Cereal Chemistry

(1)

Effect of the Relative Quantity of Flour Fractions on Cake Quality.

D. H. Donelson and J. T. Wilson. Cereal Chem 37:241.

An unbleached, commercially milled 48% extraction soft wheat flour was fractionated by a batter method into water-solubles, gluten, starch tailings, and prime starch. Flour blends using various proportions of the fractions were prepared and bleached. White layer cakes were baked using a lean formulation. A batter-mixing schedule incorporating a preliminary doughing step was necessary in order to obtain layers comparable in volume and internal structure to cakes baked from the parent flour. The baking quality of these reconstituted flours appeared to be strongly influenced by their composition. By means of a central composite statistical design, a multiple regression equation was derived relating layer volume to the relative proportions of the fractions making up the flours. Because of interaction, responses of fractions varied significantly at different concentrations of the fractions. It was found that, in general, the water-soluble fraction tended to decrease cake volume, although not greatly, and that tailings had a marked effect in increasing volume and improving internal appearance. Small changes of concentration of gluten or of prime starch above or below the normal amounts had little effect on volume, but much greater or smaller than normal concentrations of either resulted in much smaller cakes. It was concluded that the relative proportions or balance of flour components conditioned the contribution to cake structure of each component and had a significant effect upon the quality of the cake.

(2)

Studies on the Effect of Flour-Fraction Interchange upon Cake Quality.

D. H. Donelson and J. T. Wilson. Cereal Chem 37:683.

A good-quality unbleached cake flour and a poor-quality cake flour were fractionated into water-solubles, gluten, starch tailings, and prime starch. Fractions were combined to form reconstituted flours comprising complete interchanges of the components at the composition of each flour. These reconstituted flours were bleached, and layer cakes were baked using a lean (no milk or eggs, high sugar) formulation. The contributions to cake volume of the gluten, water-solubles, and tailings fractions obtained from the good flour were significantly greater than, and the effects on gross cake structure with these fractions were superior to, those of the corresponding fractions obtained from the poor flour. The prime starch from the poor flour was significantly superior to that of the good flour. Gluten had the greatest effect on cake volume and structure. Interactions of gluten times composition and water-solubles times tailings times composition were highly significant, which indicated considerable variation of the responses to these flour components with concentration. It was suggested that the expression of these quality factors may be contingent upon an inherent quality aspect, related to the physical and chemical constitution of each factor, and upon a concentration dependence, related to the percent composition of the flour.

(3)

Note on a Rapid Method for the Estimation of Damaged Starch in Soft Wheat Flours.
J. R. Donelson and W. T. Yamazaki. Cereal Chem 39:460.

(4)

Studies on the Dynamics of Cake-Baking. I. The Role of Water in Formation of Layer Cake Structure. J. T. Wilson and D. H. Donelson. Cereal Chem 40:466.

A study was made of the effect of liquid level in the batter on the volume, crumb structure, and top contour of layer cake, using 1) a standard white layer recipe and 2) a simplified formula which omits milk solids and egg protein. The quantitative data for each response was fitted to a second-degree polynomial. Water concentration had a critical effect on the extent of starch gelatinization during baking, which in turn determined the type of crumb structure found. With either formula, maximum volume was obtained at the liquid level where layer contour was rounded, but the structure score was highest at a slightly higher liquid level. The optimum level was consistently higher for the full formula than for the simplified one. The change in volume and contour with liquid level was much more abrupt and was greater with the simplified formula. The increased amount of water needed for the full formula demonstrated that milk solids and egg protein have definite absorption requirements, and indicated that water bound by them is not available for starch gelatinization.

(5)

Mechanism of Improver Action in Cake Flours. I. The Relation Between Flour Specific Surface and Chlorine Distribution.
J. T. Wilson, D. H. Donelson, and C. R. Sipes. Cereal Chem 41:260.

Chlorine content of Beta-Chlora-treated, chlorine-treated, and control short-extraction soft wheat flours, each dry-fractionated by four- or five-stage air-classification, was measured by wet-ashing and potentiometric titration for total chlorine, and by direct titration for chloride ion. Specific surface of each flour and fraction was computed from particle size data obtained with an electrolytic resistivity instrument. For each treated flour, the finest fraction had a chlorine uptake three times as great as that of the parent and five times as high as that of the large high-starch fractions. Only 40 to 68% of the added chlorine was titratable, which indicates that part of the improver forms addition or substitution products. The values for the total new surface area produced by impact milling during air-classification were essentially the same, whether determined directly from particle size data or from factors based on differences in ratios of chlorine to surface area between flour fractions and their parent flour. These results support the hypothesis that uptake of the improving reagents is primarily a random process wherein the probability of attack on a flour particle is a function of its surface area.

(6)

Studies on the Dynamics of Cake-Baking. II. The Interaction of Chlorine and Liquid in the Formation of Layer-Cake Structure.

J. T. Wilson and D. H.Donelson. Cereal Chem 42:25.

The quality of Kissell Research Formula layer cakes has been shown to be influenced among other things by chlorine dosage used on the flour, and by liquid level used in the batter. The present study is concerned with the interaction of these two factors. A response surface type of design was used, and cakes were assigned numerical scores for volume, structure, and contour. Volume and structure data indicated a simple relationship between independent variables, i.e., chlorine dosage and liquid level. When desirable contour was also required, complications arose. Acceptable cakes could be obtained: 1) with moderate chlorine dosage and rather high liquid levels, in which case contour was relatively insensitive to liquid level, or 2) with heavy chlorine dosage but moderate liquid levels, in which case contour was very sensitive to liquid level.

(7)

Enzymatic Determination of Starch in Wheat Fractions.

J. R. Donelson and W. T. Yamazaki. Cereal Chem 45:177.

The Donelson-Yamazaki enzymatic procedure for estimation of damaged starch in soft wheat flour has been modified for use in the determination of starch in wheat fractions by a preliminary heat-gelatinization of the starch in the sample. The procedure is applicable to small quantities of sample. Starch determinations were made on wheat meals, flours, starches, and brans, and the data were compared with starch values obtained by the polarimetric procedure. The data were very highly correlated, and both methods performed comparably with respect to precision.

(8)

Note on the Application of Donelson-Yamazaki Damaged-Starch Procedure to High-Damage Wheat Flour and Starch.

J. R. Donelson and W. T.Yamazaki. Cereal Chem 46:567.

(9)

Note on the Enzymatic Determination of Starch in Corn Starch and Corn Meal.

J. R. Donelson and W. T. Yamazaki. Cereal Chem 46:568.

(10)

Comparison of Flour Particle Size Distributions Measured by Electrical Resistivity and Microscopy.

J. T. Wilson and D. H. Donelson. Cereal Chem 47:126.

A comparison was made of procedures for particle size distribution analysis on a group of air-classified flour samples. The procedures were microscopic (with the use of Martin's diameter) and electrical resistivity (with the Coulter counter). Shape correction factors derived by two independent means, using methods of moments, were in good agreement. It appears that the microscopic method is oversizing and a correction factor should be applied to the microscopic data. When this is done, particle size distribution data obtained by the two methods appear to be very similar.

(11)

Effects of Flour Lipids on Cookie Quality.

L. T. Kissell, Y. Pomeranz, and W. T. Yamazaki. Cereal Chem 48:655.

Flours of four wheat varieties, defatted with petroleum ether, produced smaller cookies with reduced top- grain definition than parent whole flours. Return of unfractionated free lipids to defatted flours at normal concentration restored original spread and top-grain quality. Polar and nonpolar lipid fractions alone were only partially effective in improving defatted flour; both were required for full restoration of quality. Thin- layer chromatography of lipid extracts revealed no detectable varietal differences. Flour-lipid interchange by variety produced no cookie quality differences owing to free lipid source. Cookie characteristics at normal lipid concentration were determined by varietal properties of defatted flour residues. Both whole (parent) and defatted flours increased progressively in cookie spread and top-grain score when treated with free lipids at 1.5X, 2X, and 3X normal levels.

(12)

Functional (Breadmaking) and Biochemical Properties of Wheat Flour Components. IX. Replacing Total Free Lipid with Synthetic Lipid.

R. C. Hoseney, K. F. Finney, and M. D. Shogren. Cereal Chem 49:366.

Adding sucrose monotallowate to a standard baking formula increased loaf volume from 7.0 to 18%, depending on the level of shortening in the formula. When two sucroglycerides (sucrose monotallowate and sucrose monopalmitate) were added to petroleum-ether-defatted flour, each replaced the total free flour lipids, and increased loaf volumes 18 and 22%, respectively, above that of the original flour (with shortening). Native free flour lipids could also be replaced with sodium or calcium stearoyl-2-lactylates. However, adding either lactylate, unlike the sucroglycerides, did not increase loaf volumes above that of the control flour. When two nonionic surfactants (pluronic polyols F-108 and F-68) were baked with petroleum-ether-defatted flour, loaf volumes were generally comparable to that of the control flour. However, all loaves baked with pluronic polyols had impaired crumb grains.

(13)
Soft Wheat Flour Particle-Size Analysis by Integrated Sieve and Coulter Counter Procedures.
D. H. Donelson and W. T. Yamazaki. Cereal Chem 49:641.

A procedure is described for particle-size distribution analysis of coarse soft wheat flour. Sieving was integrated with Coulter Counter analysis of particles at two suspension concentrations. Flours from pure- variety wheats milled under conditions producing varying proportions of coarse, medium, or fine particles gave mass-median diameters and 80%-range values indicative of inherent endosperm texture as reflected by Particle Size Index. Relative granulation characteristics of varieties were not adversely affected by season of crop growth.

(14)
The Relationship Between Flour Particle Size and Cake-Volume Potential Among Eastern Soft Wheats.
W. T. Yamazaki and D. H. Donelson. Cereal Chem 49:649.

A high negative correlation has been found for white layer cake volume vs. mass-median diameter of laboratory-milled cake flours obtained from pure-variety wheats. Cake volume was also highly associated inversely with mass-median diameters of straight-grade and coarsely milled flours, and directly with the quantity of sifted meal from wheats milled to obtain patent flours for cake baking. Varietal differences in cake potential for these wheats thus appeared to be associated largely with inherent differences in endosperm friability.

(15)
Effects of Prior Salt Treatment on Gluten Dispersibility.
R. L. Clements. Cereal Chem 50:87.

Gluten was homogenized in 1M sodium chloride (NaCl) and then repeatedly extracted with water. Approximately 60% of the gluten protein was solubilized in the initial extracts as the salt concentration in the extraction medium declined to 10 mM. Continued extraction of the residue resulted in swelling to a voluminous gel, indicative of a highly hydrophilic nature. This swelling did not occur until salt concentration in the medium had declined to less than 5 mM. Exhaustive washing of the gel resulted in slow but steady extraction of a second protein fraction which accounted for approximately 30% of the gluten protein. The fraction solubilized in the initial extractions of the gluten was precipitated by salts to give a gliadin-like product, whereas the fraction precipitated from later extracts exhibited the gross characteristics of glutenin. Addition of traces of salts to the intermediate residue gel resulted in immediate clotting and loss of bound water. When gluten was treated with NaCl at concentrations below 1M, subsequent washing resulted in immediate extraction of the gliadin-like fraction, but the degree of residue swelling was directly related to the concentration of salt in the treatment medium. Gluten treated with 0.01M NaCl did not swell. Gluten treated with 1M potassium chloride, magnesium chloride, or calcium chloride exhibited effects similar to those resulting from treatment with 1M NaCl, but results suggest specific cations may have specific effects. When glutens from different varieties of wheat were treated with 1M NaCl and subsequently extracted, no pronounced differences were noted.

(16)

Effect of Variability in Sugar Granulation on the Evaluation of Flour Cookie Quality.
L. T. Kissell, B. D. Marshall, and W. T. Yamazaki. Cereal Chem 50:255.

The effects of sugar particle size on the evaluation of soft wheat flour quality were determined by a sensitive cookie-baking method. Sugars with different particle-size distributions varied in ability to differentiate two flours with contrasting qualities. Optimum performance of the test was obtained using sugar with a mean size range of 250 to 200 microns. Ten varietal flours were tested with monosized sugar fractions from sieve separations on 10 screens ranging from 24 to 200 mesh per in. Cookie spread and top- grain scores increased with decreasing mean particle size of sugar, and differentiation improved with sugars in the through 48-mesh to over 80-mesh (295 to 175 microns). Natural distributions of sugars were truncated at 32-, 35-, and 48-mesh cutpoints, with each finer separate exhibiting improved cookie spread and appearance. Monosized sugar fractions were blended to give normal distributions about mean sizes of 240, 185, and 155 microns, respectively. Cookie performance and overall differentiation among flours from several wheat varieties were improved progressively with decreasing mean particle size of the sugar blends within the limits of the conducted trials.

(17)

Protein Enrichment of Cookie Flours with Wheat Gluten and Soy Flour Derivatives.
L. T. Kissell and W. T. Yamazaki. Cereal Chem 52:638.

The sugar-snap cookie baking performance of soft red winter (SRW) flour fortified with increasing levels of three vital wheat glutens was compared with results obtained with similar blends using five soy-derived protein concentrates. Cookie spread and top-grain scores were reduced by each supplement at differential rates dependent upon concentration and functionality of the protein source. Reductions in baking quality were least with commercial vital glutens, followed, in order, by laboratory-fractionated SRW gluten, nondispersible soy-protein isolate, modified soy flours, soy-protein concentrate, and dispersible soy-protein isolate. With commercial glutens, cookie-crumb protein (N x 5.7) levels were increased 150% at the point of significant reduction in baking performance, compared with 27% increase with laboratory-fractionated gluten and 10-20% increase with soy derivatives. Lipid extracts from SRW flour, six commercial lecithins from soy, and a commercial safflower lecithin were evaluated at low concentrations as improvers of cookie spread in conjunction with the SRW flour-protein fortified blends. Soy lecithins were most effective, with safflower lecithin equal to, or better than, flour lipids. Maximum crumb protein increases permitted by use of natural surfactants were: 375% with commercial glutens; 83% with laboratory-prepared gluten, and up to 56% with soy derivatives. Satisfactory sugar-snap cookie size, top grain, and internal appearance were maintained.

(18)
Short-Time Baking Systems. I. Interdependence of Yeast Concentration, Fermentation Time, Proof Time, and Oxidation Requirement.
P. L. Finney, C. D. Magoffin, R. C. Hoseney, and K. F. Finney. Cereal Chem 53:126.

Balancing formulas for short-time baking systems led to the conclusion that yeast concentration, fermentation time, proof time, and oxidation requirement are interdependent. Breads produced with fermentation times of 120, 70, or 45 min. were comparable to those made with a standard 180 min of fermentation. The only required formula changes included increases in yeast concentration and oxidant (KBrO3) and decreases in proof time. Changes in other ingredients gave inferior (non-optimum) results. When fermentation time was decreased from 180 to 70 min, required yeast concentration increased by a factor of 3.6 from 2 to 7.2%, KBrO3 requirement increased by a factor of 3, and proof time (about 30% of fermentation time) decreased from 55 to 21.5 min. Optimum breads produced with fermentation times of 70, 120, or 180 min were equal in loaf volume, internal and external appearances, and flavor. Gas production was a function of fermentation time and yeast concentration, and remained constant for any balanced, optimized system.

(19)
Pearl Millet. II. Partial Characterization of Starch and Use of Millet Flour in Breadmaking. S. M. Badi, R. C. Hoseney, and P. L. Finney. Cereal Chem 53:718.

Pearl millet starch ranged in diameter from 8 to 12 microns, somewhat smaller than corn or sorghum starch. Pasting properties of millet starch were similar to those of sorghum starch, except during the 1-hr holding period of 95 C. Millet starch contained 17% amylose compared with 23% in sorghum starch. Amylograms of millet flour gave low peak viscosities compared to sorghum flour, indicating an active alpha-amylase system. Adding 10% millet flour to a standard baking formula slightly increased loaf volume and improved crumb grain. The addition of 10% millet flour to a formula containing no malt or sugar gave a loaf volume significantly better than the same wheat flour baked with the standard formula containing 6% sugar. Adding small quantities of sorghum flour (5-20%) to the standard formula decreased loaf volume.

(20)
Nonfat Dry Milk Fractions in Breadmaking. I. Effect on Loaf Volume.
R. S. Ling, R. C. Hoseney, and P. L. Finney. Cereal Chem 53:787.

