WHEAT MARKETING CENTER

U.S. Wheat Classes & Flour Quality Characteristics
美国小麦类型和面粉质量特点

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技术总监 简柏克

U. S. Hard Wheat
美国硬麦

Hard Red Spring (HRS)　硬红春麦(HRS)

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What is HRS Wheat? – The Market Class
硬红春麦 – 市场类型

Hard red spring (HRS) is one of the six major U.S. wheat classes 硬红春麦 (HRS) 是美国六大类小麦之一

3 subclasses 它有三个子类型:

Dark Northern Spring: ≥ 75% dark, hard, and vitreous kernels (DHV)

褐色北方春麦：含75%或以上的深褐色、坚硬、玻璃质状籽粒(DHV)

Northern spring: < 75% and ≥ 25% DHV

北方春麦：含25-74%的DHV

Red spring: < 25% DHV

红春麦：含不到25%的DHV

Grade requirements for U.S. No. 1 HRS 美国一等硬红春麦的等级要求:

≥ 58 lb/bu test weight 容重≥58磅/蒲式耳（76.4公斤/百升）

≤ 3% total defects 总缺陷粒≤ 3%

≤ 3% wheat of other classes 其他类型小麦≤ 3%

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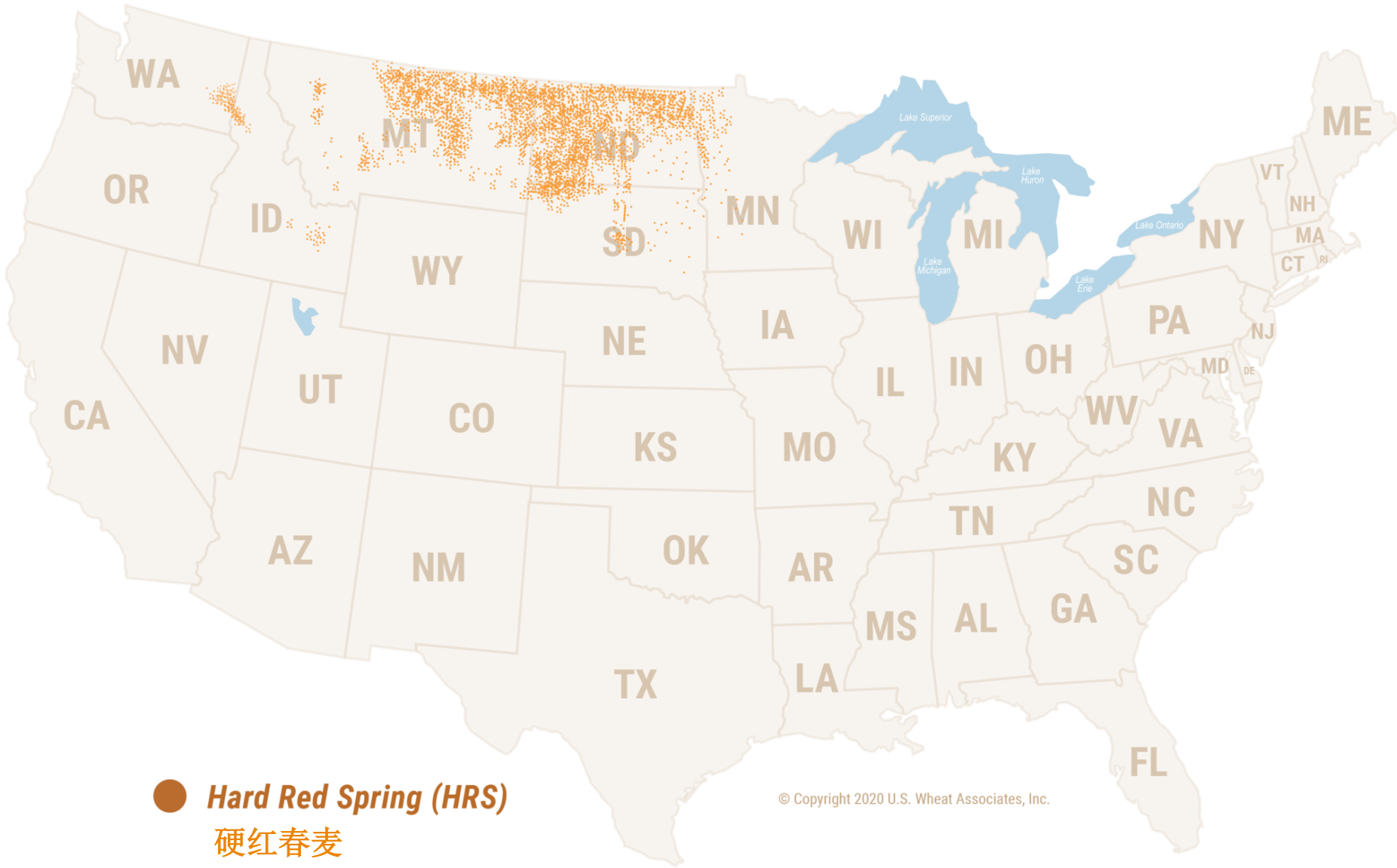


Cultivating HRS Wheat
硬红春麦的种植

Best performance observed in northern growing regions 最适合在北部产区种植

- Northern U.S. (MT, ND, SD, MN, ID, WA, and OR) 美国北部（蒙大拿州,北达科他州,南达科他州,明尼苏达州,爱达荷州,华盛顿州和俄勒冈州）
- Canada 加拿大

Nitrogen required to maintain high protein levels 需要氮以获得高蛋白

- Requires ~3 lbs N/bu to maintain 14% protein 需要约3磅/蒲式耳的氮才能有14%蛋白
- Premiums for > 14% protein HRS incentivize the use of N 大于14%蛋白的溢价将促进氮的使用

