措施

- Confirm that you are using a premix that is appropriate for your flour.
  确认你采用的预混料是适合你的面粉特性的。

- Check the dust collector. Excess riboflavin will give the dust a yellow color. Quantitative testing will need to be done to identify other vitamins and minerals that may be present. If this is the case, alter or remove the pneumatic suction after the point of addition, or fortify the flour at a later stage of the milling process. 检查灰尘收集器，过剩的核黄素使灰变黄，也需做数量测试是否含有维生素和矿物质，如果有这个情况，在添加点拆开更换或去除或在加工过程后期强化面粉。

- Make sure that the flour is not exposed to high heat (>40° C) or light during after the premix has been added.确定在添加预混料后面粉没有暴露在高温下（大于40度）或光下。
- Do not run the flour through purifiers or under heavy suction after you've added the premix. Purifiers need to be installed earlier in the production line.加入预混料后不要用清粉机或在强力吸风下运行，清粉机需安装在生产线的前端。 R

第四部分: 保证质量控制

- 质量控制系统的重要性
- 关注安全
- 阐述质量控制测试
- 总的质量控制方法
- 记录保留
- 喂料量跟踪
- 铁抽样测试
- 用营养指示计作数量测试
- 外部定量测试
- 质量控制进度表
- 权威机构外部跟踪
- 示范

质量控制系统的重要性

- 面粉业主在确保国家努力带给人们的强化面粉成功上取了巨大的作用，获得令客户满意的强化面粉产品
- 一个均衡的高质量的强化产品需使客户满意和满足政府的标准
- 在面粉厂和纵观国家强化计划的整体水平，好的质量要求有好的发展和综合质量保证及控制程序。R

监测强化面粉

强化监测从三方面进行:

1. **内部监测** (质量保证和控制) 通过厂家, 从中心面粉协会得到可能的帮助。
2. **外部监测** (食品控制和强制) 通过政府。
3. **覆盖和效果追踪**，由政府和指定的机构。

半定性面粉试验

- 铁抽样试验和维生素A颜色试验当用知道的面粉强化样品恰当的做试验对一个未知的样品在强化标准上提供粗略的估计。
- 如下描述的计量是一种能报告结果的方法。
  - 无强化检测
  - 低标准
  - 正常标准
  - 高标准
  - 很高标准

定性面粉试验

- **定性试验是简单和快速的试验在加工厂即可进行并确定如果面粉样品已经强化或没有强化，通过一些试验程序获得一个预估的是否是在强化中或过强化了的。**
- 用于此目的的初步试验是**铁抽样试验** [更多的信息见相关的这一程序]
- 有些情况下铁抽样试验不能使用因为其添加的铁的类型和水平。在那种情况下可供选择的定性试验为：
  - **核黄素黑光试验** - 核黄素在紫外光下发荧光. 此试验需在黑屋或盒子里用湿的光滑的面粉与没强化的和标准强化的比较。
  - **维生素 A 颜色试验** – 这是一个稍微棘手的试验需在试验室进行，它是基于比较蓝色的强度以铜硫酸盐为一个标准溶液形成的维生素A
- 这些二择选一的试验对铁的抽样试验是不好的替代方式。一个建议是始终有一些元素铁包括在预混料中作为**标记**,但要认识到如果在定量检测时这将增加铁的总含量.

关注安全

50多年的经验证明面粉强化是非常安全和较低风险的，通过建立质量管理和控制程序是容易控制的。

与面粉强化关联的两个安全事宜:

1. 建立安全和适当的标准:

   在食品中维生素和矿物质的国家强化标准必须制定得足够高以确保有足够的营养成分提供，但确要保证消费者在长期的消费微量营养素时是较低的风险水平.