A good baking-quality nonfat dry milk (NFDM) was fractionated by isoelectric precipitation. The soluble protein fraction (whey) was responsible for the loaf volume increase obtained with NFDM. The soluble fraction was dialyzed to separate the solD (material retained in the bag) and solDZ (material passing through the bag) fractions. Both fractions contributed to loaf volume. When the solDZ fraction was fractionated further by ion-exchange chromatography, the anion fraction alone was equal to NFDM. The ammonium ion used to elute the anion fraction was apparently responsible for the loaf volume increase of that fraction. Ammonium ion, in the form of diammonium phosphate, functionally replaced NFDM in bread making.

(21)

Effects of Interactions Among Flour Lipids, Other Flour Fractions, and Water on Cookie Quality.

W. T. Yamazaki and J. R. Donelson. Cereal Chem 53:998.

Soft wheat flour was fractionated into five components---free lipids, gluten, tailings, starch, and water solubles. Cookies baked from a blend of these fractions were identical to those baked from the parent flour. The good quality of cookies baked from blends of fractions indicated that a composite structure obtained by doughing fractions is not necessary for the production of normal cookies. The interaction of free lipids with tailings and water had an adverse effect on the internal structure of cookies, and this effect was intensified when gluten was added as an interactant. Inclusion of starch as a further interactant moderated the effect and also controlled the spread of cookies.

(22)

Effects of Flour Fraction Composition on Cookie Diameter.

W. T. Yamazaki, J. R. Donelson, and W. F. Kwolek. Cereal Chem 54:352.

Three pure-variety straight-grade untreated flours were fractionated into five fractions: free lipds, starch, gluten, tailings, and water-solubles. For each variety, blends were prepared according to McLean and Anderson's extreme vertices experimental design, with various proportions of the last four fractions. The blends (with restored lipids) were baked into cookies and the effects of fraction composition on cookie diameter were noted. The functions of fractions were similar for Thorne and Blackhawk and different for Shawnee. Within the "valid area" of compositional variation, and at high starch levels, high water-solubles content was associated with small cookie diameter for Shawnee but with larg diameter for Thorne and Blackhawk. High tailings content was associated with poorer cookie in Shawnee blends. The starch fraction did not show varietal differences. For all three varieties, fraction effect on diameter was associated with alkaline water-retention capacities of the fractions gluten, starch, and tailings, and the effect was additive.

(23)

Nonfat Dry Milk Fractions in Breadmaking. II. Effect on Oxidation Requirement.

R. S. Ling, R. C. Hoseney, and P. L. Finney. Cereal Chem 54:388.

Use of nonfat dry milk in the baking formula increased the potassium bromate requirement of dough and the dough's tolerance to excess potassium bromate. Both soluble and insoluble milk fractions increased the potassium bromate requirement. A dialyzable fraction of the solubles increased the potassium bromate requirement and appeared to buffer the requirement. A surface-response study with ammonium ion, phosphate ion, and potassium bromate as variables showed that, for all practical purposes, loaf volume was affected only by the concentration of ammonium ion. However, adding either ammonium ion or phosphate ion increased the potassium bromate requirement. The effects were additive; a combination of the ions required more potassium bromate than either alone. Thus, the potassium bromate requirement of NFDM comes from both the insoluble (protein) fraction and from ammonium and phosphate ions free or generated in the dough.

24)

Distribution of Ash Among Flour Extracts and Fractions and Its Relation to Electrical Conductivity.

R. L. Clements. Cereal Chem 54:840.

Flours from soft red, soft white and hard red winter wheats, and defatted and bleached flours were fractionated and ash was determined in the fractions. In addition, various flours were serially extracted five times with water and ash was determined in extracts and residues. Ash was also determined in extracts and residues. Ash was also determined in extracts of millstream flours representing a wide range of ash levels. Electrical conductivities of all extracts were measured. In the fractionations, ash from two aqueous extractions accounted for 50% of total recovered ash, with starch contributing 27-30%, gluten 11-21% and tailings 4-8%. Variations among flours apparently resulted partially from differences in water retention. From fivefold extraction of flours, 72-77% of total recovered ash was in the combined extracts and 23-28% in the residues. From millstream flours suspended in water for one hr at room temperature, recovery of total ash from the liquid phase was 75-80% for low-ash, and 60-65% for high-ash flours. For extracts prepared under uniform conditions, conductivities were proportional to ash levels of flours.

(25)

Electrical Conductivity of Flour Suspensions and Extracts in Relation to Flour Ash.

R. L. Clements. Cereal Chem 54:847.

Electrical conductivities of flour extracts were directly related to flour ash, and log-log plots of ash vs. specific resistance were essentially linear. Conductivities of flour suspensions were lower than of corresponding extracts due to electrolyte desplacement, but suspensions were studied to determine effects of time and temperature on equilibration rates. Conductivities equilibrated rapidly in aqueous sospensions of low-ash flours, but conductivities of suspensions of high-ash flours continued to increase after 90 min. Heat treatment (15 min at 100 C) accelerated equilibration, but increased conductivities of low-ash flours and decreased conductivities of high-ash flours. Enzymes might be involved in the steady increase in conductivities of suspensions of high-ash flours during incubation at room temperature. Conductivity measurements, which are convenient and rapid, might be a useful index of flour quality.

(26)

Large-Scale Laboratory Soxhlet Extraction of Wheat Flours, and of Intact and Cracked Grains.

R. L. Clements. Cereal Chem 54:865.

Flours and cracked wheat (5-6 kg) were extracted with hexane on a large-scale Soxhlet extractor, and extracts were sampled at intervals, analyzed for total lipid, and chromatographed by thin-layer chromatography (TLC). About 95% of hexane-extractable lipid was extracted in the first 8 hr. TLC showed no qualitative differences among extracts from different stages of extraction. Hexane-extraction yielded 1.07-1.15, 1.01-1.05, and 0.95-0.97% lipid (dry basis) from soft red (SR), soft white (SW), and hard winter (HW) wheat flours, respectively. Extraction with acetone or chloroform yielded about 20% more lipid than hexane. Hexane-extracted lipid averaged 1.07% (dry basis) from cracked hard wheat and 1.32% from SR and SW wheats. Lipid averaged 0.12, 0.23, and 0.30% from intact hard red (HR), SR, and SW kernels, respectively. Yields from hexane extraction of intact and cracked rye were comparable to yields from wheats, but oat groats gave 3.63% lipid (56% of the lipid from cracked groats). Small amounts of lipids from intact grains appeared to be from the cuticle, but the results suggest little lipid is extracted from unbroken kernels, and lipid yield may be an index of kernel damage.

(27)

Quantitative Studies of Wheat-Flour Lipids Extracted with Various Solvents by an Elution Method.

R. L. Clements. Cereal Chem 54:1198.

Untreated, slurried-and-dried, and hexane-Soxhlet-extracted flours and flour fractions mixed with diatomaceous earth were packed in columns and lipids were eluted with various solvents. Among 15 solvents studied, water-saturated 1-butanol (BW) generally give maximum lipid yields, but a 2- propanol:fluorocarbon:water mixture gave comparable results. Hexane elution gave about 20% less and chloroform elution about 20% more lipid than hexane Soxhlet extraction. Most alcohol-containing solvent systems did not give higher yields than 95% ethanol or chloroform alone. Nonpolar solvents generally eluted more lipids from soft wheat than from hard wheat flours, but polar solvents eluted about the same amounts from soft and hard wheat flours. Nonpolar solvents extracted less lipid from flours suspended in water and dried, but as polarities of solvents were increased, yields approached those of untreated flours. Lipids from hexane-extracted flours also increased with solvent polarity. When flours were eluted with a sequence of hexane, chloroform, and BW, a higher proportion of total lipid was extracted by hexane and chloroform from soft than hard wheat flours, but total yields were comparable. Among fractions from nonextracted flour, almost 90% of total ethanol-extractable lipid was in the gluten (7.68% lipid). Gluten from hexane-Soxhlet-extracted flour contained 1.60% lipid and contributed 63.6% of the total. Results suggest that elution of lipids by use of standardized columns and procedures is a practical method for comparative studies of solvents, flours, and flour treatments.

(28)

Short-time Baking Systems. III. Malt Interdependence in a Sugar-Free Formula.

P. L. Finney, G. L. Rubenthaler, H. C. Jeffers, and P. D. Anderson. Cereal Chem 54:1259.

Breads with equal loaf volumes and crumb grains were produced by optimizing proof time for each level of diastatic malt (250 degree L, or about 60SKB/g, 20 C) added in a sugar-free bread formula. As malt was increased from 0.05 to 0.75%, proof time decreased linearly from 42 to 33 min. When malt was decreased from 0.05 to 0%, loaf volume decreased from 975 cm3 to 860 cm3, and proof time increased rapidly from 42 to 60 min. Although each level of malt from 0.025 to 0.75% was equally sensitive to over- or under-proofing, dough containing 0% malt could be proofed an additional 120 min with essentially no change in bread quality, including loaf volume. Breads containing 7.2% yeast and fermented for 70 min required 50% less diastatic malt than breads containing 2% yeast and fermented for 180 min. In addition, 7.2% yeast breads containing 0 to 0.025% malt fermented for 70 min had significantly higher loaf volumes and better crumb grains than did the 180-min breads.

(29)

High-Fiber Cookies Containing Brewers' Spent Grain.

N. Prentice, L. T. Kissell, R. C. Lindsay, and W. T. Yamazaki. Cereal Chem 55:712.

Dried and milled brewers' spent grain (BSG) was blended with flour at levels from 5 to 60% BSG for cookie formulation. Functionality of BSG was related inversely to the heating history of the samples. Additions of soy lecithin to the dough systems improved sugar cookie performance (spread and top grain formation). Under optimum conditions, maintaining acceptable physical qualities of the product with 40% BSG was possible, corresponding to a 74% increase in nitrogen and a tenfold increase in crude fiber. Organoleptic evaluations showed that 15% incorporation, corresponding to a 27% increase in nitrogen, a fourfold increase in crude fiber, and a threefold increase in dietary fiber, was the upper limit for sugar cookies as well as for such specialty cookies as chocolate chip, oatmeal, and raisin. At this level of incorporation, consumer panels indicated that organoleptic quality was lowered, but the cookies were still in the acceptable range. The particle size-nitrogen-fiber relationships in milled BSG might be optimized to improve acceptability of cookies.

(30)
Wheat Starch Gelatinization in Sugar Solutions. I. Sucrose: Microscopy and Viscosity Effects. M. M. Bean and W. T. Yamazaki. Cereal Chem 55:936.

A photomicrographic technique was used to study swelling behavior of individual wheat starch granules heated in water and various sugar solutions. With the polarizer rotated slightly off extinction, birefringent and gelatinized granules could be photographed simultaneously. Granule diameters were measured from enlargements of photographs taken during heating and were plotted as ratios of the granule diameters at 50 C. A rapid increase in diameter occurred during and immediately after loss of birefringence, and coincided with the first-stage gelatinization exhibited by amylograph viscosity curves. The rapid swelling stages occurred at progressively higher temperatures and at faster rates as sugar concentration was increased to 60%, the highest used. Amylograph viscosities emphasized the delaying effects of sucrose on gelatinization of starch and demonstrated that only first-stage swelling may occur in 50% sucrose solution before the medium boils. Such results are applicable to layer-cake systems in which the level of sugar often equals that of water in the batter.

(31)
Wheat Starch Gelatinization in Sugar Solutions. II. Fructose, Glucose, and Sucrose: Cake Performance.
M. M. Bean, W. T. Yamazaki, and D. H. Donelson. Cereal Chem 55:945.

Solutions of the monosaccharides glucose and fructose raised the initial gelatinization temperature of wheat starch, but to a lesser extent than did sucrose. Comparisons of the temperatures for loss of birefringence at several solution concentrations showed sucrose greater than glucose greater than fructose. The differences among the three sugars increased with concentration. Layer cakes baked with the Wooster research formula, substituting either of the monosaccharides for sucrose, demonstrated the need for high glucose and even higher fructose levels or lower batter absorptions compared with sucrose to obtain cakes with optimum contour and volume. Successful cakes were obtained if the sugar/water ratio in the batter would permit a starch gelatinization temperature of approximately 90 C.

(32)

Density Fractionation of Wheat Flours in Nonaqueous Solvents. I. Effect of Flour Moisture Level on Distribution of Solids, Protein, and Ash Among Fractions.

R. L. Clements. Cereal Chem 56:1.

Moisture in pin-milled hexane-extracted soft and hard wheat flours was adjusted to low, intermediate, and high levels. The flours at each moisture level were then fractionated by sequential flotations at 0 C in a series of Freon TF-hexane mixtures, sp gr 1,350-1.450 at 25 C in 0.010 increments to give 10-12 floating fractions plus residues. Protein was highest (68-75% db) in the first floating fraction from soft wheat flour and maximum (54-64%) in the first or second fraction from hard wheat flour. About 70% of the total solids from soft wheat flour were distributed in two high-density fractions containing 1-4% protein. About 75% of the solids from hard wheat flour were distributed in three to four high-density fractions containing 1-14% protein. Protein was high (up to 23%) in residues. Ash was uniform among floating fractions from both flours, but high (6-23%) in residues. Increasing flour moisture caused high-density components to float off earlier in the solvent sequence, but had little overall effect on fractionation.

(33)

Density Fractionation of Wheat Flours in Nonaqueous Solvents. II. Behavior of Fractions in Water.

R. L. Clements. Cereal Chem 56:6.

Fractions of different densities were separated from soft and hard wheat flours by sequential flotations of the flours in chlorofluorocarbon-hexane mixtures. The fractions were analyzed for soluble protein, soluble solids, hydration capacity, pH, and electrical conductivity. The fractions could be combined into three broad fractions: 1) a low-density to intermediate-density, high-nitrogen, hydrophilic fraction (25% of the flour), pH 5.5, 2) a high-density, high-nitrogen, high-ash fraction (less than 1% of the flour), and 3) an intermediate-density to high-density fraction (75% of the flour), primarily starch, with nitrogen, ash, and pH dependent on degree of inclusion of fractions 1 and 2.

(34)

Functionality in White Layer Cake of Lipids from Untreated and Chlorinated Patent Flours. I. Effects of Free Lipids.

L. T. Kissell, J. R. Donelson, and R. L. Clements. Cereal Chem 56:11.

Commercial unchlorinated soft red winter patent flour (pH 5.8) was treated to pH 5.2 (low), pH 4.8 (intermediate), and pH 4.0 (high) levels using 560, 1,120, and 2,240 ppm of chlorine gas, respectively. Hexane-extractable (free) lipids were removed by exhaustive refluxing with the solvent. Baking performances of the hexane-extracted (defatted) flours were poor and about equal, regardless of chlorine treatment. When lipids were returned to the respective extracted flours, the original baking quality of the chlorinated flours was restored. Cake volume increased with increasing chlorination to a miximum at pH 4.8, then decreased at pH 4.0. When lipids from pH 4.0 (highly chlorinated) flour were added to the defatted flours of low and intermediate chlorine treatment, baking performance was inferior to the responses with their own lipid extracts. Addition of lipids from untreated, low, and intermediate chlorination rate sources improved baking function of the highly chlorinated flour residue. In a parallel test in which the same chlorine treatments were applied to hexane-extracted unchlorinated flour, a similar set of responses was obtained, but the combination of variables yielding acceptable performance was restricted to low and intermediate chlorine rates. The improtance of the presence of free lipids in situ at the time of chlorination was confirmed.

(35)

Cake-Baking Dynamics: Relation of Flour-Chlorination Rate to Batter Expansion and Layer Volume.

L. T. Kissell and W. T. Yamazaki. Cereal Chem 56:324.

Physical behavior of cake batters made with the Wooster research formula and the AACC full-formula was observed by a cathetometer during baking and cooling cycles. The maximum height of the batter-air interface of each cake was recorded at 1-min intervals. The effects of 14 levels of chlorination on baking performance were determined, using 0-1.0 ml of Cl2 per gram of flour (pH 5.7-3.8). Batter expansion was greater for treated flours, even at the lowest chlorination rate, than for untreated flour. For AACC batters, thermal expansion and final volume were maximum at 20-30% of the normal chlorination rate (0.5 ml of Cl2 per gram) and for Wooster batters, at 50% normal. With both methods, batter expansion and final layer volume reduced gradually with increasing chlorine dosage. In informal organoleptic tests, the crumb texture of AACC cakes was acceptable over a chlorination range of 20-100% of normal and was optimum over a range of 40-80%.

(36)

Note on Coumestrol in Soybeans and Fractions at Various Germination Times.

