Milling Information Gleaned from the SRW Wheat QEC

Edward Souza, Lonnie Andrews, Ron Martin, Meera Kweon, Mary Guttieri

USDA-ARS and Ohio State University

Wooster OH

USDA

Miag Multomat Milling
ARS Soft Wheat Quality Laboratory

- ◆ 3 Breaks, 5 Reduction, 2 Re-sifted
- ◆ 12 Cultivars from 2006 SRW QEC
- ◆ 5 Cultivars from 2005 Ohio crop
  - Roane, Hartman, Vigoro 9222, INW 0302
  - AGS 2000 sample from 2005 used as replicate for 2006 AGS 2000 sample.

USDA

SWQL Testing
Larger samples for quality councils and pre-release are milled using the Miag Multomat mill -
a multi-stream commercial style flour mill.
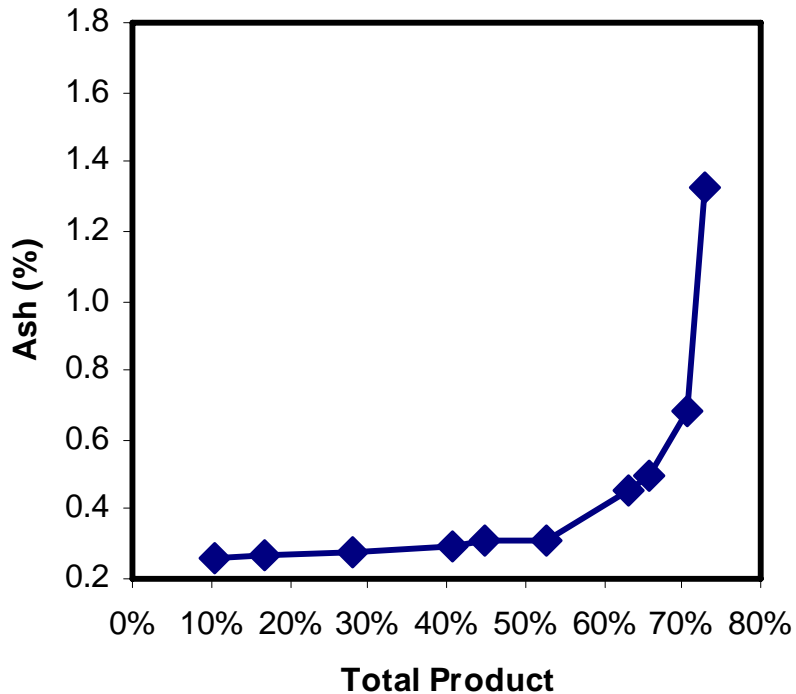
Miag Multomat Mill Stream Analysis

- ◆ Flour ash curve analysis used as graphical presentation of mill stream quality.
- ◆ Flour ash % measured on each stream.
- ◆ Streams sorted from lowest flour ash % to highest flour ash %.
    - ■ Flour streams added sequentially.
    - ■ Cumulative flour ash % is recalculated after each sequential addition.
- ◆ Sucrose and lactic acid SRC analysis also measured on each flour stream.

USDA

## Flour quality of streams from Miag Multomat milling of 16 soft red winter wheat varieties, USDA-ARS SWQL

Mill stream	Flour weight	Ash percent on flour basis	Sucrose SRC percent on flour basis	Lactic acid SRC percent on flour basis
	g/kg	%	%	%
1st Reduction	115.0	0.27	84.4	109.5
Duster	63.9	0.27	90.2	118.9
2nd Reduction	117.9	0.28	98.7	126.0
2nd Break	113.7	0.31	90.7	111.2
Grader	40.7	0.32	88.5	108.2
1st Break	79.6	0.32	85.1	94.1
3 Reduction	97.7	0.48	107.4	112.6
3rd Break	30.5	0.56	109.7	108.4
4th Reduction	46.8	0.68	118.0	104.7
5th Reduction	23.3	1.30	126.6	93.4

