EVALUATION OF ADDITION OF ALKALINE SOLUTIONS ON OVERALL QUALITY AND FUNCTIONALITY OF NORMAL AND PALE, SOFT, AND EXUDATIVE (PSE) PORK GELS

A Thesis

by

SONIA YVETTE GARZA

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

December 2009

Major Subject: Food Science and Technology

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Approved by:

Chair of Committee,	Rhonda K. Miller
Committee Members,	M. Elena Castell-Perez
	Peter S. Murano
	Lloyd W. Rooney
Intercollegiate Faculty Chair,	Jimmy T. Keeton

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ABSTRACT

Evaluation of Addition of Alkaline Solutions on Overall Quality and Functionality of Normal and Pale, Soft, and Exudative (PSE) Pork Gels. (December 2009)

Sonia Yvette Garza, B.S., Texas A&M University

Chair of Advisory Committee: Dr. Rhonda Miller

Industry surveys indicated that up to 16% of pork is pale, soft, and exudative (PSE); which has reduced functionality. Recently, the cost of sodium phosphates (SP) has escalated. SPs are used to improve water holding capacity (WHC), increase pH, and retard lipid oxidation. Alkaline non-meat ingredient addition could improve PSE pork functionality and replace SP in pork products.

The objective was to examine effects of alkaline solutions on pH, color, WHC, and texture of PSE and normal pork gels. Normal (pH 5.6-5.9) and PSE (pH $\leq$ 5.4) loins were obtained and homogenized. Treatment solutions were: no added solution (control); double-distilled deionized water (ddW); 0.1, 0.2, and 0.3% (w/v) SP; and 0.1, 0.2, and 0.3M potassium bicarbonate (PB), sodium bicarbonate (SB), potassium carbonate (PC), or sodium carbonate (SC).

PSE gels had lighter color, lower pH, WHC, and cook yields, and higher TPA values than normal gels. Control and ddW gels had lower pH, and higher L*, a*, and b* values. As treatment levels increased, gels had higher pH, and lower L*, a*, and b* values. SP gels had lower pH, WHC, cook yields, and higher L*, a*, b*, and TPA values compared to PB, SB, PC, and SC gels. PC and SC gels had higher cook yields than normal control gels and PB and SB gels were intermediate. For both meat types, TPA values improved for PB and SB gels compared to normal control gels, but did not differ from SP gels. As levels of PC and SC increased, gels were softer, less cohesive, chewy, and lower in work 2 than other gels. Cooked PSE gels treated with 0.2 or 0.3M PC or SC were less red and yellow and had cook yields that surpassed normal control and ddW gels. Normal and PSE gels treated with 0.2 or 0.3M PC or SC did not differ in TPA measurements for hardness and work.

PSE pork functionality was improved with PC or SC addition to be similar to or higher than normal samples. PC and SC are feasible alternatives to replace SP in pork gel systems without loss of WHC, color, or pH.

DEDICATION

I dedicate this thesis to my mother and father. I am blessed to have wonderful parents who support my endeavors and who will stop at nothing to ensure that my dreams come true. Their love and encouragement has always been a source of strength and courage for me. The faith they have taught me and continue to instill in me will stay with me for the rest of my life, and for that I am forever in their debt.

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TABLE OF CONTENTS

LIST OF TABLES

TABLE Page

TABLE Page

LIST OF FIGURES

NOMENCLATURE

PB	Potassium bicarbonate
PC	Potassium carbonate
PSE	Pale, soft, and exudative
SB	Sodium bicarbonate
SC	Sodium carbonate
SP	Sodium phosphate
TPA	Texture profile analysis
WHC	Water holding capacity

.

CHAPTER I

INTRODUCTION

The pale, soft, and exudative (PSE) condition describes meat that is a pale pink to grayish color, has a soft/ mushy texture, and low water holding capacity (WHC). Marriott and Schilling (1998) estimated that the amount of PSE pork can range from 10-40% in the United States. This type of meat results in lower yielding products and has limited value for further processing (Sayre, Kiernat, & Briskey, 1964; Wismer-Pedersen, 1960). This fact is of particular importance considering nearly 80% of the pork in the US retail market place is further processed (Wright et al., 2005). Furthermore, when thermal processed, the chemical and physical attributes of PSE meat produce a product that is often undesirable to the consumer in color, juiciness, and texture (Martinez & Zering, 2004).