2. 防止过分强化的面粉事故发生:

   在面粉强化中通过设定一个实际标准用设备和程序监测预混料和微量营养素的水平可熟练的避免矿物质和维生素添加过量。

   - 操作人员能容易的认识到如果要通过常规的质量控制测试添加一个比预期高的预混率，另外，过强化面粉由于铁和核黄素其显示的颜色过重使大多数消费者不能接受。[R]

面粉厂总的质量控制方法

- 在生产过程中检测强化的标准程序必须确保结果可靠，如果有问题出现能立即快速执行校正行动。
- 作为其它质量保证和质量控制程序两者强化的过程和结果需要追踪和记录。R
- 在所有面粉厂用于面粉强化的基本质量控制方法在常规基础上应该相对的快和简洁.

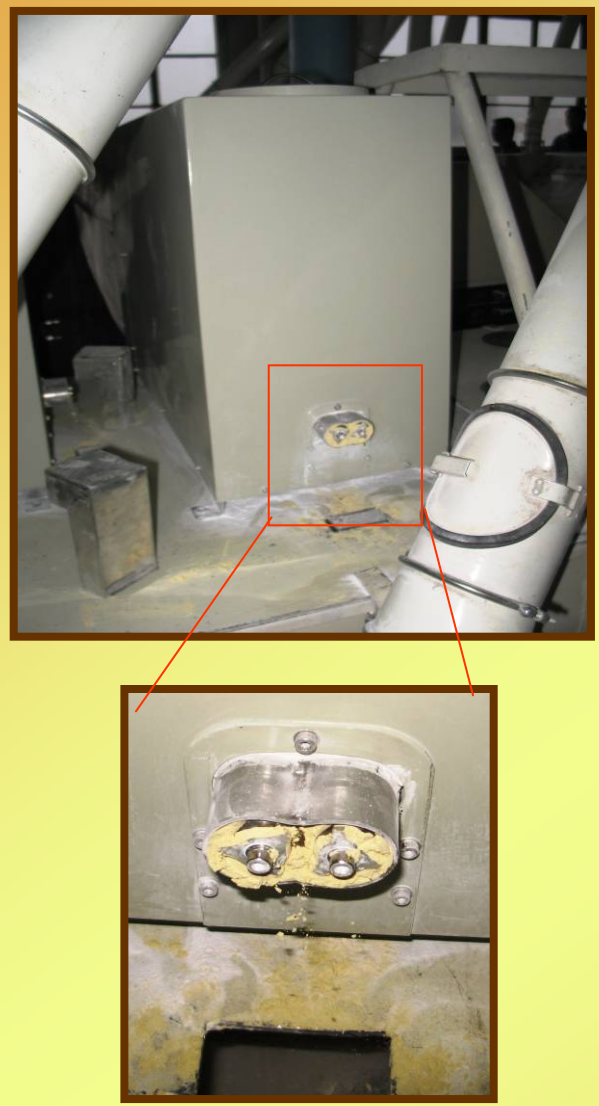
  1. **预混料使用和强化面粉生产记录保留**
  2. **预混料喂料量和面粉流量的监测**
  3. **定性试验（铁抽样试验）**
  4. **定时的送样品做定量试验**

- 除了万一有特殊问题，其调整需依照整个时间的趋势而不是任何一时间测试的结果。

记录保留

- **预混和记录:** 在发货和预混料的使用上检查, 记录和保持信息. *点击这里看一有关预混料质量控制日志的例子。*
- **面粉生产记录:** 收集和保持信息生产了多少强化面粉. *点击这里看一有关面粉生产质量控制日志的例子。*
- **预混料使用调和:** 调和和记录预混料与相对目标需要的实际使用情况，所用的预混料数量应该与对应的面粉生产记录比较并进行记录。这能提供简单的确定方法如果正确的预混料量在使用。R
- **质量控制测试记录:** 那些在外面做的和在米厂进行的质量控制测试结果都必须认真的记录并存档这些文件记录了历史和生产者在强化过程中的监督情况。 R