G. L. Lookhar t, P. L. Finney, and K. F. Finney. Cereal Chem 56:495.

Coumestrol, an estrogenic compound found in most forage plants was determined by high performance liquid chromatography in germinated and ungerminated (Amsoy 71, Clark 63, and Columbus variety) soybeans and fractions therefrom. The coumestrol increased with increasing germination time and the increase in concentration of coumestrol ranged between eightfold and 200-fold depending on variety and germination time. Coumestrol level was highest in the hulls, which are readily separable from the beans.

(37)

Note on the Effect of Bran Lipids on Cookie Quality.

W. T. Yamazaki, J. R. Donelson, and R. L. Clements. Cereal Chem 56:584.

Lipids extracted with hexane from the bran of soft red winter or eastern soft white winter wheats increased the cookie-spread potential of test cookies to the same degree as did lipids extracted from flour. In baking tests, addition of bran lipids to the flour as a hexane solution, followed by solvent evaporation, was more effective than adding them as solids to the shortening phase. Because it yields a greater amount of lipids and is less costly than flour, bran is an attractive source of lipids for improving cookie quality.

(38)

Natural Levels of Nutrients in Commercially Milled Wheat Flours. I. Description of Samples and Proximate Analysis.

K. Kulp, P. M. Ranum, P. C. Williams, and W. T. Yamazaki. Cereal Chem 57:54.

The overall purpose of this study was to determine the baseline levels and the variations of the nutrients proposed for enrichment of wheat flours in the United States and Canada. This initial paper details the selection, procurement, sampling, and proximate analyses of the 63 flour and parent wheat samples used in this study. The type of wheat and the milling parameters of all samples were documented by the mill. The classes of flour analyzed included bread, family, hearth, cake, and cookie-cracker flours. The samples were procured from mills selected on the basis of geographic location and type of flour produced to permit the assessment of variability of the studied nutrients due to wheat, milling practices, and other regional factors. The collected samples were sent to 13 laboratories for 39 separate assays of each flour and 17 assays of each parent wheat. Analyses reported here include protein, ash, starch damage, and Kent-Jones flour color values.

(39)

Gasograph: Design, Construction, and Reproducibility of a Sensitive 12-Channel Gas Recording Instrument.

G. L. Rubenthaler, P. L. Finney, D. E. Demaray, and K. F. Finney. Cereal Chem 57:212.

The gasograph is an instrument designed to measure and continuously record the gas produced in 12 fermenting doughs (of about 10 g of flour). Values are recorded as gasograph units (GU), which can be readily expressed as millimeters of mercury or cubic centimeters of gas. Gasograph channel to channel reproducibility is at least equal to that of different manometric-type and gauge-type nonrecording instruments. The first two gasographs produced essentially identical results on successive days at two research laboratories, comparing fermentation rates of two yeast levels (3.5 and 7.25%) and three straight grade baker's flours formulated in sponges containing 6% sucrose, 1.5% NaCl, and 150% water in addition to flour and yeast. The average of the coefficients of variability of treatments within laboratories was 0.55%, and within channels between laboratories was 0.75%. Thus, the excellent reproducibility between laboratories was somewhat lower than that within laboratories. Typical gasograms demonstrate the high reproducibility of the actions of formula ingredients, yeast, sugar, and diastatic malt. The coefficient of variability was 0.69%. The gasograph can be used to indicate the presence or absence of inhibitors or stimulators of yeast respiration and to investigate the interaction of formula ingredients and fermentation rates during various stages of the fermentation and proofing of dough. Traces of alpha-amylase in wheat and flour can be easily detected with the instrument.

(40)

Note on a Simple Method to Produce a High Extraction Faba Bean Cotyledon Flour.

M. M. Morad and P. L. Finney. Cereal Chem 57:230.

(41)

Germinated and Ungerminated Faba Bean in Conventional U.S. Breads Made With and Without Sugar and in Egyptian Balady Breads.

P. L. Finney, M. M. Morad, and J. D. Hubbard. Cereal Chem 57:267.

Eighteen hours of steeping followed by four days of germination only moderately changed the amino acid spectrum of faba beans (Vicia faba). Aspartic acid, ammonia, and serine increased 17.2, 10.8, and 7.2%, respectively, whereas isoleucine, tyrosine, glycine, and arginine decreased 11.8, 9.5, 7.2, and 7.0%, respectively. Flour from ungerminated and germinated decoated faba beans replaced (15%) straight grade baker's flour and produced straight dough, yeast-leavened loaf breads that were equally acceptable with and without sugar. Twenty percent replacement with ungerminated faba flour was suitable in Egyptian balady bread. Slurries containing 15% faba bean flour yielded slightly more gas when yeast fermented than did the control wheat flour slurries containing 0.60% malt (50 DU/g, 20 C).

(42)

Effect of Germination on Physicochemical and Bread-Baking Properties of Yellow Pea, Lentil, and Faba Bean Flours and Starches.

M. M. Morad, H.K. Leung, D. L. Hsu, and P. L. Finney. Cereal Chem 57:390.

The physicochemical properties of flours and starches from ungerminated and germinated yellow pea, lentil, and faba bean were investigated. The alpha-amylase activity of the legume flours increased about 8.1 times for yellow peas, 2.4 times for lentils, and 1.5 times for faba beans after four days of germination. Scanning electron microscopy indicated some alteration of starch granule surfaces after germination. Germination caused changes in starch pasting properties of the legume flours and their starch fractions. Replacing wheat flour by legume starches affected loaf volume, crumb grain, and crust color of the breads. Germination appeared to have more detrimental effects on the baking properties of yellow pea starches than on those of lentil and faba bean starches.

(43)

A Baking Method to Evaluate Flour Quality for Rotary-Molded Cookies.

C. S. Gaines and C. C. Tsen. Cereal Chem 57:429.

A baking method to evaluate the quality of flour used in the production of rotary-molded (RM) cookies was developed. The ingredient formula and baking conditions were chosen to be similar to those used in commercial production of RM cookies. The RM method and the American Association of Cereal Chemists (AACC) official method were compared, using flours of varying quality. The RM and AACC methods evaluated flour quality differently. The AACC method evaluated flour quality on the basis of cookie width, and the RM method evaluated it using cookie thickness and density, which are important in the commercial packaging of RM cookies.

(44)

Note on the Effect of Removal of Free Flour Lipids on the Internal Structure of Cookies as Observed by a Resin-Embedding Method.

R. L. Clements. Cereal Chem 57:445.

(45)

Note on Fresh Egg Yolk in 50% Whole Wheat Bread.

R. E. W. Birch and P. L. Finney. Cereal Chem 57:448.

(46)

Note on a Simple Device for Monitoring Batter Expansion in Layer Cakes During Baking.

R. L. Clements and J. R. Donelson. Cereal Chem 58:153.

(47)
Functionality of Specific Flour Lipids in Cookies.
R. L. Clements and J. R. Donelson. Cereal Chem 58:204.

Cookies baked from hexane-extracted flour exhibited limited spread and top grain as a result of breakdown of internal structure. Functionality was restored when total free lipids were added back to the extracted flour. To determine the source of functionality, free flour lipids were separated quantitatively by preparative thin-layer chromatography. Zones were removed, eluted, and added back to cookie mixes containing hexane-extracted flours. Two fractions (about 13% of free lipids) corresponding to digalactosyldiglyceride (plus phosphatidylchloline) and monogalactosyldiglyceride exhibited high degrees of restoration. Pure commercial digalactosyldiglyceride added alone at 0.1% of flour weight (dry basis) or pure phosphatidylcholine from egg yolk added at 0.5% resulted in essentially complete restoration. Monogalactosyldiglyceride added at levels up to 0.15% gave little response. The data suggests that digalactosyldiglyceride and/or phosphatidylcholine are the primary contributors to functionality. An unidentified glycolipid with chromatographic mobility similar to that of monogalactosyldiglyceride also appears to contribute to functionality

(48)
Relation of Cultivar and Flour Particle Size Distribution to Cake Volume.
V. K. Chaudhary, W. T. Yamazaki, and W. A. Gould. Cereal Chem 58:314.

Intermediate-cut air-classified fractions from flours of different cultivars representing several wheat classes, and therefore differing in granularity, were similar in mass median diameter but formed cakes with significantly different volumes. Similarly, flours reconstituted from fractions separated by wet-fractionation and representing different cultivars were similar in mass median diameter but formed cakes differing in volume. These results suggest that in addition to particle size itself, heritable endosperm-fracturing properties are important in influencing layer-cake quality.

(49)
Micro Baking Evaluation of Some U.S. Wheat Classes for Suitability in Iranian Breads.
H. A. Faridi, P. L. Finney, and G. L. Rubenthaler. Cereal Chem 58:428.

Micro baking techniques were developed for making the four most popular Iranian breads: barbari, lavash, taftoon, and sangak. Four U.S. wheat classes were tested for suitability in Iranian breads, using five wheat varieties and a western white composite. The soft white winter wheats produced the most desirable breads.The one soft white spring wheat produced satisfactory bread, although finished breads were excessively brown. Hard red winter wheat was strong and too dark most of the time. Club wheat was weak, making dough handling difficult and bread texture porous.

(50)

Iranian Flat Breads: Relative Bioavailability of Iron.

G. S. Ranhotra, J. A. Gelroth, F. A. Torrence, M. A. Bock, G. L. Winterringer, H. A. Faridi, and P. L.Finney. Cereal Chem 58:471.

The iron in five types of Iranian flat breads (Barbari, Lavash, Taftoon, Sangak, and Village) and in the corresponding fermented doughs was assessed for its efficacy in promoting hemoglobin synthesis in hemoglobin-depleted rats. Bioavailability of iron in these breads differed significantly, ranging from 53 to 95% (relative to iron in ferrous sulfate) as calculated by the modified AOAC method and from 63 to 100% as calculated by methods based on gain in hemoglobin. No direct relationship of these values to protein, phytate, or dietary fiber content of breads was observed. Comparison of breads with doughs showed that the baking process appreciably improved the bioavailability of iron in Barbari, Taftoon, and Sangak breads and decreased it in Lavash and Village breads.

(51)

Experimental Milling of Soft Wheat Cultivars and Breeding Lines.

W. T. Yamazaki and L. C. Andrews. Cereal Chem 59:41.

A four-stand Allis Chalmers experimental mill was modified to improve precision in milling soft wheat and was then used to compare three milling procedures. A six-break, variable-roll, variable reduction-pass system was found to be best suited to accommodate the diverse types of soft wheat cultivars and breeding lines. A milling characteristic termed endosperm separation index, which appeared to be a measure of ease of separation of endosperm and bran, was found to be associated with yield of straight-grade flour.

(52)

Role of Free Flour Lipids in Batter Expansion in Layer Cakes. I. Effects of "Aging."

R. L. Clements and J. R. Donelson. Cereal Chem 59:121.

White layer cakes baked from unbleached patent flours that had been aged (exposed to moving air) for 9 or 14 weeks exhibited greater oven expansion than did cakes baked from bleached control flours. A measurable increase in expansion occurred in cakes baked from flours aged two weeks. Expansion in cakes baked from defatted unbleached and bleached flours reconstituted with free lipids from aged flours suggests that expansion induced by aging is a result of changes in free lipids. Cake volumes were retained when the lipids were added back to defatted bleached flours, but some degree of collapse usually resulted when the lipids were added back to defatted unbleached flours.

(53)

Role of Free Flour Lipids in Batter Expansion in Layer Cakes. II. Effects of Heating.

R. L. Clements and J. R. Donelson. Cereal Chem 59:125.

Free lipids were extracted from unbleached flours and heated at 100 C for different periods, either unsupported or supported on diatomaceous earth. Cakes were then baked from defatted bleached and unbleached flours reconstituted with the heat-treated lipids. Heating unsupported lipids for up to 60 min usually resulted in oven expansion greater than that of unbleached controls. Heating supported lipids for shorter periods resulted in oven expansion equal to or exceeding expansion from bleached control flours. Differences in sensitivity to heating were noted among flours. Expansion was retained as volume when heat- treated lipids were added to defatted bleached flours, but cakes usually collapsed when lipids were added to defatted unbleached flours.

(54)

Note: Technique for Objectively Measuring a Relationship Between Flour Chlorination and Cake Crumb Stickiness.

C. S. Gaines. Cereal Chem 59:149.

Stickiness of cake crumb was measured objectively and found to be highly negatively correlated with flour chlorination rate. Flour pH and cake volume were not well correlated with objective cake crumb stickiness.

(55)

Cake Batter Viscosity and Expansion upon Heating.

C. S. Gaines and J. R. Donelson. Cereal Chem 59:237.

A technique using a modified viscograph that enables continuous measurement of cake batter viscosity on a complete cake formula from 20 to approximately 100 C is described. Batter viscosity, influenced by batter moisture content and flour chlorination, was compared with cake expansion during baking. Statistically significant variation in the cake expansion during baking of two cake flours was attributed to differences in apparent viscosity of the batter.

(56)

Small-Scale Milling to Estimate the Milling Quality of Soft Wheat Cultivars and Breeding Lines.

W. T. Yamazaki and L. C. Andrews. Cereal Chem 59:270.

Flour yield from 20-g milling in a modified Brabender Quadrumat Jr. mill was correlated significantly with straight-grade flour yield and endosperm separation index data from an Allis-Chalmers milling of soft wheat. Adjusting the yield from the small-scale milling to a uniform grain moisture content improved the relationship with endosperm separation index. The procedure provides a means of evaluating milling quality potential in soft wheat breeding lines at an early stage of development.

(57)

Effect of Germination on Electrophoretic, Functional, and Bread-Baking Properties of Yellow Pea, Lentil, and Faba Bean Protein Isolates.

D. L. Hsu,H. K. Leung, M. M. Morad, P. L. Finney, and C. T. Leung. Cereal Chem 59:344.

The physicochemical properties of protein isolates from ungerminated and germinated yellow peas, lentils, and faba beans were investigated. Polyacrylamide gel electrophoretic patterns revealed different degrees of protein modification among the three legumes after four days of germination. The effect of germination on nitrogen solubility, emulsifying capacity, foam capacity and stability, viscosity, gelation, and water sorption properties of the protein isolates from the three legumes also varied. Replacement of wheat flour with 5 or 8% legume protein isolates had deleterious effects on loaf volume and crumb grain of bread. Germination affected the baking properties of protein isolates from faba beans, but not those from peas or lentils.

(58)

Contribution of Chlorinated Flour Fractions to Cake Crumb Stickiness.

C. S. Gaines and J. R. Donelson. Cereal Chem 59:378.

Cakes from two flours were evaluated objectively for stickiness and cake volume by interchanging fractions (ie, prime starchy tailings, gluten, water solubles, and hexane-extracted lipids) from chlorinated and unchlorinated flour. Stickiness of cakes made from chlorinated flour resulted primarily from chlorine alteration of the prime starch fraction. Cake volume improvement was caused primarily by chlorine alteration of flour lipids.

(59)

Influence of Dough Absorption Level and Time on Stickiness and Consistency in Sugar-Snap Cookie Doughs.

C. S. Gaines. Cereal Chem 59:404.

Five soft wheat flours and one hard wheat flour were objectively evaluated for sugar-snap cookie dough consistency and stickiness at four widely spaced dough water absorption levels. Evaluations were made immediately after mixing and 1 hr later to observe the influence of time. Change in dough consistency or stickiness after 1 hr was a function of the dough water absorption level. Data suggest a two-phase (initial and time-dependent) requirement for water by flour and sugar, the relative strength of each phase depending on the dough water absorption level. In soft wheat flour doughs, certain dough water absorption levels did not change dough consistency (isoconsistency) after 1 hr. Water absorption levels above and below the isoconsistency level caused doughs of thicker and thinner consistency, respectively, after 1 hr. Other dough water absorption levels caused no change in dough stickiness (isostickiness) after 1 hr. Water absorption levels above and below the isostickiness level caused dough stickiness to decrease and increase, respectively, after 1 hr. In freshly mixed doughs, variation in dough absorption levels had approximately equal influence on dough consistency and stickiness. In doughs rested for 1 hr, changes in dough absorption level exerted twice the influence on dough consistency as on dough stickiness. Holding doughs for 1 hr before measurement and the addition of soy lecithin adversely affected dough-handling properties.

(60)

Influence of Ambient Temperature, Humidity, and Flour Moisture Content on Stickiness and Consistency in Sugar-Snap Cookie Doughs.