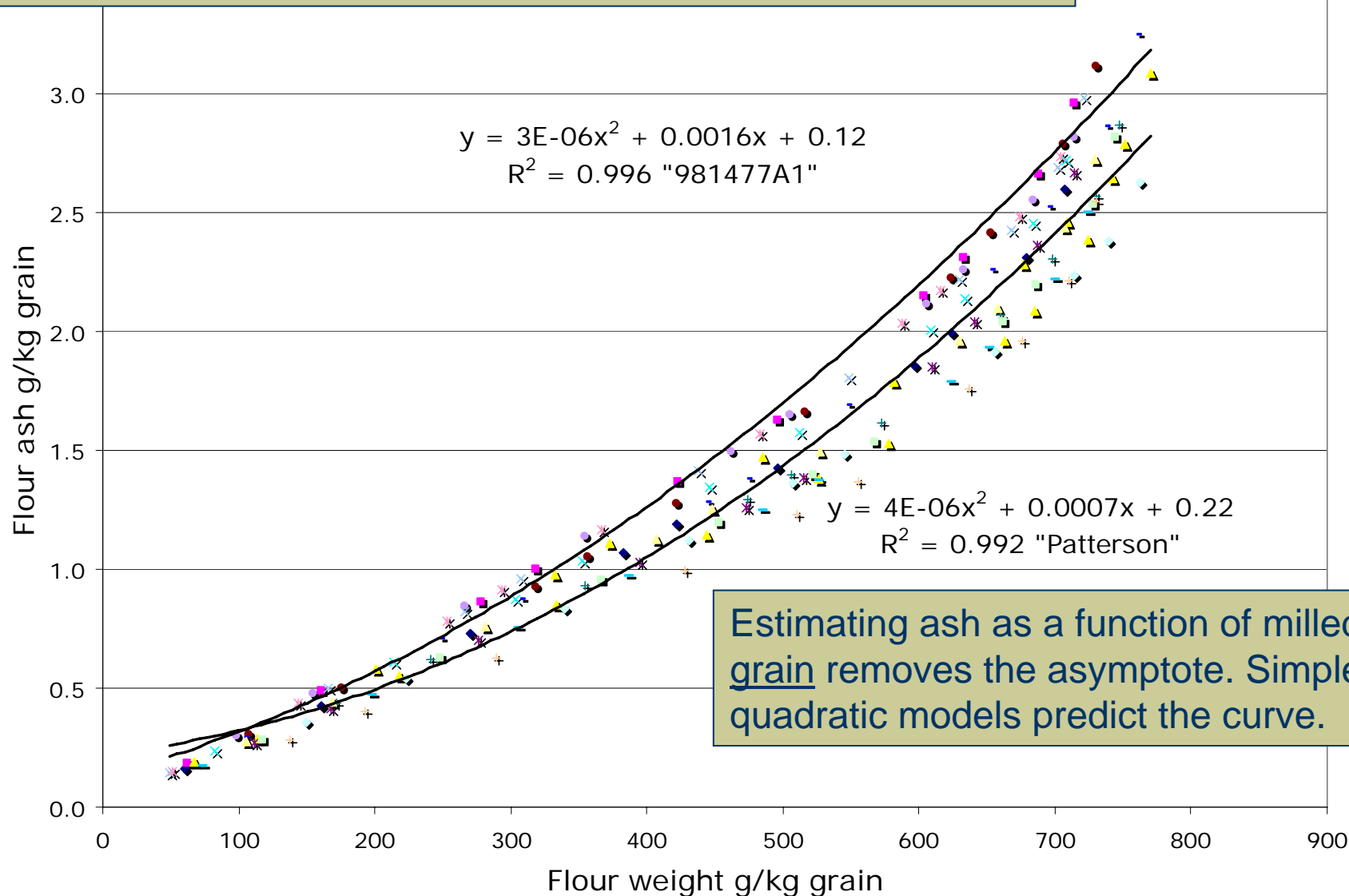# Flour ash curve analysis of Miag Multomat Mill Streams, 2006 QEC, Purdue SRW Set
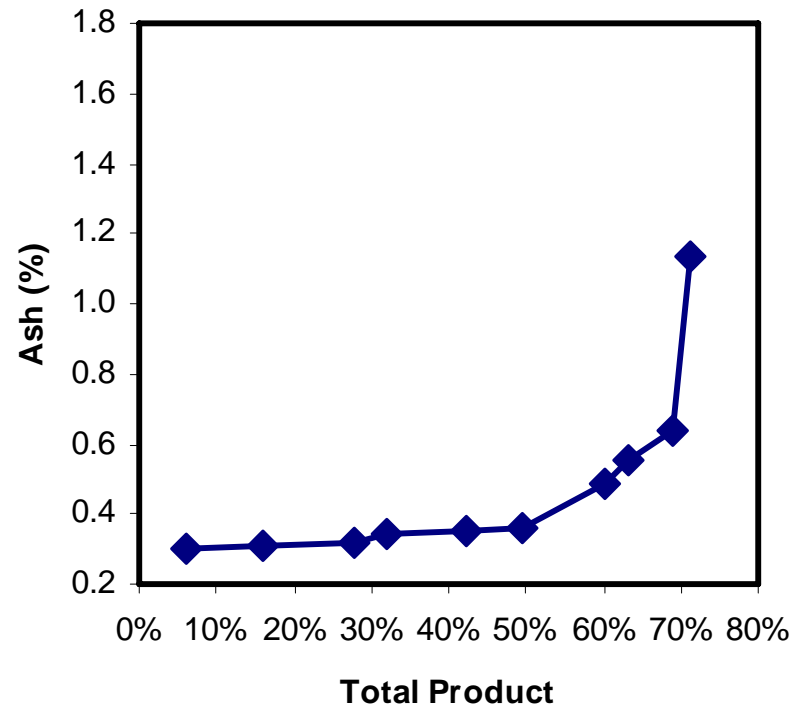
Interpretation of ash curve "elbows" are important but subjective. Asymptotic function is difficult to model.