喂料量监测



第三部分工具包描述了依据面粉生产量如何在预混喂料器上设定喂料量及选择正确的喂料量。

非常重要的是要连续的有规律的进行称量检查以确保喂料器喂料量保持稳定。

提示语 ：检查称量: 预混料卸料量超过规定的时间（1到2分钟）将与预混料的目标量进行测量和比较。

铁抽样试验

(幻灯片6中第 1)

这是面粉企业在进行质量控制确保正确的预混料加入到面粉中并得到均衡的产品的最普遍使用的测试法。

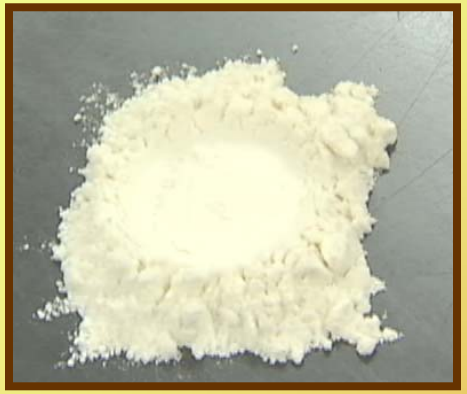
1

多长时间进行一次:

在真个开机和停机生产中每四小时一次。

试验了什么？:

在生产线末端取样（通常优先在打包处也可以在成品储藏间袋中取样测试。



2

方法描述:

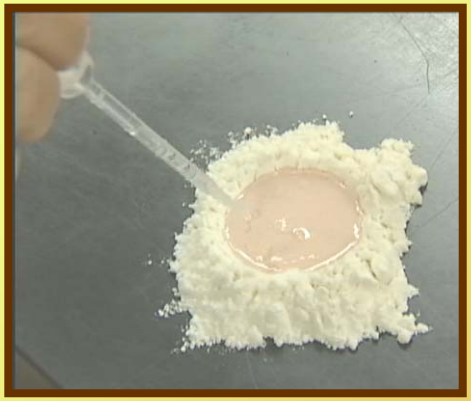
此种方法是由AACC同意的可用于强化面粉中铁的定性确定.

亚铁添加到面粉中有硫酸氢盐(KSCN)试剂反应形成一种红的合成物。

强化面粉与没处理过的面粉比较有较高比例的红点和较深的红色出现。R

铁抽样试验

(幻灯片6中第 2)



抽样试验的优点 R

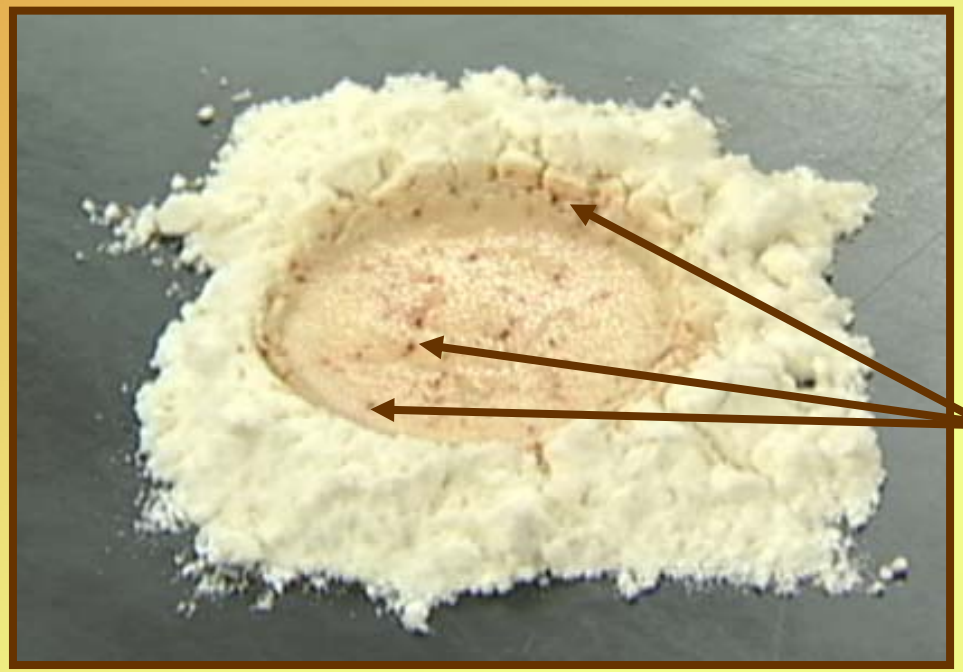
- 简单，快捷，技术容易无样品预处理要求.
- 费用低;仅需两种试剂, KSCN (or NaSCN) and HCl,
- 最小限度的人员培训即可进行此化验
- 无需实验室要求（在粉车间即可进行。）