C. S. Gaines and W. F. Kwolek. Cereal Chem 59:507.

Stickiness and consistency of sugar-snap cookie dough were evaluated when subjected to varying dry-bulb (room) temperatures in combination with three measures of ambient water vapor content (wet-bulb temperature, relative humidity, and water-vapor pressure deficit). Combinations in excess of approximately 21 C (70 F) dry-bulb temperature, 19 C (67 F) wet-bulb temperature, 54% ambient relative humidity, and 4.89 mm Hg water-vapor pressure deficit caused excessive dough stickiness, even though dough consistency was optimal. Flour moisture content (11.5-14.5%) was also evaluated for effect on dough stickiness and consistency. When dough was at optimum consistency, excessive dough stickiness could not be induced by altering flour moisture content. Stickiness and consistency of doughs made from low- moisture flour were more sensitive to changes in dough water absorption than doughs made from flours of high moisture content. Dough water absorption level was more difficult to adjust in doughs made from low- moisture flours. Dough stickiness was less in dough made from high-moisture flours, and less dough water was necessary to achieve optimum consistency in these doughs.

(61)

Effects of Germination on Bread-Baking Properties of Mung Bean (Phaseolus aureus) and Garbanzo Bean (Cicer arietinum).

P. L. Finney, D. Beguin, and J. D. Hubbard. Cereal Chem 59:520.

Flours from whole mung bean were unsuitable in straight-dough breads because of an undesirable "beany" off-flavor even at the 5% replacement level. De-coated mung produced excellent breads when substituted for 5% of bakers' flour and acceptable breads when substituted for 10-15% of bakers' flour. Three days of germination produced noticeable deleterious effects to both bread flavor and structure at the 5-10% replacement level. Flour from whole garbanzo bean produced
outstanding breads when replacing 10% of bakers' flour and acceptable breads when replacing 15-20% of bakers' flour. Germination imparted a slightly sweet taste at the 15-20% level and preserved desirable bread properties. Unlike mung and all other legumes previously tested, 48 hr of germination reduced yeast gas production of whole garbanzo flour slurries and approximately doubled that of mung. Germination did not materially alter amino acids of either mung or garbanzo, which have similar amino acid patterns.

(62)
Kernel Hardness of Some U.S. Wheats.
W. T. Yamazaki and J. R. Donelson. Cereal Chem 60:344.

Pure variety wheat samples grown over a 21-year period at locations in the eastern United States generally showed no significant correlation between particle size index (PSI) and protein content. Grain moisture content was found to exert a considerable effect on PSI. In a given wheat sample, higher moisture content was associated with greater softness as determined by our PSI test procedure. In making comparisons of hardness, an adjustment to a uniform moisture content may be made by reference to a fan-shaped family of regression lines developed under specific conditions prevailing for PSI determinations. Particle size index values appear to have greater value when they can be associated with a milling characteristic such as break flour yield rather than standing alone. PSI values obtained by grinding the wheat samples through a properly calibrated burr-type grinder correlated significantly with break-flour yield from Allis-Chalmers laboratory millings, whereas PSI data using a comminution grinder were not correlated with milling data.

(63)
Functionality in White Layer Cake of Lipids from Untreated and Chlorinated Patent Flours. II. Flour Fraction Interchange Studies.
J. R. Donelson, W. T. Yamazaki, and L. T. Kissell. Cereal Chem 61:88.

Chlorinated and untreated cake flours were hexane extracted to remove free lipids and then fractionated by an aqueous procedure into prime starch, tailings, gluten, and water-soluble fractions. The fractions were reconstituted into dry blends such t hat one component from the respective flours was interchanged at a time. Bake results with a high-ratio layer-cake formulation showed that chlorinated lipids were the primary component contributing to cake-quality potential. Lipid-interchange studies between varieties and wheat classes indicated that this functionality was general and independent of the lipid source. Differences in cake volume between flours were shown to reside in the hexane-extracted flour residues.

(64)
Influence of Certain Flour Quality Parameters and Post-milling Treatments on Size of Angel Food and High-Ratio White Layer Cakes.
C. S. Gaines and J. R. Donelson. Cereal Chem 62:60.

Heights of angel food cakes from 23 Allis-Chalmers laboratory-milled, Miag laboratory-milled, and commercially milled cake patent flours were not statistically correlated with high-ratio white layer cake volume, MacMichael viscosity, alkaline water retention capacity, protein, or ash contents. Milling method, pin-milling,
turbo-milling, starch addition, and flour chlorination all influenced angel food cake height and/or white layer cake volume. Post-milling cake flour treatments usually reduce particle size and increase starch damage. In this study improvement of white layer cake volume and angel food cake height resulted from reduction of flour particle size rather than increased starch damage. It appears that angel food cake flour must be chlorinated to exhibit significant improvement in cake size from post-milling particle size reduction.

(65)

Note: Effect of Varying Flour Protein Content on Angel Food and High-Ratio White Layer Cake Size and Tenderness.

C. S. Gaines and J. R. Donelson. Cereal Chem 62:63.

The effect of artificially varying cake flour protein content on the size and tenderness of white layer cake and angel food cake was evaluated by varying cake flour protein content from approximately 7 to 16% by air-classification techniques and by adding gluten. Volume and tenderness of white layer cakes were not significantly affected by flour protein content. Height and tenderness of angel food cake decreased as flour protein content increased. However, relatively large (approximately 2%) increases in protein content were required to effect the change.

(66)

Evaluating Cookie Spread Potential of Whole Wheat Flours from Soft Wheat Cultivars.

C. S. Gaines and J. R. Donelson. Cereal Chem 62:134.

Methods for evaluating whole wheat flour cookie spread potential were compared. The following were statistically evaluated for correlation with whole wheat flour sugar-snap cookie diameter: particle size index, straight-grade flour MacMichael viscosity, and sugar-snap cookie diameter; whole wheat flour alkaline water retention capacity, whole wheat temper, and level and extent of ginding; whole wheat flour particle size and ash, protein, and moisture contents; and whole wheat flour cookie dough liquid level. Because no good predictive correlations were found across cultivars, whole wheat cookie spread potential was concluded to be evaluated best by test baking and measuring cookie diameter. Cultivars with a softer kernel texture produced larger whole wheat cookies. Within the cultivar, whole wheat flour cookie size was significantly affected by flour particle size and moisture content.

(67)

Effect of Wheat Variety, Flour Grinding, and Egg Yolk on Whole Wheat Bread Quality.

P. L. Finney, S. Henry, and H. Jeffers. Cereal Chem 62:170.

Seventeen wheat varieties grown as drill strips in 1980 at either Lind or Pullman, WA, were milled into straight-grade bakers flours and ground into a relatively coarse whole wheat flour with a Hobart grinder or a relatively fine flour with a Udy mill. Breads produced from the straight-grade flours and from each of the whole wheat flours were formulated both with and without 5% dried egg yolk. Relatively poor correlation coefficients for loaf volume between the whole wheat and the straight-grade breads indicated that bran and germ fractions of different varieties have varying effects on bread making properties.

(68)

Effect of Wheat Variety on the Relationship Between Falling Numbers and Alpha-Amylase Activity.

P. L. Finney. Cereal Chem 62:258.

For 12 wheat varieties standard curves were established that related alpha-amylase activity to falling number values, and a method was developed that accurately quantifies alpha-amylase activity by using only falling numbers. The method essentially eliminates the genetically controlled factors, other than alpha- amylase, that affect falling numbers.

(69)

Associations Among Soft Wheat Flour Particle Size, Protein Content, Chlorine Response, Kernel Hardness, Milling Quality, White Layer Cake Volume, and Sugar-Snap Cookie Spread.

C. S. Gaines. Cereal Chem 62:290.

Eighty-three soft red and white wheat test lines or cultivars were evaluated for several milling quality characteristics (kernel hardness, kernel and flour protein, flour ash), straight-grade and cake patent flour particle size, and cake patent flour chlorine response. Each characteristic was statistically evaluated for associations with sugar-snap cookie diameter and high-ratio white layer cake volume. An additional 136 soft wheats were included to evaluate associations among cookie diameter, flour particle size, and protein content. Across cultivars, both cookie diameter and cake volume were positively associated with soft textured wheats having lower protein contents, which produced more break flour and flour having smaller particle size. Wheats producing straight-grade flour with small particle size also tended to produce patent flours with small particles (both before and after pin-milling). Wheats having better milling quality were more coarsely granulating during milling and tended to produce smaller cakes and cookies. Wheats producing more break flour were finer granulating. Kernel hardness (particle size index) was not correlated with milling quality (endosperm separation index).

(70)

Distribution of Deoxynivalenol in Soft Wheat Mill Steams.

L. M. Seitz, W. T. Yamazaki, R. L. Clements, H. E. Mohr, and L. Andrews.

Cereal Chem 62:467.

A study was made of the distribution of deoxynivalenol (DON) in mill streams of soft wheat infected to varying degrees with scab (Fusarium graminearum). Eleven lots of soft wheat ranging in DON contents from 0.03 to 2.89 ppm were each cleaned by screening, conditioned to 14% moisture, and milled on a Miag Multomat mill. Cleaning reduced DON content of wheat by an average of 16%, and screenings had 4.7-fold higher DON contents than cleaned wheat. DON was found in all mill fractions, which included straight- grade flour, four break flours, six reduction flours, break and reduction shorts, red dog, and bran. Mean DON concentration in straight-grade flour was about 90% of that in cleaned wheat. The different lots of wheat, regardless of DON concentration, generally give similar fractional distributions of DON as indicated by correlation coefficients. Mean DON concentrations were lower in flours (except for first reduction) and higher in offals than in whole wheat. Among break flours, mean DON concentrations increased slightly from the first to the third break. However, the first reduction flour exhibited a higher mean DON concentration than subsequent reduction flours, with the lowest concentration found in the fifth reduction flour.

(71)

A 30-Minute Conditioning Method for Micro-, Intermediate-, and Large-Scale Experimental Milling of Soft Red Winter Wheat.

P. L. Finney and L.Andrews. Cereal Chem 63:18.

Conditioning wheat in 30 min involved a 2% pre-temper for 15 min, a pre-break, a final temper for 15 min and an optional second pre-break. The method was highly successful for milling 200 g of soft red winter wheat on two Quadrumat Juniors, 1.5 kg on an Allis-Chalmers mill, or 10 kg on a Miag Multomat mill. Flour moisture, yield, ash, damaged starch, and cookie quality were comparable whether tempered 18-24 hr or tempered a total of 30 min using the pre-break methods described.

(72)

Components of Cake Batter Expansion in White Layer Cakes.

J. R. Donelson and R. L. Clement s. Cereal Chem 63:109.

Objective measurements were used to study the components of batter expansion in white layer cakes. Free flour lipids are necessary for expansion, but the hexane-extracted flour residue controls the degree of batter expansion in chlorinated patent flours. Cake volume and batter expansion data indicated that shortening emulsifiers probably influence baking performance by contributing to batter aeration, whereas free flour lipids probably contribute to foam stability.

(73)

Cleaning, Milling, and Baking Tests with Hard Red Winter Wheat Containing Deoxynivalenol.

L. M. Seitz, W. D. Eustace, H. E. Mohr, M. D. Shogren, and W. T. Yamazaki.
Cereal Chem 63:146.

Seven commercial lots of 1982 hard red winter wheat were selected for cleaning, milling, and baking tests. Five scab-infected lots had deoxynivalenol (DON) concentrations ranging from 0.64 to 5.10 ppm, and two lots were scabfree controls. Each lot was cleaned by four methods: 1) normal, single cleaning to obtain maximum screenings with a minimum of wheat lost; 2) double cleaning using the normal flow; 3) single cleaning with suction increased on the millerator and the entoleter aspirator; and 4) single cleaning followed by washing the wheat with water. None of the cleaning methods completely removed DON, and the special methods showed little or no advantage over the normal, single cleaning. Cleaning efficiency varied with DON concentration among lots of cleaned wheats (means of four cleaning methods) ranging from 48 to 86% of that in uncleaned wheat. The cleaned wheat were milled with a Miag Multomat mill. All mill fractions from scab-infected wheat contained DON. Concentrations of DON were generally lower in flours, and higher in offals, than in the cleaned wheat. Average DON concentration of straight-grade flour was 44 and 75% of that in uncleaned and cleaned wheat, respectively. DON was not destroyed by baking bread. Only bread from flours with highest levels of DON had slightly reduced loaf volumes and off-colors in bread crumb compared to controls.

(74)

Revised Micro-testing for Soft Wheat Quality Evaluation.

P. L. Finney and L. C. Andrews. Cereal Chem 63:177.

A revised two-phase quality evaluation micro procedure for early generation screening of wheat is described. Improved milling and baking predictability and labor savings were accomplished by enlarging the sieve housing and adding a 94SS sieve to the Quadrumat Jr. micro milling method. The added sieving enabled relative wheat hardness to be differentiated, which saved labor by replacing the Labconco-ground particle size index test. Furthermore, use of the additional sieve improved milling quality predictability by relating Quadrumat to Allis-Chalmers break-flour yields with a correlation coefficient of about 0.98. Additional labor savings and improved predictability resulted, because tempering of wheat before experimental milling was unnecessary if two regression coefficients expressing the effects of wheat moisture on Quadrumat break-flour yield and Quadrumat flour yield were used to correct all data. With or without tempering, the throughs of the Quadrumat 94SS correlated best with the Allis-Chalmers mill alkaline water retention capacity (AWRC) values. However, acceptable Allis AWRC predictability was accomplished on the combined flours of the 94SS overs and throughs. The combined flours had the advantage of yielding AWRC values essentially unaffected by variable wheat moisture content during milling.

(75)

Texture (Hardness and Softness) Variation Among Individual Soft and Hard Wheat Kernels.

C. S. Gaines. Cereal Chem 63:479.

The texture of individual kernels of soft and hard wheat cultivars was measured by grinding individual kernels in ethanol in a blender jar and subsequently determining median particle size by laser light scattering. This method parallels the production and measurement of break-flour yield of bulk wheat samples. There was a large variation in individual kernel texture within a cultivar (approximately one-half of the texture range of all kernels of the respective wheat class). Most variation in kernel texture of a particular cultivar was observed among the kernels of a single wheat rachis (head), probably resulting from different maturation times of kernels on a wheat rachis. The influence of kernel weight, and indirectly, size, on the measurement of kernel texture was small enough to allow good separation of soft and hard wheat texture data. Estimates of the kernel texture/weight relationship were sufficiently precise to reduce the overlapping of soft and hard wheat data from 6% without consideration of kernel weight to 1.5% when weight was included in the regression. Many hundreds or thousands of kernels were required to statistically differentiate between two samples containing mixtures of hard and soft wheat kernels that have mixture ratios as close as 2%. Overlapping of soft and hard wheat data greatly increases the number of kernels required but is a consequence of a single-kernel method that has a strong relationship with kernel weight, size, and density. If these factors are considered by least squares regression, overlapping may be reduced.

(76)

Optimizing Grinder Type and Methods of Expressing Wheat Meal Particle Size for Wheat Texture (Hardness or Softness) Measurement and Near-Infrared Reflectance Spectroscopy.

C. S. Gaines, R. E. Miller, J. R. Donelson, and M. M. Bean. Cereal Chem. 64:46.

The grinding characteristics of three wheat grinders (LabConco, Falling Number KT-3303, and Udy cyclone) were compared by measuring the particle size of meals produced, using four sieving techniques and five Microtrac laser light-scattering optical measurements. Seven wheat samples used in the evaluation represented a wide range of texture (hardness or softness). The LabConco-ground meals were coarser than the others, and samples were best differentiated by sieving the meals to determine particle size distribution or means as an assessment of wheat texture. Meals produced by the Falling Number grinder were of generally intermediate particle size distribution, and samples were best differentiated by analyzing meal particle size with the Microtrac instrument. The Udy cyclone produced meals having much finer mean particle size, more narrow particle size distributions, and overall the best differentiation among wheat samples (using the Microtrac). Therefore, the Udy/Microtrac combination was the best procedure for evaluating the texture of wheat samples with equal, if not better, statistical power than a (more coarse) grinder and sieving combination commonly used for particle size index testing.

(77)

A Study of Gliadins of Soft Wheats from the Eastern United States Using a Modified Polyacrylamide Gel Electrophoresis Procedure.