HRS yield is lower than HRW 硬红春麦的单产低于硬红冬麦

- Further incentivizes good N management to offset yield losses 更需要良好的氮管理，以弥补单产损失

16 MMT currently grown annually in the northern U.S. 目前美国北部年产量1600万吨

- Accounts for 20% of all wheat grown in the U.S. 占全美小麦总产量的20%

HRS Wheat Characteristics
硬红春麦特点

The U.S. wheat class system is designed to clearly separate wheat for different end uses 美麦的分类体系，明确区分不同最终用途的小麦

- Specific quality characteristics must be met in order to be included in a given class
  必须符合特定的质量特点，才能被归于某一类小麦
- As a result, each class has specific end uses 因此，每个类别小麦都有特定的最终用途

HRS wheats have quality characteristics that are especially suitable for hearth breads, rolls, bagels, and pizza crusts 硬红春麦的质量特点令其特别适用于炉火面包、面包卷、贝果和披萨饼皮

- High protein, strong gluten, high water absorption 蛋白高，面筋高，吸水高
- Superior performance in frozen dough products 用于冷冻面团产品，表现优异

HRS Flour Quality: Table 1. 2018 DNS Flour Quality Data
硬红春麦面粉质量：表1. 2018年DNS面粉质量数据

	DNS by Protein 不同蛋白的DNS			
	Low 低蛋白	Medium 中蛋白	High 高蛋白	Overall 总体
Farinograph				
Peak Time (min)	6.3	7.2	8.6	7.7
Water Absorption (%)	62.6	63.8	64.8	64.1
Stability (min)	8.9	9.7	12.3	10.8
Extensograph				
Energy at 45/135 min (cm^2)	130 / 132	115 / 146	112 / 154	116 / 147
Extensibility at 45/135 min (cm)	15.6 / 13.2	15.8 / 13.9	16.3 / 12.9	16.0 / 13.2
Rmax at 45/135 min (BU)	504 / 746	538 / 813	523 / 922	523 / 855
Alveograph				
P (mm)	104	101	92	97
L (mm)	109	124	150	134
P/L ratio	0.96	0.81	0.61	0.72
W (10^{-4} J)	377	411	432	415
Protein ranges: Low, <13.5%; Med, 13.5 - 14.5%; High, >14.5%			*From: U.S. Wheat Associates. 2018 Crop Quality Report*	

From: U.S. Wheat Associates. 2018 Crop Quality Report.

HRS Flour Quality Characteristics 硬红春麦面粉质量特点:

Table 2. DNS and CWRS Flour Quality Data 表2. DNS和CWRS面粉质量数据

Farinograph 粉质仪	DNS	CWRS
Water Absorption (%)	64.3	64.5
Stability (min)	18.6	10.6
Extensograph 拉伸仪		
Energy at 135 min (cm^2)	207	157
Extensibility at 135 min (cm)	182	213
Rmax at 135 min (BU)	891	574

*From: Dr. Soon-Bin Neoh. Presentation. Mar 24-26 2018.

HRS End Product Quality
硬红春麦最终产品质量

HRS wheat is selected for 选择硬红春麦(HRS)是因为:

- Higher protein 蛋白更高
  - About 2 – 3% higher average protein than HRW 比HRW平均高2-3个百分点
- More strong high molecular weight glutenin subunit combinations (e.g. 5 + 10) 更强的高分子量麦谷蛋白亚基组合（例如5+10）
  - Results in stronger gluten profile 因此面筋更强

As a result, HRS has 在实际应用中，HRS具备:

- Higher water absorption 更高的吸水率
- More strength for intensive processing 筋性更强，耐加工

This makes HRS more suitable for hearth breads, bagels, and frozen dough systems 因此HRS更适合做炉火面包、贝果以及冷冻面团产品

U. S. Hard Wheat
美国硬麦

Hard Red Winter (HRW) 硬红冬麦(HRW)