局限

- 不能定量，例如在样品中不能确定铁当时的数量
- 其方法显示仅仅含亚铁，如果铁加入在亚铁里在分析前样品需要用过氧化氢氧化来转化亚铁为三铁。
- 仅能用NaFeEDTA做

铁的抽样试验(幻灯片 6张中第3)

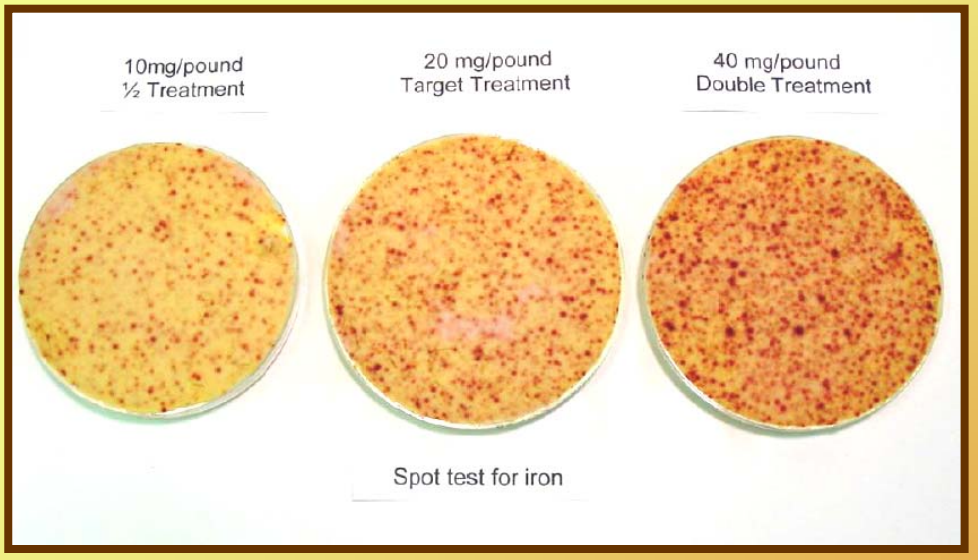
6



点击这里看一有关铁抽样试验的程序的短片

红点为
抽样点

7



铁抽样试验

(幻灯片6中第 4)

- 万一有关注这种试剂的安全性，可以用食品级 的NaSCN 。但是使用它时应特别注意比如任何浓缩化合物。
- 抽样试验工作最好用基本铁粉，用NaFeEDTA和一些 NaFeEDTA 产品生产没有斑点，差，仅有略带红色的背景颜色。
- 有许多不同的方法粉厂药剂师用于准备面粉做试验。
  - *最简单的方法是加深*，用50 cc 的大口烧杯放入一小堆面粉置于工作台上用塑料加入试剂，用可弃的点滴器和当完成后将面粉扫入废物框。
  - *其它面粉准备方法需更多时间但得到更好的半定量结果。方法1是制作一湿的Pekar滑的试验用两个不知和知道的样品，将试剂溶入湿滑中*。Muhlenchemie (info@muehlenchemie.de公司网址: www.muehlenchemie.de) **有一特殊准备的提供改进的量化程序**