R. L. Clements. Cereal Chem. 64:442.

The conventional continuous aluminum lactate-lactic acid buffered polyacrylamide gel electrophoresis system was modified by omitting aluminum lactate from the gel and lower (cathode) reservoir, giving a discontinuous system with the gel buffered with lactic acid only. Omission of aluminum lactate (usually contaminated) eliminates a potential source of impurities that affect gel formation and properties. Gliadins were extracted with ethylene glycol, giving high-density extracts that permit direct application to gels without additives. Using 10% acrylamide gel slabs, gliadin patterns of more than 120 soft red and soft white winter wheat cultivars were obtained. Patterns fell into four categories ("types") based on configuration of bands in the central region of the pattern: type I, a single heavy band; type II, two closely spaced heavy bands; type III, two widely spaced bands of moderate to heavy intensity; type IV, three (or more) bands of moderate intensity. About half of the cultivars studied were "Arthur type" (type II). Most soft white wheat cultivars were type III. Patterns of several cultivars (especially among types II and III) appeared to be very similar, if not identical.

(78)

Note: A Labor-Saving Technique for Polyacrylamide Gel Electrophoresis of Gliadins from Large Numbers of Single Wheat Kernels.

R. L. Clements.Cereal Chem. 65:150.

Gel capacity was increased by use of a 40-place well-former, and labor was reduced by steeping crushed kernels in ethylene glycol and applying extracts to gels without centrifugation. About 30 min of labor was required to process 80 kernels for simultaneous polyacrylamide gel electrophoresis on two gels. Large numbers of single kernels were extracted with minimal effort, permitting rapid screening for establishing homogeneity in grain samples and for application to inheritance studies.

(79)

Effects of Damaged Starch, Chlorine Gas, Flour Particle Size, and Dough Holding Time and Temperature on Cookie Dough Handling Properties and Cookie Size.

C. S. Gaines, J. R. Donelson, and P. L. Finney. Cereal Chem. 65:384.

Five physical-textural attributes (stiffness, consistency, flow, adhesion, and cohesion) of sugar-snap cookie dough were evaluated as they were affected by variations in dough energy input (re-rolled one to five times), dough age (1-3 hr holding time after mixing), dough temperature (22 and 31 C), flour chlorination (pH 6.0 and 4.8), flour particle size (24-68 micrometers), flour damaged starch content (1.9-8.8%), and flour moisture content (8.2-15.4%). Flour chlorination, flour moisture content, and damaged starch had the greatest effects on cookie size. Flour moisture content and dough holding time had the greatest effects on dough handling properties. Decreased flour moisture, increased starch damage, longer holding time, warmer dough temperature, increased dough handling, and flour chlorination caused dough to handle as if they were more plastic; these doughs were more stiff and cohesive, had greater consistency, had less flow and adhesion, and made smaller cookies. Combinations of treatments compounded changes in dough handling properties.

(80)

The Contribution of High-Protein Fractions from Cake and Cookie Flours to Baking Performance. J. R. Donelson. Cereal Chem. 65:389.

Reconstituted cake and cookie flours were used to study the contribution of high-protein flour fractions (starch tailings, gluten, and water solubles) to baking performance. Substituting starch for starch tailings or water-soluble fractions resulted in significant losses in volume for reconstituted cake flours; however, exchanging starch for the gluten fraction gave normal baking responses although crumb scores were lower. Significant improvements in baking performance (larger cookies) were obtained for reconstituted cookie flours in which starch was substituted for either the gluten or starch tailings fractions. Hydration data for these treatments indicated that gluten and starch tailings fractions may influence cookie spread because of their hydrophilic properties.

(81)
Prediction of Damaged Starch in Straight-Grade Flour by Near-Infrared Reflectance Analysis of Whole Ground Wheat.
P. L. Finney, J. E. Kinney, andJ. R. Donelson. Cereal Chem. 65:449.

The amount of damaged starch generated by grinding 25 g of whole wheat samples of a Udy cyclone mill was measured by enzymatic and near-infrared reflectance (NIR) methods. High correlations were achieved between the methods. In addition, it was possible to predict the amount of damaged starch induced by controlled Allis-Chalmers and Quadrumat Junior millings by the NIR analysis of the Udy-ground samples. Hard and soft classes of wheat could usually be separated by NIR analysis of damaged starch.

(82)
Measurement of the Water Uptake Rate of Crackers.
C. S. Gaines and P. L. Finney. Cereal Chem. 65:471.

Four types of commercial crackers baked by six commercial producers from 12 flours were evaluated by a new, inexpensive method for assessing the internal structure of those products, i.e., water uptake. Data from the sorption method were compared to data from an instrument designed to evaluate the hardness of commercial crackers, the Biscuit Texture Meter (BTM). The BTM had a lower coefficient of variation; however, rate curves from the water uptake method could predict the BTM values with an R2 of 0.91. Equipment for the water uptake method costs considerably less than the BTM.

(83)
Effects of Selected Commercial Enzymes on Cookie Spread and Cookie Dough Consistency. C. S. Gaines and P. L. Finney. Cereal Chem. 66:73.

Seventeen commercial enzyme preparations having cellulase, protease, beta-glucanase, beta-glucosidase, or cellobiase activities were added to cookie doughs made with chlorine-treated soft red winter wheat flour. Cookie diameters and Instron universal testing machine physical-texture measurements of the doughs were made immediately after mixing and after holding for 2 hr at 32 C. Several cellulase preparations from Trichoderma reesei were the most effective at maintaining stability of dough consistency and cookie size when doughs were held for 2 hr before processing. When untreated doughs were held 2 hr they became more stiff and baked smaller cookies. The protease papain was the most effective at increasing cookie spread and top grain. At the concentrations studied, papain produced sugar-snap cookies from hard red winter and hard spring wheat flours that were as large as control cookies made from soft red winter wheat flour.

(84)

Soft Wheat Milling and Baking Quality in a Soft Red Winter x Hard Red Winter Wheat Population.

L. May, D. A. Van Sanford, and P. L. Finney. Cereal Chem. 66:378.

A single-cross soft red winter x hard red winter wheat population was evaluated in the F3, F4, and F5 generations for preliminary soft red winter wheat milling and baking quality. Tests conducted included the softness equivalence (SE), adjusted flour yield, grain protein concentration (GPC), alkaline water retention capacity, and cookie diameter. Some of the progeny possessed low alkaline water retention capacity and GPC and high SE and adjusted flour yield, indicating acceptable preliminary soft red winter wheat milling and baking quality. Narrow sense heritability estimates for these traits were low but generally significant, ranging from 0.05 for GPC to 0.47 for SE. The results of the present study suggest that quality constraints may not preclude the use of hard wheat cultivars in soft wheat breeding programs as sources of new germ plasm.

(85)

Reduced Variance in the Sugar-Snap Cookie Baking Method Using a Cylinder and Plunger to Produce a More Uniform Dough.

P. L. Finney and C. S.Gaines. Cereal Chem. 66:405.

A cylinder and plunger were fabricated and used to apply moderate pressure to produce more uniform doughs prior to rolling out, cutting, and baking sugar-snap cookies by AACC method 10-52. Use of the cylinder and plunger reduced the standard error by approximately 29% and reduced the number of rebakes required due to lack of agreement between duplicates by 97%.

(86)

Milling and Baking Quality of Soft White Wheat Genotypes Subjected to Pre-harvest Sprouting.

M. E. Sorrells, A. H. Paterson, and P. L. Finney. Cereal Chem. 66:407.

Damage due to pre-harvest sprouting can cause major economic losses in regions where precipitation occurs frequently at harvest time. This research was conducted to evaluate the effects of pre-harvest sprouting on milling and baking characteristics of resistant and susceptible soft white wheat genotypes subjected to conditions inducing pre-harvest sprouting. Three sprinkler irrigation treatments were applied for durations of 5 hr on each of two consecutive days (5/5 hr), 10 hr on one day, or for 10 hr on each of two consecutive days (10/10 hr). Percent germination and alpha-amylase activity in the 5/5- and 10-hr treatments were not significantly different from the control. Under conditions inducing severe pre-harvest sprouting (10/10-hr treatment), pre-harvest-sprouting resistant genotypes had lower germination, lower alpha-amylase activity, higher grain yield, higher test weight, and higher alkaline water retention capacity than susceptible genotypes. Relative to the control, the 10/10-hr treatment reduced flour yield of resistant genotypes more than that of susceptible cultivars. Flour protein, sugar-snap cookie diameter, ash content, kernel hardness, and top grain were not affected by any of the treatments. The effects of pre-harvest sprouting on the tested soft wheat milling and baking characteristics were relatively minor, even with high levels of sprouting damage. Two of the resistant genotypes provided protection from pre-harvest sprouting damage with lower germination and lower alpha-amylase activity. The resistance to pre-harvest sprouting in two of

these genotypes should benefit farmers by extending the duration of the wetting period before visible damage is incurred and benefit processors by reducing hydrolytic breakdown of starch.

(87)
Influence of Chemical and Physical Modification of Soft Wheat Protein on Sugar-Snap Cookie Dough Consistency, Cookie Size, and Hardness.
C. S. Gaines. Cereal Chem. 67:73-77.

Across-cultivar mixograph patterns of 64 flours were evaluated together with protein content. They were found to predict sugar-snap cookie diameter less well than a combination of break flour yield, alkaline water retention capacity, and protein content. Soft wheat proteins within five cultivars were modified with potassium iodate, L-cysteine, N-ethylmaleimide, and ditheoreythritol. The protein-modifying agents significantly affected cookie spread and weight, although they had relatively little effect on dough consistency as measured by the Instron universal testing machine. Proteins within cultivars were also modified by mixing (at two levels of dough water addition) sugar-snap cookie doughs at four mixing times. Dough liquid level affected cookie spread and top grain and universal testing machine consistency. Longer mixing time increased sensory ranking of cookie hardness, although hardness increased without a significant change in dough consistency. Any gluten developed during mixing was relatively small compared with the increase observed in cookie hardness. Soft wheat proteins functioned by affecting sugar-snap cookie size, weight, and texture without forming an extensive gluten network.

(88)
Note: Flour Fraction Interchange Studies of Effects of Chlorination on Cookie Flours.
J. R. Donelson. Cereal Chem. 67:99-100.

Flour fractionation-reconstitution procedures were used to study the spread-depressing effects of chlorination on cookie flours. In a series of interchanges between individual flour fractions from untreated and chlorinated flours, the reduction in cookie spread was found to be the result of changes in the chlorinated starch fraction. Hydration data (alkaline water retention capacity) indicated the loss in cookie spread was related to increased hydration of the chlorinated starch fraction.

(89)
Polyacrylamide Gel Electrophoresis of Salt-Soluble Proteins of Soft Wheats from the Eastern United States.
R. L. Clements. Cereal Chem. 67:264-267.

Electrophoretic procedures were developed for the study of soluble proteins of soft wheats. Best results were obtained with a cationic system using 10-20% acrylamide gradient gels buffered at pH 5.3-6.0 with potassium acetate/beta-alanine acetate, and with an anionic system using 8% acrylamide gels buffered at pH 8.0-8.5 with Tris-HCL/Tris glycine. Extraction medium had little effect on patterns, and good results were obtained with both meals and single kernels. Genotypical differences in patterns were noted, but major differences were quantitative rather than qualitative Patterns of high- and low-protein specimens of selected cultivars showed only minor differences.

(90)

Associations Among Quality Attributes of Red and White Soft Wheat Cultivars Across Locations and Crop Years.

C. S. Gaines. Cereal Chem. 68:56-59.

The means and distributions of correlation coefficients among seven principal wheat and flour quality attributes (test weight, break flour yield, straight-grade flour yield, flour protein content, sugar-snap cookie diameter, white layer cake volume, and alkaline water retention capacity) of 53 soft wheat cultivars grown in the eastern United States were compared relative to pericarp color (red or white). Quality attributes of red wheat cultivars usually were adversely affected by protein content. Quality attributes of white wheat cultivars were relatively unaffected by protein content. Among most red wheats, but not among most white wheats, high protein content was correlated with harder kernel texture. Break flour yield was correlated with alkaline water retention capacity for most white wheats, but not for red wheats. Within each color class, individual cultivars varied greatly in correlations among quality tests.

(91)

Instrumental Measurement of Cookie Hardness. I. Assessment of Methods.

C. S. Gaines, A. Kassuba, and P. L. Finney. Cereal Chem. 69:115-119.

Probing and a three-point break technique for instrumental measurement of cookie hardness were appraised. Both techniques were used to evaluate the hardness of cookies produced by three laboratory formulations: the AACC micro method and macro method for sugar-snap cookies and a new commercial formula for wire- cut cookies. The three formulas differ in their ratios of sugar, shortening, and water. Both instrumental and sensory measurements indicated that wire-cut formula cookies were the least hard of the three formulations. The three-point break technique measured both hardness and brittleness, but the probe technique required less product. Probing was used to assess differences among four wheat cultivars and effects of post bake age on cookie hardness. Least significant differences and variances for probing data (as a percentage of the range of hardness observed with the four cultivars) were usually smallest for the wire-cut formula cookies.

(92)

Instrumental Measurement of Cookie Hardness. II. Application to Product Quality Variables.

C. S. Gaines, A. Kassuba, P. L. Finney, and J. R. Donelson. Cereal Chem. 69:120-125.

A probing technique was used to measure the effects of various treatments on the hardness of cookies produced by two laboratory formulations, the AACC micro method for sugar-snap cookies and a new formula for wire-cut cookies typical of commercial products. The technique was able to quantify hardness differences associated with wheat cultivar, wheat class blending, quality of ingredients, cookie geometry, wheat test weight, kernel shriveling, crop year, and flour protein content. Higher protein content and more kernel shriveling were associated with harder cookies. Higher flour protein content resulted in harder wire- cut formula cookies (as is usually observed in commercial baking); however, sugar-snap cookies were thicker and less hard. Probing was also used to evaluate the hardness of cookies produced from two pairs of flours that were fractionated and then reconstituted with one to three fractions interchanges. Fractions that contributed positively to cookie hardness were tailings, gluten, and water-solubles. Fractions appeared to contribute to hardness in the order of their hydrophilicity.

(93)

Relation Between Wheat Kernel Hardness, Environment, and Gliadin Composition.

F. R. Huebner and C. S. Gaines. Cereal Chem. 69:148-151.

Variation in wheat kernel hardness has recently increased, making wheat classification more difficult. To assess effects of growing conditions on protein composition and hardness, wheat grown in a greenhouse and commercial field-grown wheats were examined. Mature kernels from greenhouse plants were harvested and segregated according to origin from wheat heads. Individual kernels were tested for hardness with a particle size analyzer, and gliadins were extracted and analyzed by high-performance liquid chromatography. Chromatograms were integrated, and amounts of fractions varying in hydrophobicity were determined. For greenhouse-grown wheats, hardness correlated with at least one gliadin fraction but not with original head positions of kernels. This also was true for commercial wheats, but such samples also varied in hardness due to multiple gentoypes. Thus, differences in hardness among single kernels of a cultivar may result from variation in protein synthesis in kernels from different head locations, from variation between heads of the same plant that develop at different dates, and from multiple biotypes within cultivars.

(94)

Effects of Metal-Complexing Agents on Water Binding by Gluten.

R. L. Clements. Cereal Chem. 69:315-320.

Glutens from four soft red winter wheat cultivars were obtained by sedimentation (fractionation) of flours in water, in ethylenediaminetetraacetic acid (EDTA) at four concentrations (0.00125-0.0075M), and in 1M sodium chloride. Glutens then were repeatedly extracted with water by suspension of fragmented gluten in water followed by centrifugation at 1,000 x g. Volumes of sediments were measured after each centrifugation to determine water binding. Glutens obtained by sedimentation of flours in 0.0075M EDTA or in 1M sodium chloride became increasingly hydrophilic during water extraction, forming voluminous gels. Glutens from flours fractionated in 0.00125M EDTA did not swell. When flours were fractionated in 0.0025M EDTA, swelling of Becker gluten approached the response from fractionation of flour in 0.0075M EDTA, but Hillsdale gluten exhibited only slight swelling. Glutens from Caldwell and Compton flours showed intermediate swelling. Glutens obtained by fractionation of flours in water followed by treatment with sodium chloride or EDTA and lyophilized also exhibited measurable swelling when gluten powders were extraacted with water. Wide differences between swelling responses of Becker and Hillsdale glutens, regardless of location or crop year, indicate a genetic basis for the differences. Results suggest that divalent cations bound to gluten are removed by EDTA (or by sodium chloride at high concentrations), resulting in increased interaction with water. Amounts of EDTA required to induce maximum response appear to vary with genotype.

(95)

Phytate Content of Soft Wheat Brans as Related to Kernel Size, Cultivar, Location, and Milling and Flour Quality Parameters.