Mill stream analysis of 16 SRW cultivars, Miag Multomat Standardize cumulative flour ash weight on grain weight rather than flour weight.

$y = 3E\text{-}06x^2 + 0.0016x + 0.12$
$R^2 = 0.996$ "981477A1"

$y = 4E\text{-}06x^2 + 0.0007x + 0.22$
$R^2 = 0.992$ "Patterson"

Estimating ash as a function of milled grain removes the asymptote. Simple quadratic models predict the curve.

Flour ash g/kg grain

Flour weight g/kg grain

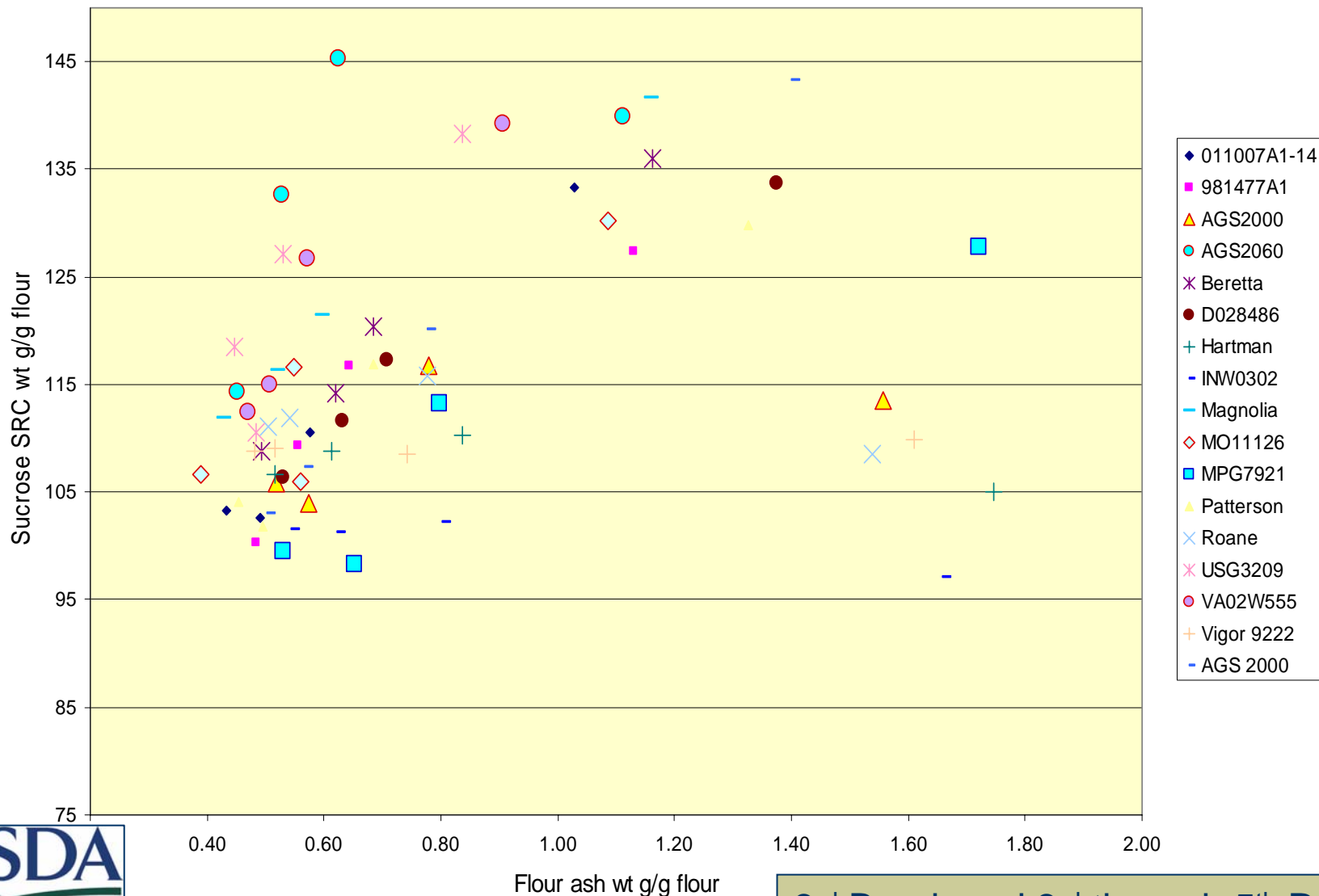# Average of Streams for 16 SRW cultivars Miag Multomat mill on <u>flour basis</u>.