铁抽样试验(幻灯片6中第 5)

- 在标准程序中一个修正的程序使在面粉中强化铁粉用方案of 1 part 1 N HCl 和 6 parts 甲醇或变性的乙醇在 2 N HCl 的地方得到好的效果。这个方案非常稳定能保持数月。这个程序在白色背景下有黑点能避免用强酸的方案。

铁抽样试验

(幻灯片6中第 6)

从抽样试验中适当的作响应

- 在日常生产运行期间（按需要每2，4，8小时取一次）单个抽样试验结果显示比目标水平多或少的污点将不是理由去调整微量营养素的喂料系统。
- 通过抽样试验和定量试验发现一定数量的铁总是有一些可变性。
- 如果系统在整个时间段上的趋向（例如持续的低和高或趋向低和高）通报了，必须要进行调整。
- 在一个或两个抽样试验结果的基础上调整预混料添加系统，当保证不调整可能是扩宽了系统的可变性和将来的检测的复杂性。
- 当在整个时间段用几种测量方法计算，铁的抽样试验中观察到铁的水平有较低和较高时，必须采取措施。
  - 检查预混料喂料器和面粉运送和混合机器和如果有必要进行调整
    - 取另外一样品做试验

强化面粉定量试验

- 强化面粉的定量试验大多经常送出去分析，通过用比粉厂还精细的设备和相当有经验的和有生产量的实验室
- 典型的实验将预混料成分用作其它的指标来作。这种方法对预混料来说是有效的办法。已恰当的设计，制造和混合以达到不同营养素的比率连续。.
- 因为比率是连续的，测量面粉中的一种微量营养素能检验其它交货的情况。
- 预混料加入后假定那已经没有破坏或微量营养素指标的分离
- 铁通常被用作一种营养素指标但是当添加时维生素A也用。

外部定量试验 (幻灯片6中第1)

- 在强化面粉中维生素和矿物质的定量试验要求精细的设备和仔细的依赖草案因为维生素和矿物质的量与面粉相比太少了。
- 对粉厂的定量试验应该在，合成样品应在生产线上或成品库和粉厂送检的备有证明文件下做。
- 结果的准确性问题应参考已鉴定的，用官方同意试验程序的参考实验室。

- 强烈推荐任何实验室做定量试验：
  - •用食品强化标准加鉴定的微量营养素水准去修正结果中任何的偏离
  - • 经常地用面粉强化标准来评估实验室分析每个化验的误差

外部定量试验 (幻灯片6中第 2)

收集强化面粉混合样品

- **合并样品通过混合在横跨一个生产班次的间隔空余时间取得强化面粉小样产生的。**
  - 合并样品由5到10个抽样样品制成应该有批量生产代表性，例如8 小时运转。
  - 样品制成合并样本应该是相同规格在整个生产过程中均匀取样的，以便在此期间体现总的生产。
  - 合并样品的目的是估计在生产运行中平均的营养价值。用合并样品通过限制试验数量需要建立一平均值的估计保持强化分析成本低。
  - 一种或甚至几种高或低营养价观测的回应是完全不相称的定量试验应用，主要目的是随着时间的变化建立一趋势当用此种方法时是一种有价值的工具。