F. R. Dintzis, J. Lehrfeld, T. C. Nelsen, and P. L. Finney. Cereal Chem. 69:577-581.

The phytate content of wheat bran is of interest because bran, an important dietary fiber source, contains significant amounts of phytate, which has been reported to impair mineral retention under certain dietary circumstances. The purposes of this study were to examine the phytate content of brans from soft wheat cultivars as influenced by kernel size and growing location and to determine whether any relationships existed between phytate content and flour and milling quality parameters.

The influence of kernel size upon bran phytate content was determined in six soft wheat cultivars. The phytate content was significantly greater (12-24%) in bran obtained from the larger kernels in three of the six cultivars. Phytate content of the brans from 15 soft wheat cultivars grown at three different locations during the same crop year was influenced strongly by environmental factors. For these cultivars, the phytate content of the bran was significantly (P less than 0.01) correlated with the milling parameters percent flour extraction, endosperm separation index, and friability (r = 0.53, -0.41, and 0.47, respectively). These correlations suggest that endosperm is more easily separated from bran and reduced to flour when it is from soft wheats in which the bran phytate content is greater. The rankings of bran phytate content and milling and flour quality parameters were highly variable across cultivars and growing locations.

(96)

Effect of Wheat Moisture Content on Hardness Scores Determined by Near-Infrared Reflectance and on Hardness Score Standardization.

W. R. Windham, C. S. Gaines, and R. G. Leffler. Cereal Chem. 70:662-666.

Near-infrared reflectance instrumentation provides an empirically measured scale for wheat hardness. The hardness scale is based on the radiation-scattering properties of meal particles at 1,680 and 2,230 nm. Hard wheat meals usually have larger particle sizes than soft wheat meals. The objective of this study was to determine the sensitivity of near-infrared reflectance wheat hardness measurements to moisture content, and to make the hardness score (HS) independent of moisture by correcting hardness measurements for the actual moisture content of measured samples. Forty wheat cultivars composed of hard red winter, hard red spring, soft red winter, and soft white winter were used. Wheat kernel sample groups were stored at 20, 40, 60, and 80% rh. After equilibration, the samples were ground, and the meal was analyzed for HS and moisture. Averaged across wheat sample and relative humidity treatments, HS were 48, 50, 54, and 65 for 20, 40, 60, and 80% rh, respectively. HS from storage at 80% rh (13.4% meal moisture) were higher (P less than 0.05), and HS from storage at 20% rh (9.3% meal moisture) were lower (P less than 0.05) than the control values, which had an intermediate meal moisture content (11%). Within each class of wheat, HS increased as moisture content increased. An algorithm was developed to correct HS to 11% moisture. The correction provided HS that were nearly independent of moisture content.

(97)

Development of a High-Temperature-Dried Soft Wheat Pasta Supplemented with Cowpea (Vigna unguiculata (L.) Walp). I. Cooking Quality, Color, and Sensory Evaluation.

C. J. Bergman, D. G. Gualberto, and C. W. Weber. Cereal Chem. 71:523-527.

High-temperature (HT) dried soft wheat pasta (SP) supplemented with 10, 20, and 30% cowpea meal (CM) was produced. Pasta with cowpea (CP) contained up to 30% more protein than did the SP. Ash reached a maximum of 1.3% in the 30% CP. After 10 min, the CP treatment's cooking loss decreased with additional CM, and the 30% CP had a cooked weight lower than that of the SP. CM addition improved pasta color scores and integrity during cooking, and breakage decreased during storage. No difference in acceptability was found between samples made with CP and 100% wheat. Results demonstrate that HT drying and CM addition can overcome some of the constraints of using soft wheat flour in pasta production.

(98)

Effects of Septoria Leaf Blotch on Soft Red Winter Wheat Milling and Baking Quality.

A. L. McKendry, G. E. Henke, and P. L. Finney. Cereal Chem. 72:142-146.

Septoria leaf blotch causes economic yield losses in wheat worldwide. Research on the impact of septoria leaf blotch on grain quality, however, has been limited to its effect on test weight. The objectives of this study were to determine the effect of septoria leaf blotch severity on soft red winter wheat quality in cultivars with varying levels of resistance and to assess the impact of disease pressure on selection for improved quality in breeding programs. Twelve cultivars expressing a range of genetic resistance were grown in a split-plot design with four replicates in two Missouri environments. Cultivars were considered main plots. Five experimental subplot treatments, including a non-inoculated unprotected control and plots with fungicide protection as well as plots inoculated at tillering, jointing, and flag leaf, were used to establish a range of septoria leaf blotch severity. Increased disease pressure resulted in linear reductions in test weight (r = 0.97**), milling quality (r = 0.98**), adjusted flour yield (r = 0.97**), and a linear increase in water absorption in the flour (r = 0.95**). Increased disease severity also resulted in an increase in flour protein and a decrease in baking quality, however, the linear correlation coefficients were non-significant. The role of resistance genes for maintaining quality was important for milling quality but was negligible for baking quality. Cultivar by treatment interactions were due primarily to changes in magnitude and not in cultivar rank, which suggested that selection for milling and baking quality would be effective even when septoria leaf blotch disease pressure is high.

(99)

A Micro Method for Cake Baking (High Ratio, White Layer).

M. O. Raeker and L. A. Johnson. Cereal Chem. 72:167-172.

A micro method for baking high-ratio white layer cakes requiring only 5 g of flour was developed to test small quantities of experimental ingredients. Optimum mixing time, mixing speed, mixer design, and baking temperature were determined for the micro method. Among all the conditions tested, three mixing stages (4+2+2 min) at 670 rpm speed, using a flat paddle, and baking at 191 C produced cake properties similar to those produced by using the AACC method 10-90. These are similar conditions to those used by AACC method 10-90, which uses 200 g of flour instead of 5 g. The 5- and 200-g cake-baking methods were compared by using different levels of spray-dried egg whites and bovine blood plasma (0, 25, 50, 75, and 100% of the normal level of egg white protein). Although only one cake flour was used, correlation coefficients between the 5- and 200-g cake-baking methods for specific gravity, cake volume, and symmetry index measurements were 0.80, 0.99, and 0.98, respectively, for egg whites and 0.84, 0.99, and 0.99, respectively, for blood plasma.

(100)

A Soup Model Study Comparing Flour Peak Viscosity During Heating and Viscosity of Flour Gels During Reheating.

C. S. Gaines, A. Kassuba, and P. L. Finney. Cereal Chem. 72:233-236.

A viscograph was used to study a model soft wheat flour-water gel system that was based on the apparent viscosity of commercial soups when reheated to a serving temperature of 60 C. Unless flours were produced from highly field-sprouted wheats, there was no relationship between the hot paste peak viscosity attained during first heating and the viscosity of the same pastes that were allowed to gel, stored, and were then reheated to serving temperature. Sound, unsprouted flour produced hot paste peak viscosities as low as 57 BU (50 g of flour/450 ml of water) and consistently high reheated gel viscosities. Adding malted flour to the model system, reduced the hot paste peak viscosity much more than it reduced the viscosity of the reheated gels, especially at low levels of malt. The prediction of the viscosity at serving temperature of flour-thickened soups could be better accomplished using direct measurement of alpha-amylase activity or determination of the reheated gel viscosity rather than the viscograph hot paste peak viscosity.

(101)

Predicting a Hardness Measurement Using the Single-Kernel Characterization System.

C. S. Gaines , P. F. Finney, L. M. Fleege, and L. C. Andrews. Cereal Chem. 73(2):278-283.

The single-kernel characterization system (SKCS) crushes individual kernels and uses algorithms based on the force-deformation profile data to classify wheat samples into soft, hard, or mixed market classes. Those data were utilized to produce a predictive equation for softness equivalent (SE), a direct measure of wheat kernel texture obtained from milling wheat on a modified Brabender Quadrumat Jr. mill and sieving system. Predicted SE values had a high correlation ($r^2 = 0.996$) with actual SE milling values. In contrast to SKCS hardness index values, predicted SE values accurately responded to varying kernel moisture content and kernel size, within the ranges examined. Therefore, using the SKCS data to predict an independent measure of kernel texture (e.g., SE) may be a valuable augmentation to or replacement for using SKCS algorithms to classify wheat.

(102)

Cake-Baking (High-Ratio White Layer) Properties of Egg White, Bovine Blood Plasma, and Their Protein Fractions.

M. O. Raeker and L. A. Johnson.Cereal Chem. 72:299-303.

We investigated the cake-baking properties of egg white, blood plasma, and their component proteins in a high-ratio white layer- cake formulation and describe the relationship between the functional properties of the proteins and cake quality. Egg white produced slightly larger cake volume, significantly more crowned profile, and finer crumb structure than did blood plasma. Among egg white proteins, cakes made with globulins had the highest volume, finest crumb structure, and most crowned profile compared with cakes made with other fractions. Ovalbumin produced similar volumes and profiles as egg white, but the crumb structure was coarser. Ovomucoid did not coagulate into a strong matrix during baking, and cakes made with conalbumin and lysozyme had decreased volume and very dense crumb structures. Fibrinogen produced the smallest cake volume among the blood plasma proteins. Albumin, the major protein in blood plasma, had cake- baking properties inferior to those of whole blood plasma, whereas gamma-globulin had superior properties. alpha-Globulin produced cakes with high volumes but coarse crumb structures. Separation of fibrinogen from blood plasma increased cake volumes and profiles. The correlation coefficient between cake volume and denaturation peak temperatures of the protein (composite data for all proteins) was significant ($r = 0.944$, $P = 0.001$). Foaming and emulsification properties did not significantly affect cake volume.

(103)

Milling and Baking Qualities of Some Wheats Developed for Eastern or Northwestern Regions of the United States and Grown at Both Locations.

Charles S. Gaines, Patrick L. Finney, and Gordon Rubenthaler. Cereal Chem. 73(5):521-525.

Nine soft wheats that were developed for the Eastern United States and six soft wheats developed for the Northwestern United States were each grown in the states of Michigan and Washington for two crop years. Wheats were analyzed for milling and baking qualities by two laboratories. Cultivar differences were observed relative to intended region of adaptation and to location of growth. Except for noodle color and texture, all quality tests could distinguish among cultivars on the basis of intended adaptation or location of growth. Cultivar differences due to region of adaptation were generally small but consistent for most milling and baking qualities. Northwestern-adapted wheats tended to have higher test weight, harder kernels, and to produce more flour than Eastern-adapted wheats. Northwestern-adapted wheat flours had higher amounts of ash and more damaged starch than did Eastern-adapted wheat flours. Eastern-adapted wheats were softer and their flour had less ash and less damaged starch than did Northwestern-adapted wheats. Eastern-adapted wheats absorbed less water and their flours baked larger sugar-snap cookies than did Northwestern-adapted wheats. Wheats grown in Washington were harder and produced more flour that had less ash and lower protein content than wheats grown in Michigan. Wheats grown in Michigan produced flours that had lower damaged starch, lower water absorption, larger sugar-snap cookies, larger Japanese sponge cakes, and better udon noodles than wheats grown in Washington. Wheats developed for both growing regions apparently have comparable genetic quality attributes. However, climatic conditions during growth apparently have greater influence over most quality traits than does genotype. The environment had strong influence on grain condition. Grain condition had the most influence on milling characteristics. The environment also had the most influence on baking characteristics, with softer kernels producing better end-use characteristics. Almost all of the commonly evaluated quality tests studied were sensitive to the wide range in qualities exhibited by the samples.

(104)

Influence of Kernel Size and Shriveling on Soft Wheat Milling and Baking Quality.

C. S. Gaines, P. L. Finney, and L. C. Andrews. Cereal Chem. 74(6):700-704.

Small kernels of soft wheat are sometimes considered to be harder than larger kernels and to have inferior milling and baking characteristics. This study distinguished between kernel size and kernel shriveling. Nine cultivars were separated into large, medium, and small kernels that had no shriveling. Eleven cultivars were separated into sound, moderate, and severely shriveled kernels. Shriveling greatly decreased the amount of flour produced during milling. It adversely affected all other milling quality characteristics (ash content, endosperm separation index, and friability). Shriveled kernels produced flour that had inferior soft wheat baking qualities (smaller cookie diameter and higher alkaline water retention capacity). In contrast, test weight and milling qualities were independent of kernel size. Small, non-shriveled kernels had slightly better baking quality (larger cookie diameter) than larger non-shriveled kernels. Small kernels were softer than large kernels (measured by break flour yield, particle size index, and flour particle size). Small non-shriveled kernels did not have diminished total flour yield potential or other reduced flour milling characteristics. Those observations suggest a possibility of separating small sound kernels from small shriveled kernels to improve flour yield and the need to improve dockage testing estimation techniques to distinguish between small shriveled and small non-shriveled kernels.

(105)

Use of Aspiration and the Single Kernel Characterization System to Evaluate the Puffed and Shriveled Condition of Soft Wheat Grain.

C. S. Gaines, P. L. Finney, L. M. Fleege, and L. C. Andrews. Cereal Chem. 75(2):207-211.

Shriveled kernels lower wheat test weight and reduce milling flour yields. Test weight is also lowered by rain-dry cycles that cause kernels to puff (exhibit, in part, loosened layers of pericarp). A numeric score was developed for degree of puffing and for degree of shriveling based on simple measurement devices. Wheat samples were evaluated for test weight and Single Kernel Characterization System (SKCS) hardness index, SKCS kernel weight, milling flour yield, and kernel density (hexane displacement). Those evaluations were performed before and after samples were air-aspirated to remove all shriveled kernels. Test weight, SKCS hardness index, and density of aspirated samples were used to develop a puffing score. Changes (resulting from aspiration) in test weight, SKCS kernel weight, and flour yield were used to develop a shriveling score. Higher puffing scores were related to elevated alpha-amylase activity. Puffed kernels were softer and were not associated with decreased flour yield. Puffing and shriveling scores were independent (poorly correlated), but together predicted 95% of the variation in original, non-aspirated test weight.

(106)

Effect of Wheat Moisture Content on Meal Apparent Particle Size and Hardness Scores Determined by Near-Infrared Reflectance Spectroscopy.

Charles S. Gaines and William R. Windham. (Cereal Chem. 75(3):386-391.

The AACC Approved Method for near-infrared reflectance (NIR) spectroscopy to produce a wheat hardness score for wheat market classification can be corrected for variation in wheat moisture content. The cause of the variation in NIR spectra resulting from variation in wheat moisture was investigated. Ten samples each of soft red winter, soft white winter, hard red winter, and hard red spring wheats were stored at 20, 40, 60, and 80 equilibrium relative humidity. Wheats were then ground on a cyclone grinder as required by the standard method. Variation in unground wheat kernel moisture content resulted in variation in NIR data. NIR log 1/reflectance values increased at all wavelengths as wheat moisture content increased. Spectral changes were related to changes in the apparent particle size of ground wheat meal as it was influenced by moisture content. Higher moisture contents produced slightly higher apparent particle size in meal, suggesting larger particles of pericarp that became more pliable at higher moisture (temper) levels. The apparent particle size of meal of high moisture wheats resulted in greater NIR radiation scattering and decreased reflectance. Meal moisture content itself had no effect on the two NIR wavelengths used to evaluate wheat hardness.

(107)

Starch-Water Relationships in the Sugar-Snap Cookie Dough System.

J. R. Donelson and C. S. Gaines. Cereal Chem.
75(5):660-664. Accepted June 4, 1998.

Prime starch was extracted from soft and hard wheat flours and ball-milled to produce 100% damaged starch. Small amounts of the ball-milled starch or a pre-gelatinized starch were added to sugar-snap cookie formulations. Other cookie doughs were produced from prime starch only (no flour) with small amounts of the ball-milled starch added. Starch damages of the resulting substituted soft and hard wheat flours and soft and hard wheat prime starches were determined and compared to diameters of sugar-snap cookies produced from the control and treatments. Soft wheat flour and starches produced larger diameter cookies than their hard wheat counterpart at all levels of damaged starch. Both sources of damaged starch (ball-milled or pre-gelatinized starch) had similar effects on cookie diameter. Cookies produced from all starch (no flour) were similar to their respective flour controls at approximately 8% damaged starch. To produce the same size cookie as that produced by soft wheat flour and starch, hard wheat flour and starch cookie formulations required less damaged starch and had lower alkaline water retention than did the soft wheat flour and starch cookie formulations. Other flours were treated with chlorine gas to pH 4.8. Pre-gelatinized starch (approximately 5%) was required to reduce the cookie diameter as much as chlorine treatment did. Results suggest unique quality differences between soft and hard wheat starch as they function in sugar-snap cookie baking. The functional results of those differences are not adequately quantified by the estimation of damaged starch level.