Flour ash of mill streams correlates to flour quality only at the highest concentration of flour ash.
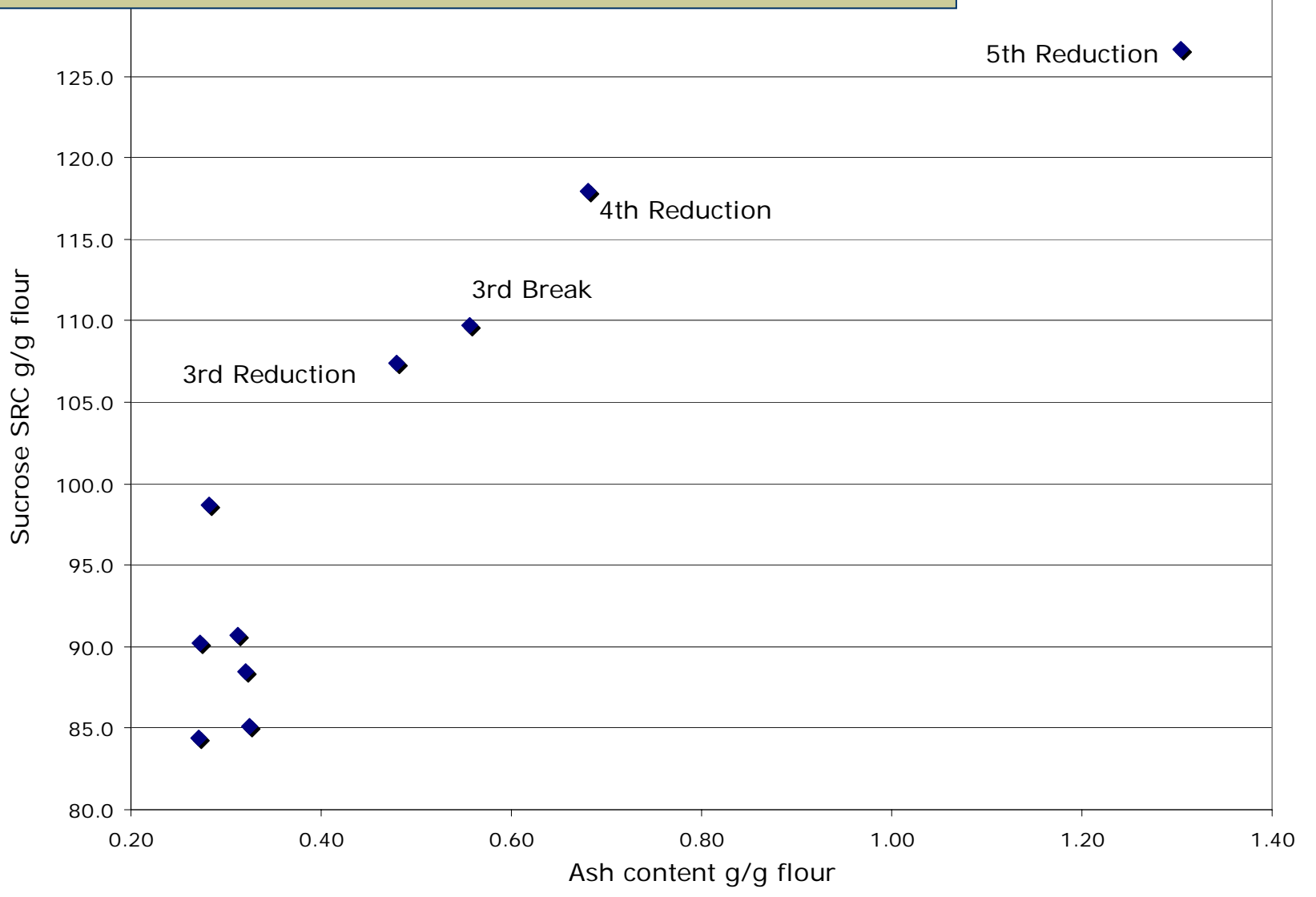
High Ash Mill Streams for 16 SRW cultivars
## Miag Multomat mill on <u>flour basis</u>.
Correlation is poor when projecting across cultivars for the higher ash mill streams.