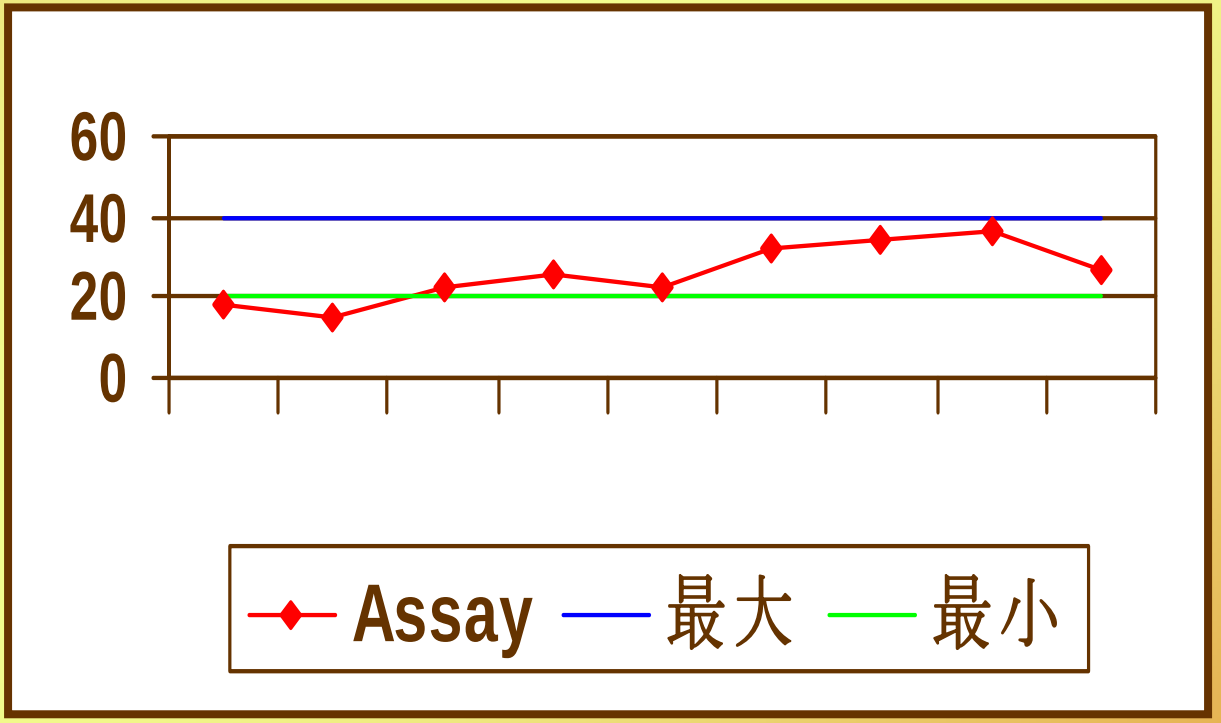
外部定量试验 (幻灯片6中第 3)
均匀度或粉厂产量测试

- 当粉厂首先开始强化他们希望确定生产均匀的强化面粉的产量。
- 这通常是通过在生产运行中定量试验一种指示营养的（铁）抽样面粉样品（不是合并样品）来做。建议再8小时运行中取7个样品。
- 计算变异系数=标准偏移作为平均百分比。
- 如果知道哪个化验的实验室分析误差低于5%, 变异系数低于 20% 表示可接受的可变性。如果变异系数高于 20%，粉厂应该调查其变化的原因，例如面粉喂料量或预混添加误差的变化。.

外部定量试验 (幻灯片6中第 4)