(108)

Granule Size Distribution and Chemical Composition of Starches from 12 Soft Wheat Cultivars.

M. Ö. Raeker, C. S. Gaines, P. L. Finney, and T. Donelson. Cereal Chem.75(5):721-728.

Granule size distribution of wheat starch is an important characteristic that can influence its chemical composition, which in turn may affect its functionality. The granule size distribution and chemical composition of soft wheat starches were characterized and compared and relationships among those properties were identified. Thirty-four starch samples from 12 soft wheat cultivars grown in the eastern half of the United States were examined. Granule size distribution was characterized using a laser light-scattering technique. Amylose and phospholipid contents were determined using colorimetric procedures. A clear trimodal distribution of granule sizes was shown by 26 out of 34 starch samples: small granules with diameters <2.8 µm, midsize granules with diameters of 2.8-9.9 µm, and large granules with diameters >9.9 µm. Volume% distribution of granules within the three size classes had ranges of 9.7-15.2% (small), 13.4-27.9% (medium), and 57.9-76.9% (large). Highly significant differences were seen among the cultivars for volume% of granules within the ranges of 9.9-18.5 µm and 18.5-42.8 µm. Cultivar specific surface area means also differed. The environment affected granule size distribution, with some cultivars exhibiting more variation than others. Pioneer 2555 was the least variable, whereas Pioneer 2550 and Geneva were the most variable cultivars. Mean total amylose (TAM), apparent amylose (AAM), and lysophospholipid (LPL) values varied significantly among cultivars. TAM was positively correlated with the volume% of granules of 9.9-18.5 µm. LPL was negatively correlated with mean starch granule diameter and positively correlated with specific surface area of granules, indicating smaller granules tended to have higher lipid contents. Results suggest that significant differences exist in granule size distribution of soft wheat starches and affect starch chemical composition. Data also suggest it is possible that lipid is preferentially associated with the biosynthesis of small starch granules.

(109)

Genotype and Environment Effects on Wheat Quality Traits in a Population Derived from a Soft by Hard Cross.

C. J. Bergman, D. G. Gualberto, K. G. Campbell, M. E. Sorrells, and P. L. Finney.
Cereal Chem. 75(5):729-737.

Advances in understanding the biochemistry and genetics underlying wheat end-use quality require that cereal chemistry research utilize lines grown in the same environments. It also requires that effects of linkage disequilibrium and small ranges in trait variation be avoided. Our objectives were to: 1) ascertain the effects of genotype and environment and their interactions on hard and soft wheat end-use quality traits, and 2) examine relationships between traits and heritability, using recombinant inbred lines derived from a soft by hard wheat cross. All traits showed transgressive segregation. Kernel texture (KT) was not genetically correlated with mixograph traits, indicating the feasibility of producing soft-textured genotypes with stronger mixing properties. KT was highly genetically correlated with alkaline water retention capacity (AWRC) and moderately genetically correlated with flour yield (FY). Protein content (PRO) was not genetically correlated with dough mixing time across lines, but was with dough mixing strength. KT, FY, and mixograph traits demonstrated higher heritabilities than did AWRC and protein. Genotype and environment and their interactions affected all traits. Year caused the greatest environment effects, affecting primarily AWRC and protein. Genotype affected mainly KT, FY, and peak time. The effect of environment on those traits supports the need to develop screening methods using genotype rather than phenotype.

(110)

Soft Wheat Quality as Related to Protein Composition

F. R. Huebner, J. A. Bietz, T. Nelsen, G. S. Bains, and P. L. Finney. Cereal Chem.76(5):650-655.
Presented in part at the AACC 80th Annual Meeting, San Antonio, TX, November 1995.

Soft red and white winter wheats from the eastern United States, used primarily to produce cookies, cakes, and biscuits, have quality requirements very different from those of bread wheats. In general, soft wheats have been bred to have low protein content, and conventional wisdom has been that protein composition of soft wheat is relatively unimportant. To test this hypothesis, relationships between soft wheat protein composition and end-use functional quality characteristics were examined. Quantitative protein compositions of eight cultivars of soft wheats grown in a wide area of the eastern United States during seven years (53 samples total) were analyzed by size-exclusion HPLC. Results were statistically correlated with numerous chemical and physical characteristics and quality factors of these wheats, their flours, and of cookies baked from the flours. For the entire sample set, wheats containing high molecular weight glutenin subunits 2+12 showed significantly different properties and cookie characteristics from those with subunits 5+10, but amounts of most individual fractions correlated poorly with quality descriptors. For individual soft wheat cultivars, however, amounts of many individual gliadin and glutenin subfractions correlated significantly with quality descriptors such as SDS sedimentation, mixograph absorption, peak mixing time, mixograph number, cookie diameter, and top grain. Protein contents as a function of genotype and environment also differed greatly among cultivars, as did ratios of gliadin to glutenin. These results clearly revealed that suitability of soft wheat cultivars for specific products can be rapidly determined by quantitative and qualitative analyses of protein composition.

(111)

Baking Formula Innovation to Eliminate Chlorine Treatment of Cake Flour.

J. R. Donelson, C. S. Gaines, and P. L. Finney. Cereal Chem. 77(1):53-57.

Chlorine treatment of soft wheat flour improves cake volume and produces a stiffer, more resilient crumb. Four pairs of chlorine-treated and untreated flours were obtained. A selected portion of the area under the Rapid Visco Analyser hot pasting flour viscosity curve was used to determine how much starch could be used with a non-chlorine-treated flour so that the area is equivalent to that produced by a chlorine-treated cake flour with no added starch. Replacement of non-chlorine-treated flour with up to 43% starch produced areas under the pasting curve that were equivalent to those produced by chlorine-treated flours. Increased concentration of dried egg albumen plus added soya lecithin and xanthan gum were included in the formulation containing starch and non-chlorine treated flour to produce a new basic ingredient set. The basic ingredient set was evaluated for its influence on cake geometry, crumb structure, and crumb texture response to compression (hardness and spring-back rate). High-ratio white layer cakes using the new basic ingredient set produced similar or better cake quality characteristics than those produced using control chlorine-treated flours. The same new basic ingredient set was used to produce pound cakes, cupcakes, and sheet cakes using non-chlorinated flours. The geometry and objective texture of those cakes also were equivalent to respective cakes produced with chlorine-treated flour. The basic ingredient set does not require any special flour treatment.

(112)

Associations of Starch Gel Hardness, Granule Size, Waxy Allelic Expression, Thermal Pasting, Milling Quality, and Kernel Texture of 12 Soft Wheat Cultivars.

C. S. Gaines, M. Ö. Raeker, M. Tilley, P. L. Finney, J. D. Wilson, D. B. Bechtel, R. J. Martin, P. A. Seib , G. L. Lookhart, and T. Donelson . Cereal Chem. 77(2):163-168.

Starches were isolated from 12 soft wheat (Triticum aestivum L.) cultivars and were characterized for waxy (Wx) allelic expression, thermal pasting characteristics, and starch granule size. Gels were produced from the thermally degraded starches and were evaluated using large deformation rheological measurements. Data were compared with cultivar kernel texture, milling characteristics, starch chemical analyses, and flour pasting characteristics. Larger flour yields were produced from cultivars that had larger starch granules. Flour yield also was correlated with lower amylose content and greater starch content. Harder starch gels were correlated with higher levels of amylose content and softer kernel texture. The cultivar Fillmore, which had a partial waxy mutation at the B locus, produced the highest peak pasting viscosity and the lowest gel hardness. Softer textured wheats had greater lipid-complexed amylose and starch phosphorus contents and had less total starch content. Among these wheats of the soft market class, softer textured wheats had larger starch granules and harder textured wheats had smaller starch granules. In part, this may explain why soft wheats vary in texture. The smaller granules have larger surface area available for noncovalent bonding with the endosperm protein matrix and they also may pack more efficiently, producing harder endosperm.

(113)

Developing Agreement Between Very Short Flow and Longer Flow Test Wheat Mills.

C. S. Gaines , P. L. Finney , and L. C. Andrews . Cereal Chem. 77(2):187-192.

Variations in soft wheat moisture content and kernel texture greatly affected the flour yield produced by a small (short flow) micro test mill (Quadrumat Jr.). An algorithm was developed that adjusted Quadrumat Jr. flour yield to 15% wheat moisture content, precluding the need to temper the wheat before milling. Another algorithm was developed to adjust Quadrumat flour yield relative to a constant softness equivalent (measurement of kernel texture) obtained during the micro milling procedure. Predicting the flour yield of the longer flow Allis-Chalmers mill from Quadrumat Jr. unadjusted flour yield (R(^2) = 0.55) was compared with predicting Allis-Chalmers flour yield from the Quadrumat Jr. adjusted flour yield (R(^2) = 0.90) across five diverse confirmation data sets. An algorithm to adjust flour yield for softness equivalent was individually developed for soft and hard wheats. Representative micro milling flour yield and softness equivalent data could be produced using as little as 10 g of untempered wheat and approximately 3 min of operator time.

Cereal Foods World

(1)
Baking quality of cookie flour--micro-method 10-52.
Gaines, C.S.
Cereal Foods World. 31:(1) p. 66, 68, 70. Jan 1986.

(2)
Alkaline water retention capacity--AACC Method 56-10.
Gaines, C.S.
Cereal Foods World v. 31:(11) p. 837-838. Nov 1986.

(4)
Wheat Quality: a quality assessor's view.
Finney,-P.L.; Gaines, C.S.; Andrews, L.C.
Cereal Foods World. p. 313, 315-319. Apr 1987.

A comprehensive report describes key aspects of the evaluation of quality in wheat cultivars, the importance of a close association between wheat quality laboratory assessment personnel and wheat breeders and the milling and baking industries, and presents and discusses definitive laboratory results comparing the quality of different wheat cultivars. Guidelines are presented for breeding, nursery evaluation, milling, and flour requirements to promote wheat and wheat product quality. Extensive analytical, milling, baking, and protein strength data are reported and discussed for 15-20 different wheat cultivars and for composites grown at different locations. Quality assessment data for different wheat food products prepared from 8 wheat cultivars also are included.(wz).

(5)
Soft wheat: view from the eastern United States.
Finney,-P.L.
Cereal-Foods-World. 34:(9) p. 682, 684, 686-687. Sept 1989.

(6)
Use of a spindle-type viscometer (Brookfield) to measure the apparent viscosity of acidulated flour-water suspensions.
Gaines,-C.S.
Cereal Foods World. 35:(8) p. 741-742, 744-745, 747. Aug 1990.

(7)
Instrumental measurement of the hardness of cookies and crackers.
Gaines,-C.S.
Cereal Foods World. 36:(12) p. 989, 991-994, 996. Dec 1991.

(8)
Collaborative studies on the baking quality of cookie flour by wire-cut type formulations (AACC methods 10-53 and 10-54)
Gaines,-C.S.
Cereal Foods World. 38:(1) p. 26, 28-30. Jan 1993.

(9)
Influence of eight flours on the hardness of commercial cookies and cracker.
Gaines,-C.S.; Kassuba,-A.; Finney,-P.L.
Cereal Foods World. 39:(3) p. 160-167 (5 p. not consecutive).Mar 1994.
(10)
Using wire-cut and sugar-snap formula cookie test baking methods to evaluate distinctive soft wheat flour setsimplications for quality testing.

Gaines,-C.S.; Kassuba,-A.; Finney,-P.L.
Cereal Foods World, 41:(3) p. 155-160.Mar 1996.

Crop Science

1)
Influence of N [nitrogen] fertilization on wheat milling and baking quality [Oasis soft red winter wheat, protein content, Georgia].
Johnson,-J.W.; Hargrove,-W.L.; Touchton,-J.T.; Yamazaki,-W.T.
Crop-Science. 24:(5) p. 904-906. Sept/Oct 1984.

(2)
Effect of cultivar, environment, and their interaction and stability analyses on milling and baking quality of soft red winter wheat.
Baenziger,-P.S.; Clements,-R.L.; McIntosh,-M.S.; Yamazaki,-W.T.; Starling,-T.M.; Sammns,-D.J.;
Crop Science. v. 25:(1) p. 5-8. Jan 1985.

(3)
Effect of cultivar, environment, and their interaction and stability analyses on milling and baking quality of soft red winter wheat.
Baenziger,-P.S.; Clements,-R.L.; McIntosh,-M.S.; Yamazaki,-W.T.; Starling,-T.M.; Sammns,-D.J.; Johnson,-J.W.
Crop Science. 25:(1) p. 5-8. Jan 1985.

(4)
Registration of 'Augusta' wheat.
Everson,-E.H.; Freed,-R.D.; Zwer,-P.K.; Morrison,-L.Ww.; Marchetti,-B.L.; Clayton,-J.L.; Yamazaki,-W.T.
Crop Science. v. 26 (1) p. 201-202. Jan/Feb 1986.

(5)
Registration of 'Hillsdale' wheat.
Freed,-R.D.; Everson,-E.H.; Zwer,-P.K.; Morrison,-L.W.; Glenn,-D.J.; Marchetti,-B.L.; Fullbright,-D.W.; Clayton,-J.L.; Clements,-R.L.
Crop Science.26:(1) p. 203. Jan/Feb 1986. .

(6)

Milling and baking quality attributes of soft red winter wheat bulk populations and derived lines.

AU Bruckner,-P.L.; Finney,-P.L. Crop Science 32:(5) p. 1174-1179. Sept/Oct 1992.

Little information is available concerning relationships between milling and baking quality of soft red winter (SRW) wheat (Triticum aestivum L.) bulk populations and quality of lines derived in subsequent generations. Experiments were conducted to determine if quality evaluation of F4 bulk populations could provide useful information on quality potential of F5 lines. This would allow SRW wheat breeders using bulk systems of generation advance to develop appropriate selection strategies. Fifty-eight F4 SRW wheat bulk populations were grown at Plains, GA, in 1988-1989. Milling and baking quality of each population was evaluated at the USDA-ARS Soft Wheat Quality Laboratory. Random F45 headrows from eight populations with diverse F4 bulk quality characteristics were grown in 1989-1990 at Tifton, GA, and similarly evaluated for milling and baking quality. Except for flour protein concentration, quality attributes of F4 bulk populations were significantly correlated with means of F5 lines derived from each population. Bulk populations with quality deficiencies produced higher proportions of lines with similar quality deficiencies. Higher proportions of lines with adequate and superior quality were identified in progenies of bulk populations having good quality. Milling and baking qualities of F5 lines derived from populations with only 50% SRW wheat parentage were more variable and less predictable based on F4 bulk evaluation than quality of F5 lines derived from populations of 100% SRW wheat parentage. Milling and baking quality of F4 bulk populations was indicative of the quality and potential of F5 lines derived from each bulk. Bulk evaluation could be used to cull low-quality-potential populations before line derivation.

(7)

Relationship of test weight and kernel properties to milling and baking quality in soft red winter wheat.

Schuler,-S.F.; Bacon,-R.K.; Finney,-P.L.; Gbur,-E.E. Crop Science 35:(4) p. 949-953. July/Aug 1995.

Although test weight is used as a grading criterion and an indication of quality in wheat (Triticum aestivum L.), its relationship to specific quality parameters in soft wheat is not well documented. Seed characteristics, flour yield, and baking quality were studied in 24 soft red winter wheat (SRWW) genotypes grown in six environments to determine their relationship to test weight. Flour yield, flour protein, alkaline water retention capacity (AWRC), and softness equivalent (SEQ) were evaluated by the micro-procedures of the USDA-ARS soft wheat early-generation milling and baking quality evaluation program. Despite removal of shriveled kernels prior to evaluation, environmental effects had a significant impact on quality parameters, ranging from 68% of total variability (SEQ) to 5% (AWRC). Test weight was not correlated with flour yield, but was significantly correlated with flour protein content ($r = 0.54$, $P < 0.05$) as was kernel density ($r = 0.49$). Thousand-kernel weight, diversity of seed size, proportion of large seed, and average kernel length and width were not correlated with flour yield or other quality parameters. Test weight did not predict flour yield in SRWW when shriveling was absent, but it was related to flour protein content, which is associated with baking quality. Kernel size or size distribution did not affect end-use quality. The best predictive model based on the characters above explained little of the total variation in flour yield ($R2 = 0.22$).

(8)
Effect of 1BL.1RS on milling and baking quality of soft red winter wheat.
McKendry,-A.L.; Tague,-D.N.; Finney,-P.L.; Miskin,-K.E. Crop Science 36:(4) p. 848-851.