Legend:
- 011007A1-14
- 981477A1
- AGS2000
- AGS2060
- Beretta
- D028486
- Hartman
- INW0302
- Magnolia
- MO11126
- MPG7921
- Patterson
- Roane
- USG3209
- VA02W555
- Vigor 9222
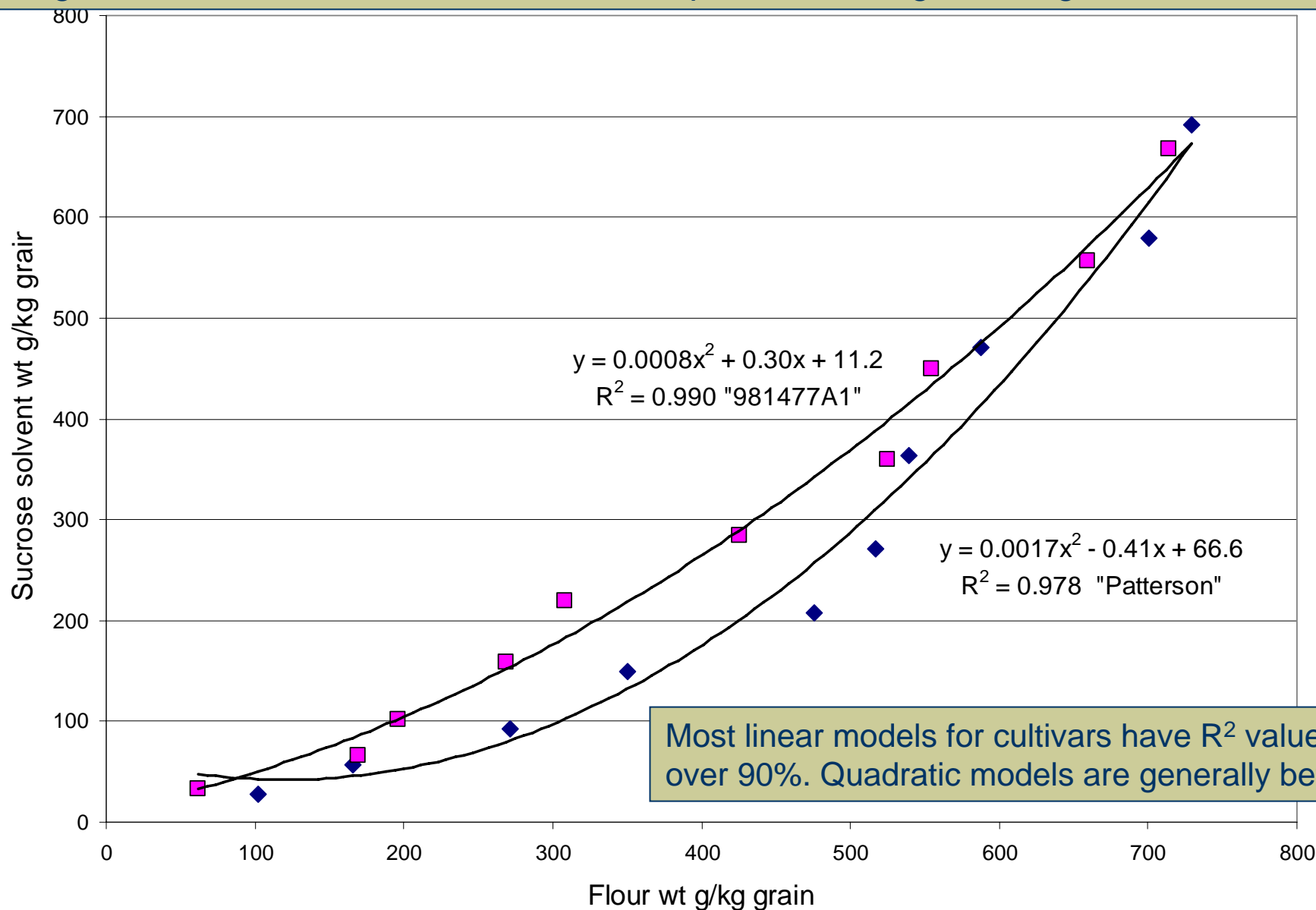- AGS 2000