Numerous methods have been used to improve PSE meat however, enhancement, in particular, is used in the pork industry where non-meat ingredients are directly added to or injected into normal and PSE pork for improved meat quality and functionality. Sodium phosphates (SP), namely sodium tripolyphosphate, have become one of the most common ingredients in enhanced pork. However, over the last two years, phosphate prices have dramatically increased, almost tripling in cost (Hills, 2009). Due to this recent increase in prices, and with no signs of improvement, meat processors are looking to other sources of functional ingredients.

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This thesis follows the style of *Meat Science*.

Several phosphate alternatives have been identified in recent years. However, for the food industry, these ingredients must be cost-effective and safe for food use. Recent research indicates sodium bicarbonate's (SB) superior improvement capabilities in pork, even surpassing improvements resulting from SP additions (Kaufmann et al., 1998; Wynveen et al., 2001; Sheard & Tali, 2004; Bertram, Meyer, Wu, Zhou, & Anderson, 2008). This ingredient has proven to be a superior marinating agent that reduces drip loss as well as shear force and improves meat yield (Bertram et al., 2008; Kauffman et al., 1998; Sheard & Tali, 2004; Wynveen et al., 2001). Use of SB as an added non-meat ingredient has shown improvements in color, texture, and water holding capacity in pre-rigor and post-rigor muscle (Kaufman et al., 1998; Wynveen et al., 2001; Alvarado & Sams, 2003; Sheard & Tali, 2004).

Sodium carbonate (SC) is a high alkaline salt used in the food industry as an anti-caking agent, leavening agent, regulator, and stabilizer. However, limited research has been conducted to describe functional properties of SC as an added ingredient in meat systems. In seafood products such as minced cod or rehydrated dried squid, SC is used to give these foods a characteristic texture via an increase in pH, moisture content, and swelling of proteins (Benjakul, Visessanguan, Tanaka, Ishizaki, Taluengphol, & Chichanan, 2000; Kolakowski, Kolakowska, Lachowicz, Bortnowska, & Wianecki, 1994). SC may possess functional properties similar or superior to SP, so that it can be used as an inexpensive substitute for SP in meat systems.

Both SB and SC are GRAS substances, or generally recognized as safe for food use. Additionally, both SC and SB have potassium alternatives, potassium bicarbonate and potassium carbonate, for use in products where sodium reduction is desired.

Although Kaufmann et al. (1998) identified 0.3M as the ideal level for SB injection of the pork loin muscle, an ideal level of SC has not been identified. Also, while research has been conducted on SB and SC proving these ingredients' capabilities to improve color, pH, and WHC; limited research has been conducted on texture attributes of thermal processed products containing these ingredients. Additionally, SP must be compared to PB, PC, SB, and SC in order to demonstrate their ability as SP replacers for the meat product industry. Therefore, the objective of this study was to determine an ideal level of SC inclusion, as well as if the addition of alkaline solutions will improve PSE meat by evaluating physical and rheological characteristics of normal and PSE gels in a model system.

CHAPTER II

LITERATURE REVIEW

Pork Quality—Pale, Soft, and Exudative Meat

Pork quality can be defined as "the combination of characteristics which specifically contribute to consumer satisfaction;" including "marbling, color of lean, firmness of lean, and freedom from moist exudates" (Breidenstein, 1963). In the early 1990s, the National Pork Producers Council (NPPC) conducted a survey to identify obstacles to improved quality to better serve consumers' needs. This industry wide survey named product consistency as one of the top ten concerns among producers, packers, retailers, restaurateurs, and consumers (Meisinger, 1996). Consumers mainly expressed frustration with varying juiciness and tenderness in pork products. Along with a consistency concern, the need to reduce the incidence of pale, soft, and exudative (PSE) pork was identified.