WHEAT MARKETING CENTER

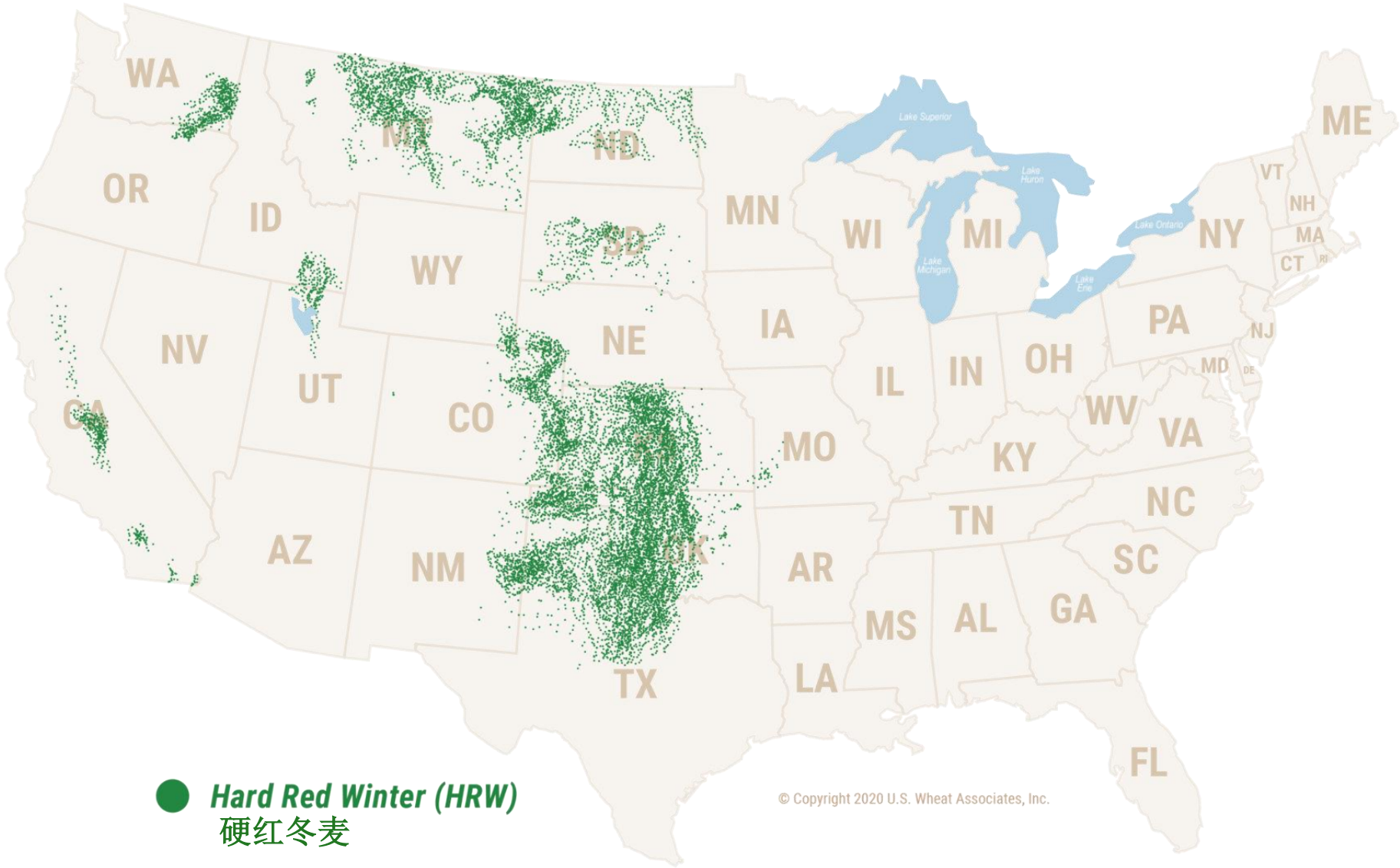
What is HRW Wheat? – The Market Class
硬红冬麦 – 市场类型

Hard red winter (HRW) wheat is one of the six major U.S. wheat classes 硬红冬麦(HRW) 是美国六大类小麦之一

- Most prevalent class grown in the U.S. 美国产量最大的类型
- No subclasses 没有子类型

Grade requirements for U.S. No. 1 HRW 美国一等硬红冬麦的等级要求:

- ≥ 60 lb/bu test weight 容重≥60磅/蒲式耳（78.9公斤/百升）
- ≤ 3% total defects 总缺陷粒≤ 3%
- ≤ 3% wheat of other classes 其他类型小麦≤ 3%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Lake Superior
Lake Huron
Lake Michigan
Lake Erie
Lake Ontario
Hard Red Winter (HRW)
硬红冬麦
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Cultivating HRW Wheat
硬红冬麦的种植

Best performance observed growing regions with moderate winters 最适合在冬季较温和的产区种植

- Southern U.S. Plains and PNW (KS, OK, NE, TX, WA, OR, and ID) 美国南部平原以及太平洋西北地区（堪萨斯州,俄克拉荷马州,内布拉斯加州,德克萨斯州,华盛顿州,俄勒冈州和爱达荷州）
- Russia, Ukraine, Kazakhstan, and Argentina 俄罗斯,乌克兰,哈萨克斯坦,阿根廷

Must ensure wheat survives the winter 必须确保小麦能越冬

- Most growers plant in stubble to protect from cold temperatures and retain moisture from snow 大多数农民会将小麦播种在上季作物的残茬间，以抵御严寒，并留住冬雪带来的水分
- Split nitrogen application required – at planting and early spring 需要分次施氮肥 – 播种时以及早春时

HRW yield is higher than HRS 硬红冬麦的单产高于硬红春麦

- Offers an economic advantage over HRS despite HRS protein premiums 虽然硬红春麦有蛋白溢价，但硬红冬麦的经济回报更高
- Increasingly loses out to corn due to low commodity prices for HRW 但硬红冬麦价格低，面积越来越竞争不过玉米

22 MMT currently grown annually in the U.S. 目前年产量2200万吨

- Accounts for 40% of all wheat grown in the U.S. 占全美小麦总产量的40%

HRW Wheat Characteristics
硬红冬麦特点

The U.S. wheat class system is designed to clearly separate wheat for different end uses
美麦的分类体系，明确区分不同最终用途的小麦

- Specific quality characteristics must be met in order to be included in a given class
  必须符合特定的质量特点，才能被归于某一类小麦
- As a result, each class has specific end uses 因此，每个类别小麦都有特定的最终用途

HRW wheats have quality characteristics that are especially suitable for hearth and flat breads, croissants, some Asian noodles, and all-purpose flours 硬红冬麦的质量特点，令其特别适用于制作炉火面包、扁平面包、牛角包、一些亚洲面条，以及通用粉

- Intermediate to high protein 中等至高的蛋白含量
- Intermediate gluten strength, moderate water absorption 面筋强度适中，吸水适中
- Adds strength to soft wheat flour blends, mellows HRS flour blends 与软麦搭配以增强筋性，与硬红春麦搭配以柔和筋性

HRW Flour Quality: Table 3. 2018 HRW Flour Quality Data
硬红冬麦面粉质量：表3. 2018年HRW面粉质量数据