X-axis: Flour ash wt g/g flour
Y-axis: Sucrose SRC wt g/g flour

Mill stream analysis of 16 SRW cultivars
Miag Multomat cumulative sucrose SRC expressed on a <u>grain weight basis</u>

Most linear models for cultivars have R^2 values over 90%. Quadratic models are generally better.

USDA
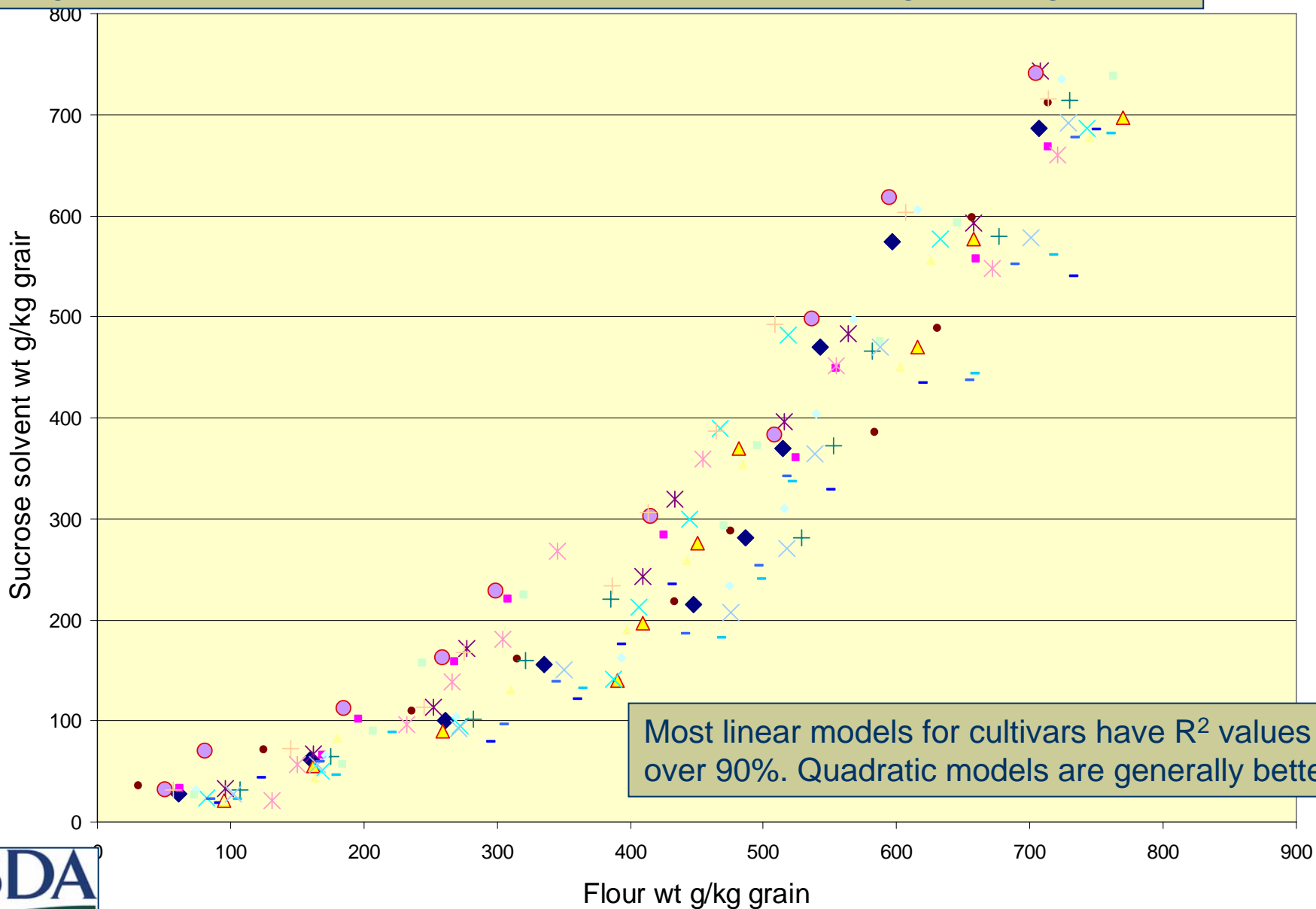
Mill stream analysis of Patterson and 981477A1 SRW cultivars,
Miag Multomat cumulative sucrose SRC expressed on a <u>grain weight basis</u>