Wheat (Triticum aestivum L.) breeders worldwide have used the 1BL.1RS translocation as a source of genes for disease resistance, broad adaptation, and enhanced yield potential. Although it appears to have detrimental effects on hard wheat baking quality, there are no known reports of its impact on soft wheat quality. This study was designed to investigate the effects of 1BL.1RS on milling and baking quality in soft red winter wheat and to evaluate the interaction of these effects with environment and genetic background. Grain from 1BL.1RS and nonrye sister lines, derived in the F9 from two experimental lines, SW85*294 and SW85*5626, was evaluated in five Missouri environments. In both genetic backgrounds, 1BL.1RS was associated with significant reductions in adjusted flour yield and overall milling quality and a significant increase in alkaline water retention capacity, which may be detrimental to soft wheat baking quality. Test weight in 1BL.1RS lines was reduced by 11.6 kg m-3 in SW85*294 but was not affected in SW85*5626. In the SW85*5626 background, 1BL.1RS increased softness equivalent 1.3 percentage units but had no affect in SW85*294. Neither flour protein content nor overall baking quality was affected by the presence of 1BL.1RS. For all traits, the effect of the genetic background was large compared with the effect of 1BL.1RS. Variation among the 1BL.1RS lines was significant in both genetic backgrounds and led to the conclusion that in these lines, the negative effects of 1BL.1RS could be overcome by selection.

(9)
Agronomic and grain quality evaluations of Triticum aestivum X Aegilops tauschii backcross populations.
Murphy,-J.P.; Griffey,-C.A.; Finney,-P.L.; Leath, Crop Science 37:(6) p. 1960-1965 Nov/Dec 1997

Aegilops tauschii Coss., a diploid progenitor of common wheat, Triticum aestivum L., is a valuable source of pest resistance alleles. However, interspecific populations generated for pest-resistant germplasm development may contain beneficial alleles for other important traits. The objective of this research was to evaluate eight agronomic and grain quality traits in three soft red winter wheat x Ac. tauschii backcross populations. A total of 355 BC2F2-derived lines were grown at locations in North Carolina and Virginia for two seasons. Grain quality evaluations were conducted at the USDA-ARS Soft Wheat Quality Laboratory. Fifty-four percent of lines did not differ significantly from their recurrent parent, averaged over all eight traits. In general, distributions were negatively skewed for grain yield and test weight and positively skewed for heading date, plant height, flour protein concentration, and alkaline water retention capacity. Line distributions for flour yield and softness equivalent were population-dependent. Twenty-three lines were significantly superior to their recurrent parent for one or more grain quality traits and similar to the recurrent parent for all remaining traits. Researchers who generate interspecific T. aestivum x Ac. tauschii populations for pest-resistant germplasm development can identify lines with beneficial alleles governing other traits in an acceptable cultivated background if the progeny undergo additional screening.

(10)
Quantitative trait loci associated with kernel traits in a soft x hard wheat cross.
Campbell, K.G.; Bergman, C.J.; Gualberto, D.G.; Anderson, J.A.; Giroux, M.J.; Hareland, G.; Fulcher, R.G.; Sorrells, M.E.; Finney, P.L.; Crop Science 39: (4) p. 1184-1195. July/Aug 1999

Kernel morphology and texture influence the value of wheat (Triticum aestivum L.). The objectives of this study were to determine associations between kernel traits and molecular markers and to identify quantitative trait loci (QTLs) affecting kernel traits in a soft x hard white wheat cross. Seventy eight F(2.5)-derived recombinant inbred lines (RILs) from a cross between the soft white wheat NY6432-18 (NY18) and the hard white wheat 'Clark's Cream' (CC) were developed by single seed descent. Kernel texture was measured by near infrared reflectance (NIR) on RIL grain samples from six environments. Digital image analysis (DIA) was used to measure kernel length, width, area, perimeter on grain samples from four environments. Test weight and thousand kernel weight (TKW) were also determined. Shape factor and density factor were calculated. The map for this population consisted of 313 molecular markers in 47 linkage groups located on all wheat homoeologous chromosome groups. Linkage groups that mapped to wheat homoeologous group 2 chromosomes were highly skewed towards NY18 alleles. Genotype effects and genotype x environment interactions were highly significant for most traits. QTLs for kernel width and kernel length also influenced kernel area and TKW, but did not influence each other. The pinB marker at the puroindoline B locus on chromosome 5DS explained over 60% of the phenotypic variation for kernel texture. QTLs for kernel traits were located on chromosomes 1A, 2B, 2D, 3B, 7A, and 7B.

Journal of Food Science

(1)
Effect of germination on nutritive value and baking properties of dry peas, lentils, and faba beans.
Hsu,-D.; Leung,-H.K.; Finney,-P.L.; Morad,-M.M. J-Food-Sci. 45: (1) p. 87-92.

A significant increase in ascorbic acid content of dry yellow peas, faba beans and lentils was seen during germination although amino acid composition was relatively unchanged following 4 days of sprouting. Riboflavin content of peas doubled after this germination period. Soaking and periodic rinsing with 50 ppm chloride, controlled microbial growth during germination. To evaluate the baking properties of the 3 legumes, wheat flours were blended with 5, 10 or 15% germinated or ungerminated legume flours and baked into bread. Substituting 15% legume flours for wheat flour had no adverse effect on loaf volume. However, 4 day germination affected the baking properties of peas and lentils, but not faba beans, causing smaller loaf volume, dark crust and off-flavor. Blanching of germinated peas further impaired baking qualities, although removing off-flavors.

(2)
Protein quality characteristics of Iranian flat breads.
Faridi,-H.A.; Ranhotra,-G.S.; Finney,-P.L.; Rubenthaler,-G.L. J-Food-Sci. 47:(2) p. 676-677, 679.

(3)
Functional (breadmaking) and compositional characteristics of Iranian flat breads.
Faridi,-H.A.; Finney,-P.L.; Rubenthaler,-G.L.; Hubbard,-J.D. J-Food-Sci. 47:(3) p. 926-929, 932. May/June 1982.
(4)
Iranian flat breads: relative bioavailability of zinc.
Faridi,-H.A.; Finney,-P.L.; Rubenthaler,-G.L. J-Food-Sci. 48:(1) p. 107-110. Jan./Feb. 1983

(5)
Effect of soda leavening on phytic acid content and physical characteristics of Middle Eastern breads.
Faridi,-H.A.; Finney,-P.L.; Rubenthaler,-G.L. J-Food-Sci. 48:(6) p. 1654-1658. Nov./Dec. 1983

Addition of soda as a leavening agent to 2 popular Middle Eastern breads, Iranian taftoon and Pakistani naan (Arabic), and use of a fermentation model system decreased phytic acid hydrolysis with no apparent advantage for bread quality. In sour starter supplemented dough, phytic acid was reduced 82% after 3 hours; addition of 0.4% soda allowed only a 29% reduction. In the breads, supplementation with soda significantly lowered phytic acid hydrolysis during fermentation, increased water absorption of the dough and increased the mixing time. Elimination of the soda would increase the availability of some minerals without influencing acceptability of the product. (emc).

Other

(1)
Advances in technology and in genetics information for breeding improvements in wheat protein potentials.
AU Konzak, C.F.; Mung, N.V.; Warner, R.L.; Rubenthaler, G.L.; Finney, P.L.
Seed protein improvement by nuclear techniques proceedings of two research co-ordination meetings The Fourth Research Co-ordination Meeting of the Seed Protein Improvement Programme. .
The Second Research Co-ordination Meeting on the Use of Aneuploids for Protein Improvement in Wheat. Vienna International Atomic Energy Agency, 1978. p. 519-531.

(2)
Pea: A highly functional fortifier in wheat flour blends.
Jeffers, H.C.; Rubenthaler, G.L.; Finney, P.L.; Anderson, P.D.; Bruinsma, B.L.
National Conference on Wheat Utilization Research, 10th, Tucson, Arizona, 1977.
Agric-Rev-Man-ARM-W-U-S-Dep-Agric-Sci-Educ-Adm-West-Reg-Off-Reg-Adm-Fed-Res. Washington, D.C., The Administration. Aug 1978. (4) p. 170-179.

(3)
Wheat malts as wheat flour nutrient supplements in bread making.
Finney,-P.L.; Rubenthaler,-G.L.
Bakers-Dig. Chicago, Siebel. Oct 1979. v. 53 (5) p. 23-25, 27. .

(4)
Iranian flat breadsrelative bioavailability of magnesium Effects of processing.
Faridi,-H.A.; Rubenthaler,-G.L.; Finney,-P.L.
Nutr-Rep-Int. Los Altos Geron-X, Inc. 27 :(3) p. 475-483. Mar 1983

(5)
Factors involved in the quality of soft wheat products.
Yamazaki, W.T.
Cereals and legumes in the food supply / edited by Jacqueline Dupont and Elizabeth M. Osman. 1st ed. Ames Iowa State University Press, 1987. p. 127-132.

(6)
Quality of hard, soft, and durum wheats.
Finney, K.F.; Yamazaki, W.T.; Youngs, V.L.; Rubenthaler, G.L.
Agronomy.(13) p. 677-748. 1987.

(7)
Formulation and nutritive value of weaning food from germinated food grains.
Nattress, L.A.; Mehta, T.; Mitchell, M.E.; Finney, P.L.
Nutr-Res. v. 7 (12) p. 1309-1320. Dec 1987.

The feasibility of using germinated seeds to formulate a nutritious weaning food for Asian developing countries was investigated. The final formulation (WF) contained germinated wheat, millet, garbanzo bean, mung bean and sesame in the proportion of 84431. The product was acceptable when served with banana and brown sugar. On a freeze dried weight basis, 100g WF contained 390 kcal, 18 g protein, 11 g fiber and 3.1, 5.5, 133, 29 mg of Zn, Fe, Ca and vitamin C respectively. Compared to the ungerminated mixture (UWF) WF had 60% less phytate. Decorticating the legumes of the formulation (DWF) decreased neutral detergent fiber (NDF) by 3%. Chemical scores based on amino acid analysis were 86, 93 and 110 respectively for WF, UWF and DWF. Relative nutritive value for WF and UWF were 0.95 and 1.01 as measured by rat assays using lactalbumin as reference protein at 3, 5 and 7% level and WF and UWF at 6, 8 and 10% level. Modified Protein Efficiency Ratios (rat assay) were 3.3, 3.1 and 3.2 for UWF, WF and DWF respectively and true digestibility of each was more than 97%. Substitution of 20% WF protein by lactalbumin did not improve PER further. However the substituted group and DWF had highest blood hemoglobin amongst all groups. It was concluded an acceptable and nutritive weaning food can be developed using germinated cereals and legumes. Germination did not seem to further improve protein quality but might affect mineral bioavailability.

(8)
Correlation of alpha-amylase inhibitor content in Eastern soft wheats with development

parameters of the rice weevil (ColeopteraCurculionidae).
Baker, J.E.; Woo, S.M.; Throne, J.E.; Finney, P.L.
Environ-Entomol.20:(1) p. 53-60. Feb 1991

The alpha-amylase inhibitor content in saline extracts of 104 Eastern soft wheat cultivars was determined by assay against a purified alpha-amylase preparation from the rice weevil, Sitophilus oryzae (L.). A two-fold range of inhibitor levels, expressed as amylase inhibitor units per gram of dry weight (AIU/g), was found across all cultivars. Inhibitory activity was lowest in cultivar 'Augusta' (5,084 +/- 124 AIU/g) and highest in cultivar 'Logan' (10,410 +/- 61 AIU/g). No correlation of inhibitor content with progeny production (r = -0.161) or rate of emergence (r = -0.292) was found among weevils reared on 30 cultivars having relatively low, medium, and high inhibitor levels, but there was a positive correlation between inhibitor content and average number of days to adult emergence (r = 0.569). Although mean development times were significantly different on cultivars with low and high AIU/g (5.9 +/- 0.2 and 36.6 +/- 0.1 d, respectively), the differences were only slight and indicated that, for these cultivars of soft wheats, alpha-amylase inhibitors have little practical effect on initial population reductions. Nevertheless, based on a population model for S. oryzae developing on wheat at 25C and 75% RH, the slight delay in mean development time (0.7 d) on cultivars with relatively high AIU/g results in a 20.9% reduction in total number of weevils after 180 d. Simulations also indicate that physical or biochemical resistance factors in wheat have to delay development time for about 6.2 d or reduce fecundity by about 40% to prevent wheat from being graded "weevily" 180 d after a single pair of weevils infests a hypothetical 6,000-bushel wheat bin.

(9)
Identification of 'Amigo' and 'Kavkaz' translocations in Ohio soft red winter wheats (Triticum aestivum L.).
Berzonsky, W.A.; Clements, R.L.; Lafever, H.N.
Proceedings of the second International Symposium on Chromosome Engineering in Plants August 13-15, 1990 / [edited by Gordon Kimber]. [Missouri? College of Agriculture, University of Missouri-Columbia?, 1991?].. p. 264-269.

(10)

Identification of 'Amigo' and 'Kavkaz' translocations in Ohio soft red winter wheats (Triticum aestivum L.).

Berzonsky, W.A.; Clements, R.L.; Lafever, H.N.

Theor-Appl-Genet. Berlin, W. Ger. Springer International. 1991. v. 81 (5) p. 629-634.

One cultivar ('GR876') and two advanced Ohio soft red winter wheat lines ('OH413' and 'OH414'), with 'Kavkaz' in their pedigrees, were examined for the presence of the 'Kavkaz,' 1RS/1BL rye/wheat chromosome translocation. Another advanced line ('OH416'), with 'Amigo' in its pedigree, was examined for the presence of the 'Amigo,' 1RS/1AL translocation. Only two satellited chromosomes were observed in most mitotic root-tip cells from 'GR876,' 'OH413,' and 'OH414,' compared to four in most cells from 'OH416.' Heteromorphic bivalents were observed in most PMCs from hybrids produced by crossing 'GR876,' 'OH413,' and 'OH414' as females to 'Chinese Spring.' No heteromorphic bivalents were observed in PMCs from 'OH416' X 'Chinese Spring' hybrids. When 'GR876' and the Ohio lines were hybridized with 'Chinese Spring' dimonotelosomic-1B, telosomic trivalents, consisting of the short- and long-arm telosomes paired with chromosome 1B, were only observed in PMCs from 43-chromosome hybrids involving 'OH416.' The long-arm telosome paired with the translocation chromosome, while the short-arm telosome remained unpaired in all other 43-chromosome hybrids. Separation of gliadin proteins from 'GR876' and the Ohio lines by PAGE revealed that secalin bands for 'GR876,' 'OH413,' and 'OH414,' migrated similarly to the secalins for 'Kavkaz.' Bands for 'OH416,' identified as possible secalins, migrated similarly to those for 'Amigo.' Cultivar 'GR876' and advanced Ohio soft red winter wheat lines 'OH413' and 'OH414' carry the 'Kavkaz' translocation, while 'OH416' carries the 'Amigo' translocation.

(11)

Test weight in relation to various milling and baking properties of Eastern U.S. soft wheats

Finney, P.L. and Bergman, C.

Proceeedings of the regional quality symposium for soft red winter wheat, Univ. of Arkansas. Little Rock, Arkansas (1996), pp.40-66.

(12)

Relationship of protein composition to quality of Eastern U.S. Soft Wheats.

Huebner, F.R., Bietz, J.A., and Finney, P.L.

Gluten ›96: Proceedings of the 6th International Gluten Workshop, Sydney, Australia (1996). Pp. 383-386.

(13)

Wheat grain quality under enhanced tropopheric carbon dioxide and ozone concentrations.

Rudorff, B.F.T., Mulchi, C.L., Finney, P.L., Lee, E.H., and Rowland, R.

J. Environ. Quality. (1996).

(14)

Protein quality in eastern United States soft wheats.

Finney, P.L. Proceedings of the 1999 Joint Research Conference of the Eastern Wheat & Southern Small Grain Workers, May 2-4, 1999, Williamsburg, Virginia.

(15)
Protein functionality differences in eastern U.S. soft wheat cultivars and interrelation with enduse quality tests.
Finney, P.L., and Bains, G.S. Lebensmittel-Wissenschaft und -Technologie,(1999). 32:406-415

(16)
Association between glutenin alleles and dough characteristics in soft wheat.
Siritunga, D.S., Campbell, K.A., and Finney, P.L. J. Theoretical and Applied Genetics.(In Press)