	HRW by Protein不同蛋白的HRW			
	Low 低蛋白	Medium 中蛋白	High 高蛋白	Overall 总体
Farinograph				
Peak Time (min)	2.7	4.4	6.3	5.2
Water Absorption (%)	57.3	57.9	58.6	58.4
Stability (min)	7.0	11.7	13.5	12.2
Extensograph				
Energy at 45/135 min (cm^2)	107 / 130	98 / 119	115 / 162	107 / 145
Extensibility at 45/135 min (cm)	14.3 / 11.7	12.9 / 10.2	15.2 / 12.9	14.3 / 11.8
Rmax at 45/135 min (BU)	528 / 796	574 / 954	586 / 1047	570 / 991
Alveograph				
P (mm)	88	84	79	83
L (mm)	62	87	101	92
P/L ratio	1.42	0.97	0.78	0.90
W (10^{-4} J)	210	272	291	280
Protein ranges: Low, <11.5%; Med, 11.5 - 12.5%; High, >12.5%			*From: U.S. Wheat Associates. 2018 Crop Quality Report*	

From: U.S. Wheat Associates. 2018 Crop Quality Report.

HRW End Product Quality
硬红冬麦最终产品质量

HRW wheat is selected for 选择硬红冬麦(HRW)是因为:

- Higher protein content 蛋白高
  - Necessary to remain competitive with HRS 需要保持相对于HRS的竞争力
- A more balanced glutenin/gliadin profile 更平衡的麦谷蛋白和麦醇溶蛋白比例

As a result, HRW has 在实际应用中，HRW具备:

- More mellow gluten properties than HRS 比HRS更柔韧的面筋
- Suitability for a wider range of flour blends than any other class 相对于其他小麦类型，搭配使用的范围更广

More suitable for artisan and flat bread products where excessive strength is undesirable, some noodles, and as a blend improver 适用于不希望面筋太强的欧包和扁平面包、部分面条以及配麦等

U. S. Hard Wheat
美国硬麦

Hard White (HDWH) 硬白麦(HDWH)

WHEAT MARKETING CENTER

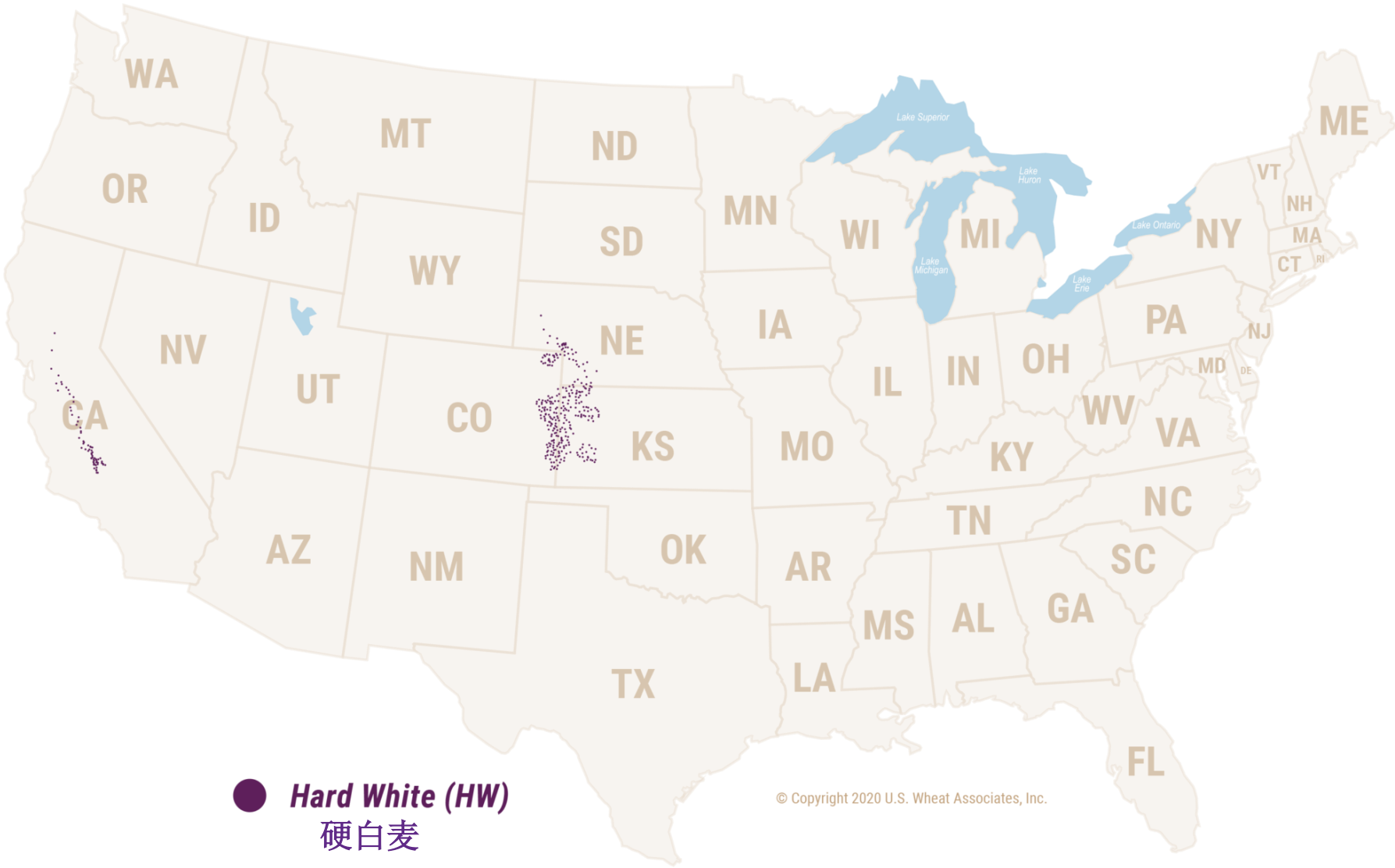
What is HDWH Wheat? – The Market Class
硬白麦 – 市场类型