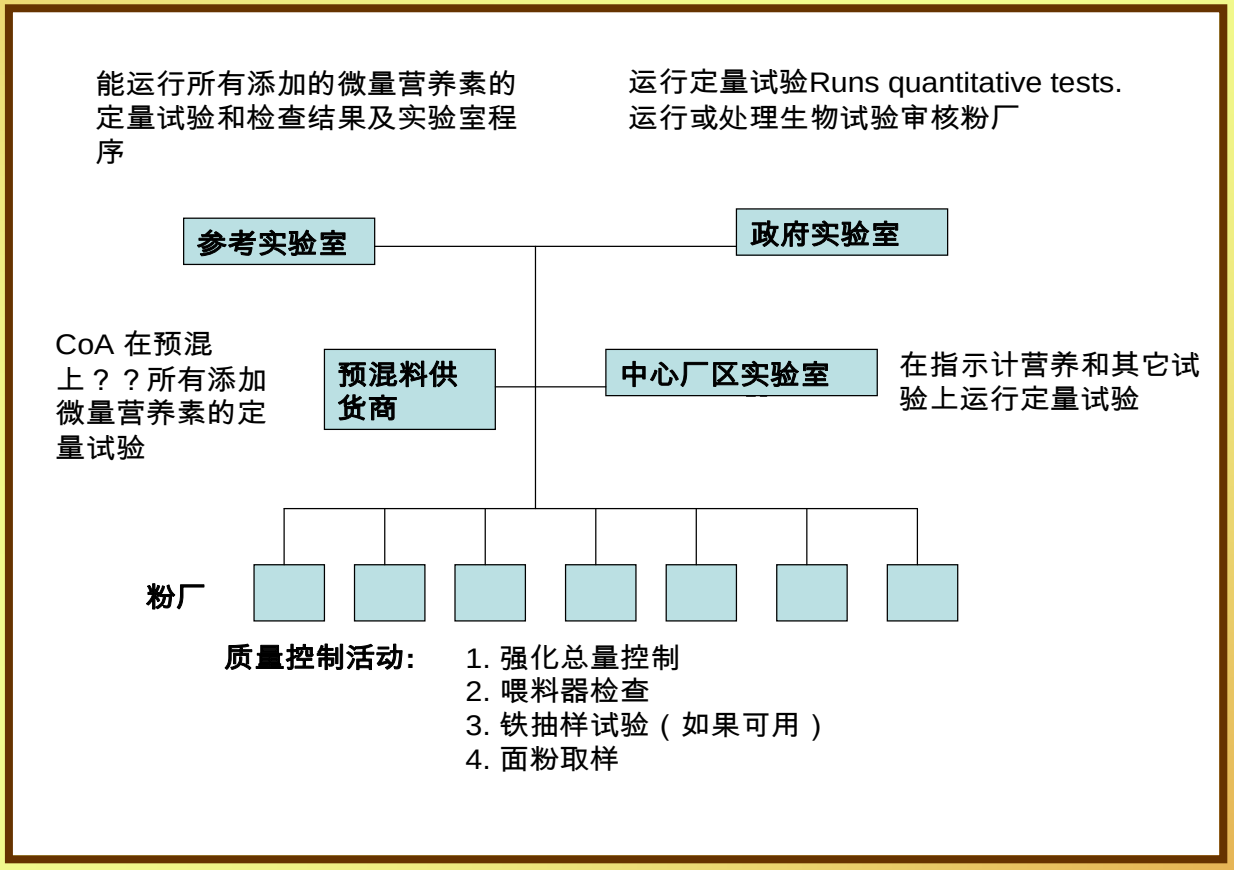
定量试验结果的利用

- 厂家不应仅仅依据单一的分析结果来调整添加量
- 长期的去向将影响你是否调整预混料的量增加或减少或要求从供货商拿不同的预混料配方。
- 任何决定和改变应当以随着定性试验时间过去的多种情况的趋向为基础。 通过测绘一个标准的控制图表这是最好的见证。



部定性试验 (幻灯片6中第 5)

面粉定性试验室
这个方框图显示在不同试验室所做的有关面粉强化试验的类型



外部定性试验 (幻灯片6中第 6)

面粉测试实验室

- 中心实验室可以是制粉协会，大型面粉公司或独立实验室/组织指派的一部分，提供给工厂日常的试验服务，特别是小型面粉厂没用试验能力。这将包括通常工厂本身不常做的微量营养素指标的数量试验。
- 政府实验室和食品控制中介与中央政府的执行和调整功能相关联。它可以做在工厂审核期间从工厂，家和市场收集来的面粉样品的数量试验，它的分析能力较先进，也可介入覆盖和效力研究。
- 参照试验室通常在外面，通过鉴定的有能力对所有添加的微量营养素进行数量试验。它可以是在另一个国家。通常用于解决在强化水平上的争端决定是否其他实验室提供精确的结果。
- *预混料供应商有他们自己的化验预混料微量营养素含量的实验室。他们也可提供给他们的预混料客户面粉试验服务、通常不收费。*