$$y = 0.0008x^2 + 0.30x + 11.2$$
$$R^2 = 0.990 \text{ "981477A1"}$$

$$y = 0.0017x^2 - 0.41x + 66.6$$
$$R^2 = 0.978 \text{ "Patterson"}$$

Most linear models for cultivars have R^2 values over 90%. Quadratic models are generally better.

Sucrose solvent wt g/kg grain

Flour wt g/kg grain

Mill stream analysis of Roane and AGS 2000 SRW cultivars, Miag Multomat cumulative sucrose SRC expressed on a grain weight basis

$y = 1.042x - 121.2$
$R^2 = 0.990$ "Roane"

$y = 0.0011x^2 + 0.1221x - 6.3775$
$R^2 = 0.975$ "AGS 2000 (05)"
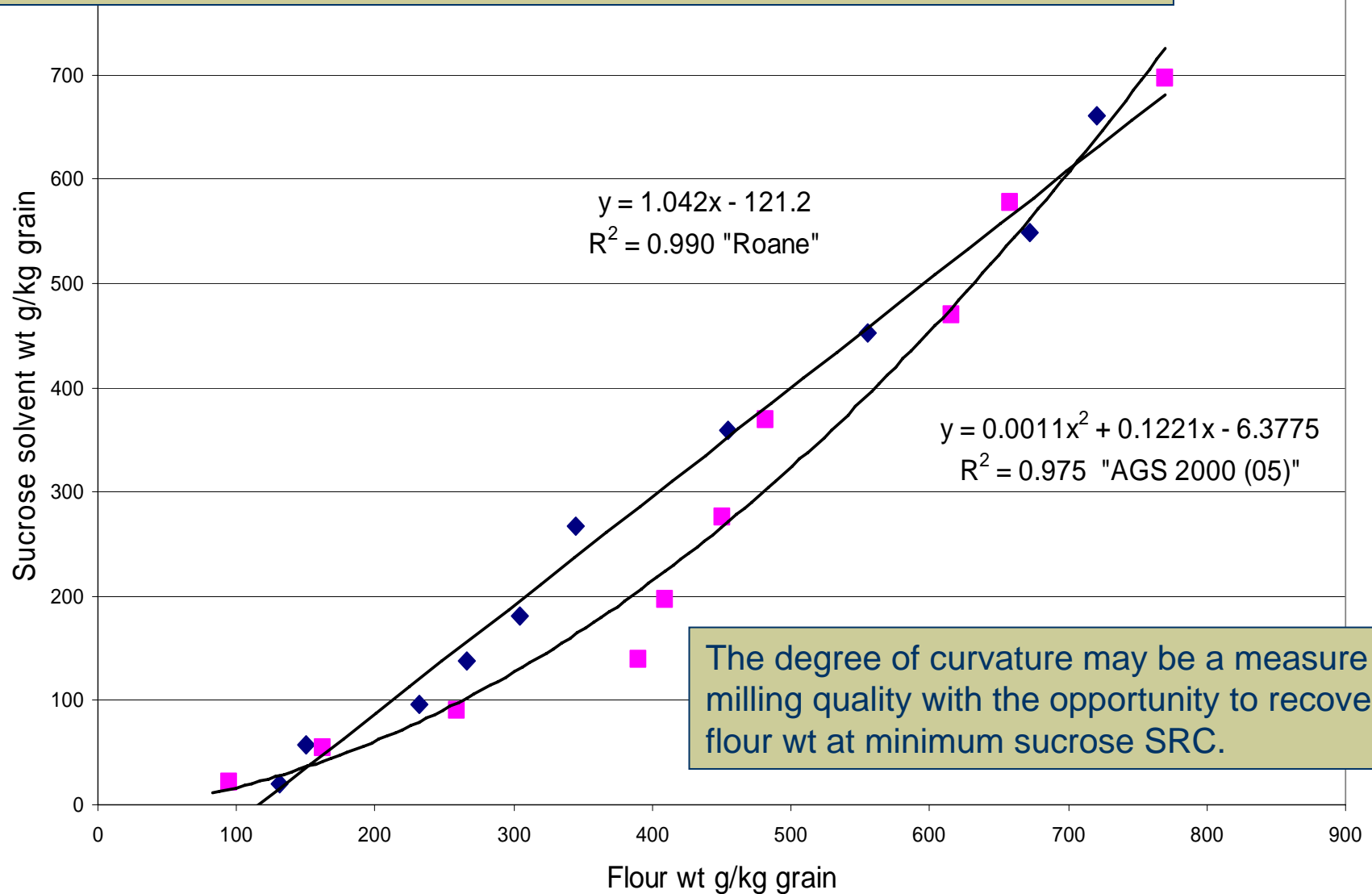
The degree of curvature may be a measure of milling quality with the opportunity to recover flour wt at minimum sucrose SRC.

Sucrose solvent wt g/kg grain

Flour wt g/kg grain

Conclusions

- Ash curves can be modeled with simpler regression equations by changing from flour weight to grain weight basis for calculations.
  - Statistical tests and confidence intervals are intuitive.

- Sucrose SRC can substitute for flour ash to generate functional mill stream analyses.

- Lactic acid curves (not discussed here) also may have merit.