Hard white (HDWH) wheat is one of the six major U.S. wheat classes 硬白麦(HDWH) 是美国六大类小麦之一

- No subclasses 无子类型
- Developed from hard red winter wheats 从硬红冬麦中培育而来
- Sweeter taste due to reduced tannins in bran 麸皮中单宁减少，味道更甜

Requires identity preservation and segregation 需身份保持和单独物流

- Increases costs for producers and end-users 增加生产者和最终用户的成本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Lake Superior
Lake Huron
Lake Michigan
Lake Erie
Lake Ontario
Hard White (HW)
硬白麦
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Cultivating HDWH Wheat
硬白麦的种植

Best performance observed in drier growing regions 最适合在较干燥地区种植

- U.S. Great Plains (CO, KS, OK, NE, MT, and ID) 美国大平原地区（科罗拉多州, 堪萨斯州,俄克拉荷马州, 内布拉斯加州, 蒙大拿州和爱达荷州）
- Australia 澳大利亚

Most acres are contracted in the U.S. 在美国，多为订单种植

- Requires certified seed to protect genetic purity 使用经认证的种子，以保护纯度
- Premiums average $0.10/bu over hard red winter wheats 价格平均比硬红冬麦高0.10美元/蒲式耳（3.7美元/吨）

HDWH yield is similar to HRW 硬白麦的单产和硬红冬麦相近

- More issues with PHS requiring drier growing conditions 病害问题更多，需要较干燥气候条件

~0.9 MMT currently grown annually in the U.S. Great Plains 美国大平原地区目前年产量约90万吨

- Account for ~2% of all wheat grown in the U.S. 占全美小麦总产量的2%

HDWH Wheat Characteristics
硬白麦特点

The U.S. wheat class system is designed to clearly separate wheat for different end uses 美麦的分类体系，明确区分不同最终用途的小麦

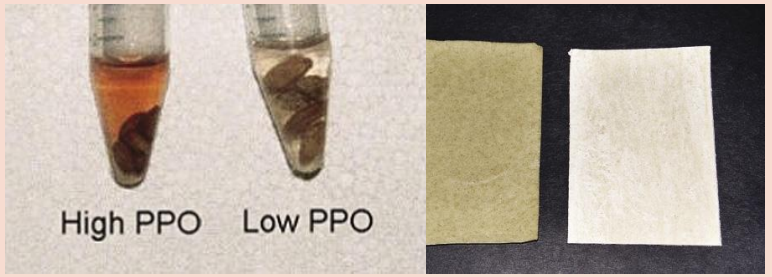
- Specific quality characteristics must be met in order to be included in a given class 必须符合特定的质量特点，才能被归于某一类小麦
- As a result, each class has specific end uses 因此，每个类别小麦都有特定的最终用途

HDWH wheats have quality characteristics that are especially suitable for whole wheat products, pan breads, flat breads, and Asian noodles 硬白麦的质量特点，使其特别适合于制作全麦产品、吐司面包、扁平面包以及亚洲面条等产品

- Intermediate to strong gluten profiles with good mixing stability 具备中等至较高的面筋强度，搅拌稳定性好
- Good starch pasting properties for noodle products 淀粉糊化特性好，适合面条产品
- Sweeter bran flavor in whole wheat/high extraction products 麸皮较甜，适合全麦类产品和高出粉率产品

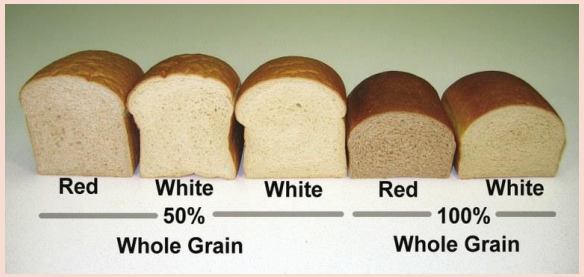
HDWH Wheat Characteristics
硬白麦特点

HDWH wheat kernels are similar to those of HRW with a white bran color 硬白麦籽粒形状与硬红冬麦相似，但表皮是白色



Lower PPO levels in many HDWH varieties grown in the U.S. 美国许多硬白麦品种的多酚氧化酶水平较低

- Better color in noodle and whole wheat products 因此面条和全麦产品的色泽较好



Higher flour extraction rates possible due to lighter bran color 表皮颜色浅，制粉时可以实现较高出粉率

- Higher fiber content that can be marketed to consumers 向消费者推广更高纤维含量的产品

HDWH Flour Quality: Table 4. 2018 HDWH Flour Quality Data

硬白麦面粉质量：表4. 2018年硬白麦面粉质量数据

HDWH by Protein不同蛋白的HDWH

	Low Protein 低蛋白	High Protein 高蛋白
Farinograph		
Peak Time (min)	7.2	11.4
Water Absorption (%)	60.1	61.4
Stability (min)	19.5	11.6
Extensograph		
Energy at 45/135 min (cm^2)	171 / 189	196 / 207
Extensibility at 45/135 min (cm)	20.7 / 15.3	23.4 / 14.6
Rmax at 45/135 min (BU)	697 / 1076	706 / 1237
Alveograph		
P (mm)	70	76
L (mm)	109	107
P/L ratio	0.64	0.71
W (10^{-4} J)	254	273
Protein ranges: Low, <11.5%; High, >12.6%	*From: U.S. Wheat Associates. 2018 Crop Quality Report*	

From: U.S. Wheat Associates. 2018 Crop Quality Report.