Pale and watery meat has been defined as undesirable for decades. This meat first appeared in the literature in 1914; even then, it afforded German sausage makers "considerable trouble" (Wismer-Pedersen, 1959). It was not until 40 years later, in 1954, that Ludvigsen related this condition to pre-rigor low muscle pH, calling it "muskeldegeneration" (Wismer-Pedersen, 1964). Today, this poor quality meat is known as PSE pork. The PSE condition describes meat that is a pale pink to grayish color, has a soft/ mushy texture, and high purge. Red, soft, and exudative (RSE) meat only differs from PSE meat in that it maintains a normal red/pink color. It is estimated that PSE and RSE meat accounts for approximately $100 million annually in lost revenue for the pork industry (Cannon, Morgan, Heavner, McKeith, Smith, & Meeker, 1996a; Carr, Kauffman, Meeker, & Meisinger, 1997). This type of meat results in lower yielding products and has limited value for further processing (Sayre et al., 1964; Wismer-Pedersen, 1960); which is of particular importance considering nearly 80% of the pork in the US retail market place is further processed (Wright et al., 2005). The 2002 Pork Benchmarking Audit (PBA) revealed about 16% of the current pork supply is PSE meat, accounting for over half of the 24% unrealized revenue lost from low quality pork (Stetzer & McKeith, 2003). A Pork Quality Survey questionnaire followed up the PBA, where pork plants measured ultimate pH (pHu), color, and exudates. The incidence of PSE had dropped to under 3.5% (Meisinger & Berg, 2006). Packers had varying acceptance ranges for each of the measurements used to define PSE, which could have affected their responses. Nevertheless, despite extensive research and nearly a century after its first description, PSE meat continues to be a problem of great interest for the pork industry.

PSE meat undoubtedly results from the rapid pH drop that occurs in muscle tissue shortly after death. Carcasses that develop the PSE condition have a pH decline that is three times faster than normal muscle (Penny, 1969), resulting in a pHu below 5.5 within hours after exsanguination (Wismer-Pedersen, 1959). This sharp pH drop coupled with relatively high carcass temperatures within hours after death, leads to detrimental protein denaturation (Offer, 1991; Penny, 1969; Sayre & Briskey, 1963; Wismer-Pedersen, 1959). It is this deformative action that causes the pale color, poor water holding capacity (WHC), and mushy texture of PSE meat (Briskey & Wismer-Pedersen, 1961; McLoughlin & Goldspink, 1963). If the PSE condition was attributed to a single factor, the pork industry might have been able to eradicate this meat long ago. However, it can be said that PSE development is difficult to control because of the many factors that contribute to this condition. Pre-slaughter factors, including genetics, nutrition, handling prior to slaughter, and stunning, all influence meat quality. Additionally, post-slaughter treatments such as carcass chilling and injecting non-meat ingredients have also been shown to affect product quality. This review will focus on the development of PSE pork, its causes, economic impacts, and improvement using meat enhancement via pH adjustors.

Early Post-mortem Processes

Briskey (1959) was among the first meat scientists to discuss and review changes that occur in the rigor mortis processes during the conversion of muscle to meat. Muscle tissue stores glycogen as an energy source to maintain normal metabolic function. Once an animal is harvested, physical and chemical conditions within the muscle change as the conversion of muscle to meat begins. It is the rate of these changes that affect the ultimate quality of meat products. After exsanguination, the circulatory system can no longer remove heat and waste products or transport nutrients and oxygen to muscles.

Once the oxygen supply has literally been cut off, anaerobic metabolism of ATP leads to lactic acid waste production. Pre-rigor muscle is still metabolically active because glycogen stores have not been depleted yet. Heat will generate from glycogen breakdown to lactic acid, or glycolysis in the muscle along with the hydrolysis of creatine phosphate and ATP. Normally, ATP turnover is balanced by its resynthesis from the glycolytic cycle in the liver. As liver function has ceased and the body can no longer synthesize lactic acid; an excess of lactic acid drives the muscle tissue pH down from just above 7 at life to a pHu close to slightly less than 6 in normal meat (Hannula & Puolanne, 2004). In pork the normal rate of pH decline, from about 7.4 in living muscle to about 5.6 post-mortem, occurs over 6 to 12 hours (Huff-Lonergan & Page, 2001). As the pH drops during rigor, it nears the isoelectric point (pI) of myosin (pI=5.4). At this point, the negatively and positively charged amino acid side chains are equal, causing maximum attraction