质量控制进度表

(幻灯片2中第1)

建议的工厂强化面粉质量控制水平的行动:

1. 每小时检查预混喂料器控制器 (低料位显示器没亮和速度显示器显示在运行。)
2. 运行喂料器检查重量至少每8小时一班进行。
3. 运行铁斑点试验至少每8小时一班进行
4. 至少每季度进行详细预混料使用和强化面粉生产的控制。
    - 责任，周期，草案和报告上述行动应该在工厂质量手册中写出，与参与的所有人沟通。所有报告须有权威和能力的人来完善信息。

质量控制进度表：动态监测

(幻灯片2中第2)

问题和行动: 调整质量控制测试次数：

- 如果现场试验显示微量营养素测试的水平低于工厂低值或高于最大误差值，那么取样频率应该增加并将采取正确的行动。
- 如果5个连续取样期结果的两个失败，不能满足技术要求，取样的强度应该改变为一个更多要求的和采取正确行动。
- 如果5个连续取样期结果的两个失败，不能满足生产要求应该停止直到错误来源被找到，必要的更正方法将提出。
- 一旦生产又开始，取样将经常进行。
- 很少频繁的采用时间调整，如果在三个连续的取样期，每类，质量控制结果是正确的。 R

通过有关权威机构外部监测

(幻灯片2中第1)

在面粉强化上外部权威机构的作用

- 检查性能和记录生产者的质量保证程序（技术或场外审核）
- 确定在工厂，包装现场和国家入口点产品要达到的技术规格（检验或现场审核）.
- 检测和合法依从的查证（应该通过数量化验依据对微量营养素含量进行分析评估。
  - 所有的样品应该包含强化，至少在工厂，重要现场和仓库应该抽法定的最少80%的样
  - 少于20%应该有一种微量营养素含量，但是总是接近最大误差水平，如果一个已经建立起来。

点击这里链接维生素和矿物质上下限水平推荐技术文件。

权威机构外部监测

(幻灯片2中第2)
政府部门审核

有两种审核类型.

- 一种称作技术或现场外审核，是否政府官员或指派者将工厂送检的信息复查，或制粉联合体如果他已经被指派去采集数据，决定是否他们正确的强化面粉，此工作可按季度进行。（见工厂报告格式样式）
- 其他形式的审查是在现场，当局的环境健康官员参观工厂决定如果工厂正确的强化面粉和有效的数据提供给现场外审核。（见工厂检查单样式）
- 一些政府食品控制机构将根据过去生产任务的好坏和多少有关工厂的抱怨和违反报告调整在现场审核的频率。

Upper Levels 上限水平

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Table 5.3 Maximum safe levels in flour

Nutrient	*Upper Level (UL)* *From the Food and Nutrition Board of the U.S. Institute of Medicine, 2001* mg/day	*Amount needed in flour for 540 grams (2000 kcal) to exceed UL* ppm
Iron	45	83
Zinc	40	74
Calcium	2500	4630
Selenium	0.4	0.74
Iodine	1.1	2.0
Folate	1	2.6
Vitamin B_1	none	
Vitamin B_2	none	
Niacin	35[14]	72
Vitamin B_6	100	206
Vitamin B_{12}	none	
Vitamin A	3.0 or 10,000 IU	6.2 mg/kg or 20,600 IU/kg
Vitamin D	0.050 or 2,000 IU	3,700 IU/kg

[13] South Africa has separate standards for the final level of micronutrients in different types of maize.
[14] The UL for niacin is based on its vasodilatation effect, which is less of a problem with niacinamide. The Scientific Committee for Food in the European Union has proposed a UL for nicotinic acid of 10 mg and a separate UL for niacinamide of 900 mg. Thus the later form poses no safety limitations in common food fortification practice.

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