HDWH Baking Quality
硬白麦烘焙品质

HDWH wheat is selected for 选择硬白麦(HDWH)是因为:

- Low PPO 多酚氧化酶含量低
- Improved bran color, especially the aleurone layer 改善麸皮颜色，尤其是糊粉层

As a result, HDWH has 在实际应用中，HDWH令:

- Better color stability in fresh noodles 生鲜面条的色泽稳定性更好
- Brighter color, especially in whole wheat/high extraction products 全麦产品和高出粉率产品的色泽更好

More suitable for yeast breads, rolls, noodles, and whole wheat products 更适合做发酵类面包、面包卷、面条以及全麦类产品

U. S. Soft Wheat
美国软麦

Soft White (SWH) 软白麦(SWH)

WHEAT MARKETING CENTER

What is SWH Wheat? – The Market Class
软白麦 – 市场类型

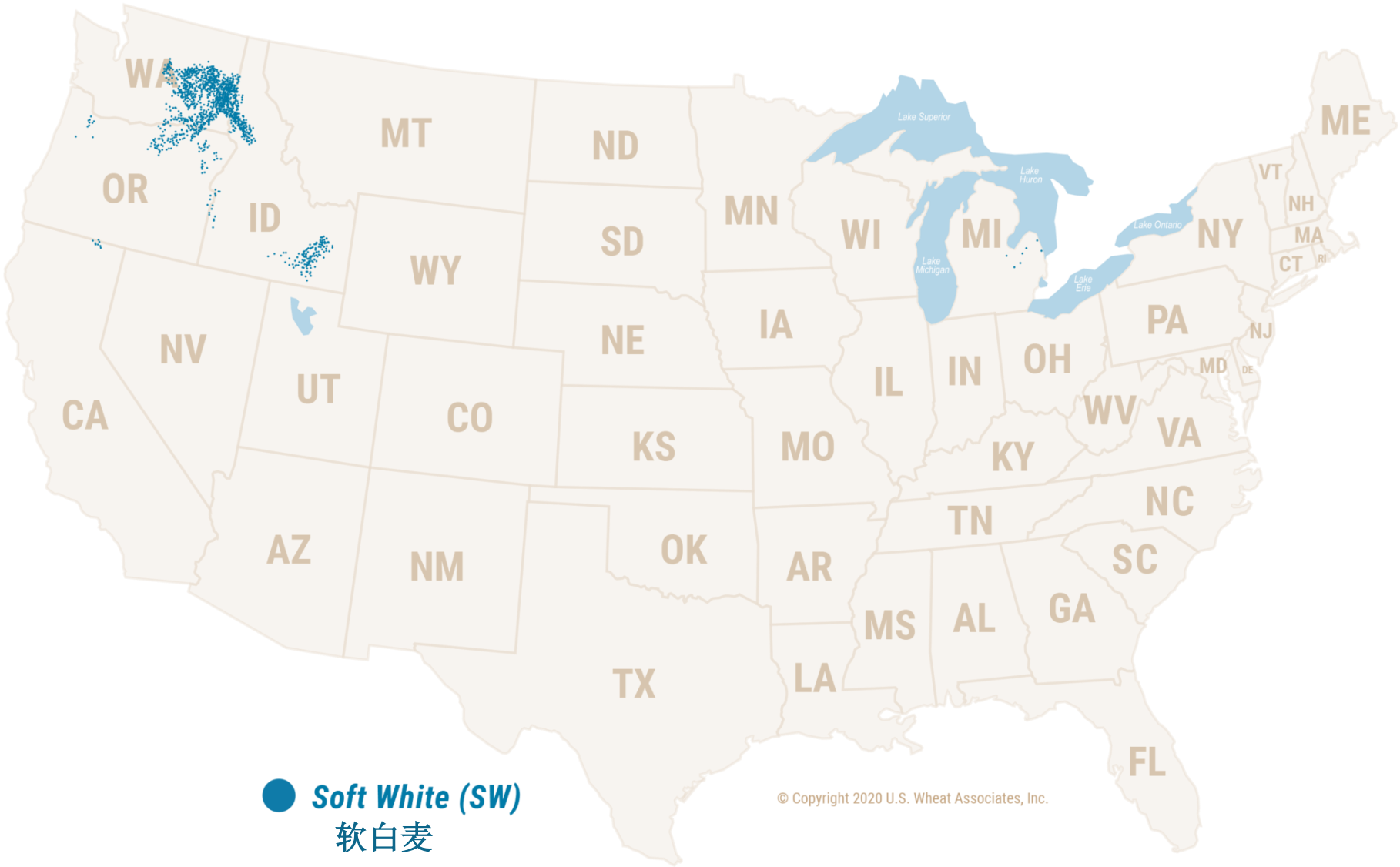
Soft white (SWH) is one of the six major U.S. wheat classes 软白麦(SWH)是美国六大类小麦之一

- 2 subclasses 两个子类型:
- White club wheat is low protein soft textured white wheat 密穗白麦是软质低蛋白小麦
- Western white wheat is a blend of SWH and white club wheats 西部白麦是普通软白麦与密穗白麦的混合

Western white wheat usually contains 10 – 30% club wheat 西部白麦一般含10-30%的密穗白麦

- Higher percentages of club wheat (up to 90%) can be included in a western white wheat blend if contracted 合同中也可约定西部白麦中更高的密穗白麦比例(最高90%)

Most common western white blend contains 20% white club wheat 西部白麦中最常见的密穗白麦比例是25%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Lake Superior
Lake Huron
Lake Michigan
Lake Erie
Lake Ontario
Soft White (SW)
软白麦
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Cultivating SWH Wheat
软白麦的种植

Best performance observed in low humidity growing regions 最适合在湿度较低的产区种植

- U.S. Pacific Northwest (PNW) 美国太平洋西北地区(PNW)