USDA-ARS Soft Wheat Quality Laboratory

We exist to return a profit to the tax-payers on their investment in public research.

Our goal is to create added value and opportunity for the wheat industry

Thanks to those who support our research:
US Wheat Associates, Wheat Quality Council, Kraft Foods

Assistance from Tom Donelson and Amy Bugaj – USDA-ARS
            Sue Carson and Sharon Croskey – Ohio State Univ.

Photo courtesy of Cornell University, Dept. of Plant Breeding

Quality of streams from Miag Multomat milling of 16 SRW cultivars expressed on a <u>grain weight basis.</u>

Mill stream	Flour weight	Ash weight on grain basis	Sucrose weight on grain basis	Lactic acid weight on grain basis
	g/kg	g/kg	g/kg	g/kg
1st Reduction	115.0	0.310	96.9	125.8
Duster	63.9	0.174	57.7	76.7
2nd Reduction	117.9	0.331	116.4	148.8
2nd Break	113.7	0.354	103.0	125.6
Grader	40.7	0.130	36.1	44.4
1st Break	79.6	0.257	67.5	74.7
3 Reduction	97.7	0.467	104.8	109.9
3rd Break	30.5	0.171	33.4	32.8
4th Reduction	46.8	0.312	55.5	49.5
5th Reduction	23.3	0.294	29.8	21.8