Research has shown that the rate of ATP turnover determines the rate of glycolysis (Bate-Smith & Bendall, 1947); which is further accelerated at high temperatures (Bate-Smith & Bendall, 1949). Pigs that are more excitable will stress easier ante-mortem and will use ATP faster, resulting in rapid glycolysis post-mortem thereby causing the dramatic pH drop characteristic in PSE meat and subsequent protein denaturation. The PSE condition will occur in pork if the pH of the muscle drops to 5.8 or lower while the carcass is still above 35˚C (Huff-Lonergan & Page, 2001). The overall rate of temperature decline in these carcasses that produce PSE meat is slower than in normal carcasses (reviewed by Huff-Lonergan & Page, 2001). This combination of high muscle temperature and low pH can cause severe denaturation of proteins, specifically myoglobin, the pigment protein most responsible for meat color.

The amount of myosin denatured increases with the rate of pH decline. Similarly, the fraction of denatured protein increases at a lower pHu, increasing moisture loss. These proteins do not bind water tightly, increasing light reflectance, thereby causing the meat to appear more pale (Brewer, 1998). The decreased solubility of the fibrillar proteins can be associated with decreased solubility of the sarcoplasmic protein (Sayre & Briskey, 1963). McLoughlin and Goldspink (1963) suggested that the color changes occurring post-mortem are due to the precipitation of sarcoplasmic proteins. Joo, Kauffman, Kim, and Park (1999) demonstrated that pork color is highly correlated to sarcoplasmic proteins.

Genotype

Today, genetics is perhaps the one most significant factor contributing to the prevalence of PSE pork. Decades ago, swine producers offered fatter and heavier hogs to the market. During the 1950s, producers began implementing breeding programs specifically designed to lower the fat content of pork carcasses and in turn , produce a trim, muscular "meat type" hog (Kauffman, Cassens, Scherer, & Meeker, 1992). Unfortunately, while this change produced lean, fast-growing pigs, the quality of the muscle unexpectedly changed. As a result, PSE meat is sometimes associated with trim, muscular hogs. Subsequently, packers soon recognized that some of these same hogs were more vulnerable to stress and suffered the possibly fatal condition known as porcine stress syndrome (PSS) (Kauffman et al., 1992). According to Kauffman, Greaser, and Russell (2002), depending on the breed, 5-15% of pigs produce PSE pork. Even though these hogs are healthy, the quality of meat is inferior.

Presently, the average processing plant grid places more emphasis on heavier muscled, leaner carcasses, providing an incentive for producers to breed pigs that carry the stress gene. Some of the highest levels of PSE were documented in cross-bred pigs (Grandin, 1994). Although these animals possess maximum lean and weight gain, they are also more excitable. These pigs are more difficult to handle at slaughter facilities; creating both meat quality and welfare issues. Two major genes that directly influence pork quality are the Halothane gene and the Rendament Naople gene (RN^{-}).

Halothane Gene

The Halothane gene, often referred to as the PSS gene, causes malignant hyperthermia, which can be triggered by stress or exposure to halothane gas, thereby giving rise to the gene's name (Mitchell & Heffron, 1982). Pigs that either carry the heterozygous (Nn) or express the homozygous recessive (nn) allele have been utilized to produce leaner carcasses; yet meat from these pigs is more prone to quality issues related to PSE pork (Channon, Payne, & Warner, 2000; Fisher, Mellett, & Hoffman, 2000; Pommier & Houde, 1993; Sather, Murray, Zawadski, & Johnson, 1991). Such animals have a genetic defect in the sarcoplasmic reticulum's ryanodine receptor caused by the RYR1 mutation (Fujii et al., 1991), resulting in increased levels of calcium (Ca^{2+}) secretion (Cheah, Cheah, Crossland, Casey, & Webb, 1984; Cheah & Cheah, 1985).