Very susceptible to Fusarium and other pathogens 较易感染镰刀菌及其他病菌

- Primary breeding focus is introducing disease resistance 育种的重点是抗病性

SWH yield is better than white club yield 普通软白麦的单产好于密穗白麦

- Better return for growers compared to white club wheat 对麦农来说普通软白麦的收益好于密穗白麦

5.5 MMT currently grown annually in U.S. PNW 目前美国PNW地区年产量550万吨

- Accounts for ~10% of all wheat grown in the U.S. 占全美小麦总产量的10%

SWH Wheat Characteristics
软白麦特点

Soft kernel texture with a white bran color 籽粒质地软，白色表皮

- Lower gluten strength and water absorption compared to hard wheat
  相比硬麦，软白麦面筋较弱，吸水较低

Best suited for cookies, cakes, and pastries 最适合做曲奇饼干、蛋糕和点心类产品

- White color is highly desirable 白色受青睐
- Lower protein better for light, delicate product texture 蛋白越低，产品质地越轻盈细腻
- Lower water absorption allows for more complete bake-off of water 面粉吸水越低，越有助于降低成品水分

SWH Flour Quality: Table 5. 2018 SWH Flour Quality Data
软白麦面粉质量：表5. 2018年软白麦面粉质量数据

SWH by Protein 不同蛋白的SWH

	Low 低蛋白	Medium 中蛋白	High 高蛋白	Overall 总体	Club 密穗
Farinograph					
Peak Time (min)	1.5	2.0	2.4	2.7	1.5
Water Absorption (%)	50.8	51.9	52.8	52.2	49.9
Stability (min)	3.9	3.3	2.1	2.9	1.4
Extensograph					
Energy at 45 min (cm^2)	58	60	59	62	20
Extensibility at 45 min (cm)	16.4	18.2	20.9	18.9	14.2
Rmax at 45 min (BU)	232	214	183	221	118
Alveograph					
P (mm)	35	32	31	32	21
L (mm)	76	100	134	121	79
P/L ratio	0.46	0.32	0.23	0.26	0.27
W (10^{-4} J)	74	81	85	83	31
Protein ranges: Low, <9.0%; Med, 9.0 - 10.5%; High, >10.5%			*From: U.S. Wheat Associates. 2018 Crop Quality Report*		

From: U.S. Wheat Associates. 2018 Crop Quality Report.

SWH End Product Quality
软白麦最终产品质量

SWH wheat is selected for 选择软白麦(SWH)是因为:

- Lower protein 蛋白较低
  - About 2-5% lower average protein than hard wheats 平均比硬麦的蛋白低2-5百分点
- Fewer high molecular weight glutenin subunits 较少的高分子量麦谷蛋白亚基
  - Results in weaker gluten 面筋较弱

As a result, SWH has 在实际应用中，SWH:

- Lower water absorption 吸水较低
- Fewer quality differences over a wider range of proteins 蛋白差异范围大，但对品质影响很小

This makes SWH wheat more suitable for delicate cakes, cookies, and pastries
因此软白麦(SWH)小麦非常适合用于制作精致蛋糕、曲奇饼干和甜点等产品

U. S. Soft Wheat
美国软麦

Soft Red Winter (SRW) 软红冬麦(SRW)

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What is SRW Wheat? – The Market Class
软红冬麦 – 市场类型

Soft red winter (SRW) wheat is one of the six major U.S. wheat classes
软红冬麦(SRW) 是美国六大类小麦之一

- Most prevalent soft wheat class grown in the U.S. 美国种植最广泛的软麦类型
- No subclasses 无子类型

Grade requirements for U.S. No. 1 SRW 美国一等软红冬麦的等级要求:

- ≥ 60 lb/bu test weight 容重≥60磅/蒲式耳（78.9公斤/百升）
- ≤ 3% total defects 总缺陷粒≤ 3%
- ≤ 3% wheat of other classes 其他类型小麦≤ 3%
- < 2.0 ppm DON 呕吐毒素< 2.0 ppm

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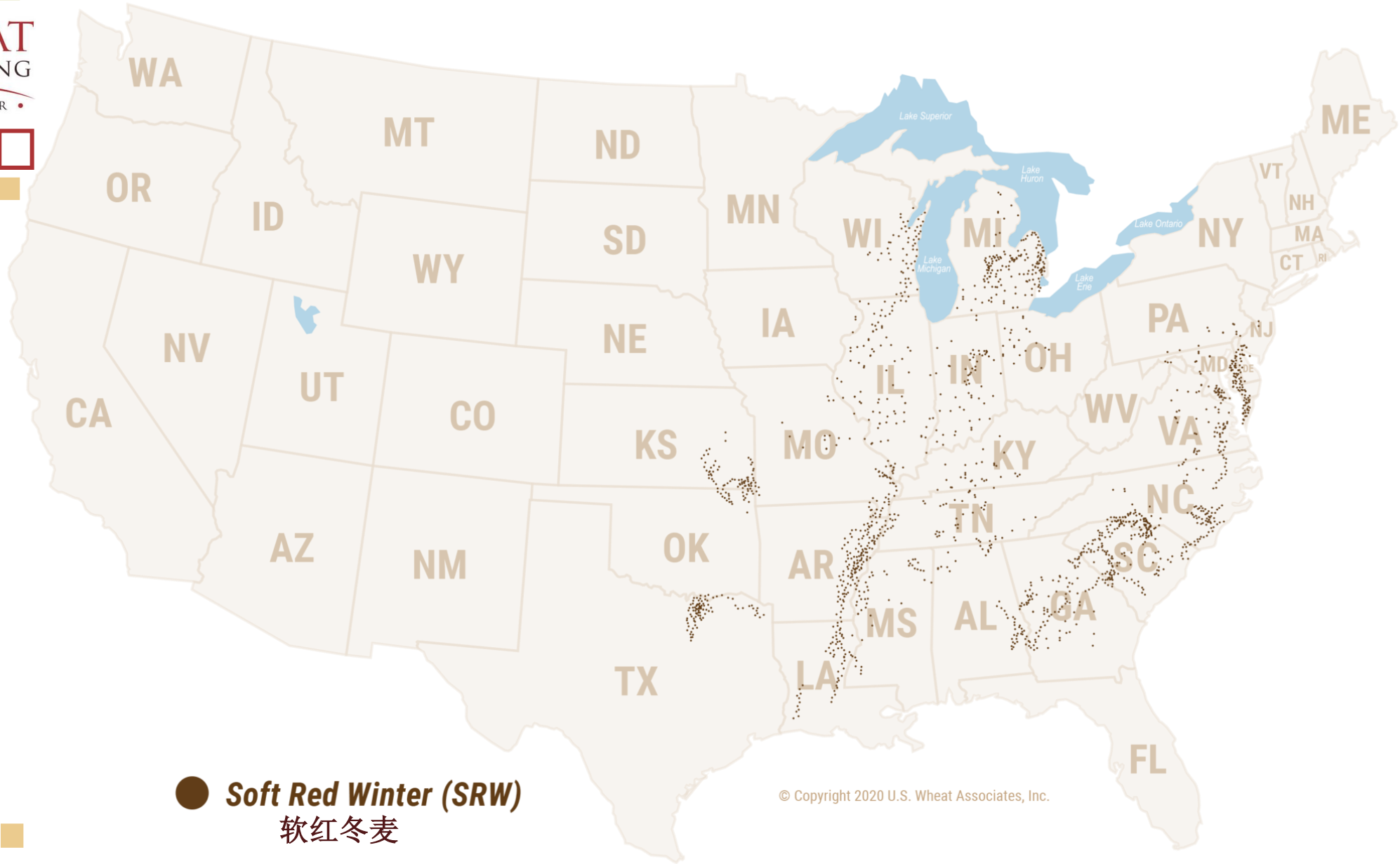

Soft Red Winter (SRW)
软红冬麦

Cultivating SRW Wheat
软红冬麦的种植

Widely adapted across higher humidity growing regions with mild winters 广泛种植于湿度较高、冬季温和的地区

- Eastern U.S./Canada 美国和加拿大的东部地区

Very susceptible to Fusarium and other pathogens 较易感染镰刀菌及其他病菌

- Primary breeding focus is introducing disease resistance 育种的重点是抗病性
- Fungicide application an annual requirement 每年都要施药

SRW in eastern crop rotation improves yields 软红冬麦在东部产区参与不同作物的轮作，有助于提高单产

- Soy and corn yields improve 8% and 5%, respectively 大豆和玉米的单产分别提高了8%和5%
- Additional ~$40/acre incremental revenue to growers 为农户带来额外的40美元/英亩的收益

6.1 MMT currently grown annually in U.S. 目前每年产量约610万吨

- Accounts for ~15-20% of all wheat grown in the U.S. 占全美小麦总量的15-20%

SRW Wheat Characteristics
软红冬麦特点

Soft kernel texture with a red bran color 籽粒质地软，红色表皮

- Lower gluten strength and water absorption compared to hard wheat
  相比硬麦，软红冬麦面筋较弱，吸水较低

Best suited for cookies, crackers, and cakes 最适合做曲奇饼干、梳打饼干和蛋糕类产品

- Lower protein better for light, delicate product texture 蛋白越低，产品质地越轻盈细腻
- Lower water absorption allows for more complete bake-off of water 面粉吸水越低，越有助于降低成品水分

SRW Flour Quality: Table 6. 2018 SRW Flour Quality Data
软红冬面粉质量：表6. 2018年软红冬面粉质量数据

	SRW by region 不同产区的SRW		
	East Coast	Gulf	Overall
Farinograph	东海岸	墨西哥湾	总体
Peak time (min)	1.2	1.2	1.2
Water absorption (%)	52.6	51.7	51.9
Stability (min)	1.7	1.8	1.8
Extensograph			
Energy at 45 min (cm^2)	42	49	48
Extensibility at 45 min (cm)	15.9	15.2	15.3
Rmax at 45 min (BU)	152	188	182
Alveograph			
P (mm Hg)	35	34	34
L (mm)	93	98	97
P/L	0.38	0.34	0.35
W (10^{-4} J)	79	81	81
Proteins: East Coast, 10.2%; Gulf, 9.9%; Overall, 9.9%			

From: U.S. Wheat Associates. 2018 Crop Quality Report.

SRW End Product Quality
软红冬麦最终产品质量

SRW wheat is selected for 选择软红冬麦(SRW)是因为:

- Lower protein 蛋白较低
  - About 2-5% lower average protein than hard wheats平均比硬麦的蛋白低2-5百分点
- Optimal SRC profiles 理想的溶剂保持力(SRC)数据
  - Affects cookie and cracker dimensions during baking 影响烘焙时曲奇和梳打饼干的尺寸
    - More spread than SWH, HRW/HRS/HW 比软白麦、硬红冬/硬红春/硬白麦扩展更好

As a result, SRW has 在实际应用中，SRW:

- Lower water absorption 吸水较低
- More consistent, controlled end product dimensions 更一致、可控的最终产品尺寸

This makes SRW more suitable for cookies and crackers as well as some cakes and flour blends
因此软红冬麦(SRW)非常适合用于制作曲奇饼干、梳打饼干、一些蛋糕类产品以及用于配粉等

Questions 提问?

Thank you for your visit

感谢您的到访

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