The defect in the ryanodine receptor of the sarcoplasmic reticulum of Nn and nn pigs can hasten post-mortem glycolysis and simultaneously decrease the pH at harvest (Bertram et al., 2003). Halothane sensitive pigs reportedly have higher levels of endogenous Ca^{2+} than insensitive pigs and release Ca^{2+} faster within the first 24 hours post-mortem (Cheah et al., 1984). During harvesting, as muscle metabolism shifts from an aerobic to an anaerobic environment, the increase of Ca^{2+} causes dramatic muscle contraction and enhanced post-mortem metabolism. Consequently, the muscle cannot control the increased temperature or lactic acid accumulation, leading to a rapid pH drop within an hour post-mortem in extreme cases (Savell, Mueller, & Baird, 2003). The drastic pH decline, combined with elevated carcass temperatures, causes PSE to develop as proteins begin to denature, losing WHC, and resulting in pale-colored meat.

Although some studies show that Halothane carriers' have greater carcass quality for lean content and cutting yield (Fisher et al., 2000; Leach, Ellis, Sutton, McKeith, & Wilson, 1996); the potential advantages of improved carcass leanness and yield are cancelled out because of the Halothane gene's negative effects on color and WHC. Guardia, Estany, Balasch, Oliver, Gispert, and Diestre (2004) found that pigs with the nn genotype were almost twice as likely to develop the PSE condition compared to NN and Nn genotypes. Sellier, Mejenes-Quijano, Marinova, Talmant, Jacquet, and Monin (1988) demonstrated that heterozygous carriers express median PSE conditions and Halothane-sensitive attributes compared to homozygous carriers. Halothane-positive pigs have shown increased lean muscle percentage, larger loin-eye areas, lower backfat thickness, and higher lean to bone ratio compared to non-carriers (Oliver, Gispert, & Diestre, 1993). Breeds more sensitive to halothane, such as the Belgian Landrace and Pietrain, have lower meat quality than those less or not sensitive to halothane, like the Duroc, Large White, and Yorkshire (Oliver et al., 1993; Sellier et al., 1988).

Rendement Napole (RN¯)

While differences in physical and chemical characteristics of meat from various swine breeds have been demonstrated (Monin et al., 1999; Sayre, 1962; Sellier et al., 1988), the Hampshire breed seems most impacted by genetic abnormalities. First coined by Sayre, Briskey, and Hoekstra (1963a), the "Hampshire" effect refers to the high glycolytic potential and low pHu associated with that breed (Monin & Sellier, 1985). The RN¯ gene was identified in Hampshire pigs in the mid-1980's (LeRoy, Naveau, Elsen, & Sellier, 1990). According to Enfalt, Lundström, Karlsson, and Hansson (1997), around 85% of the Hampshire population possessed the dominant RN¯allele.

Muscle from animals with the RN¯ gene was found to have ~70% higher than normal glycogen stores (Milan et al., 2000), and an extended post-mortem pH decline (Monin & Sellier, 1985; Sayre et al., 1963a). Pigs with the RN¯ gene produced more muscle glycogen because of an altered AMP (adenosine monophosphate) kinase (Aberle, Forrest, Gerrard, & Mills, 2001). Because of the uniqueness of these animal's elevated glycogen levels, scientists can measure the glycolytic potential to identify carriers of the RN¯ gene (McKeith, Ellis, Miller, & Sutton, 1998). Although this gene does not affect early post-mortem pH values, nor does it accelerate the decline rate, it does cause a low pHu since there are greater amounts of muscle glycogen leading to increased lactic acid production. This low pHu results in protein denaturation similar to that seen in PSS pigs under conditions of rapid pH decline and high muscle temperature; which again is related to lighter colored meat and poor WHC (LeRoy et al., 2000). Deng et al. (2002) found that the myosin tails and sarcoplasmic proteins from RN¯ gene carriers, compared to non-carries, had undergone increased denaturation, thereby possibly explaining the WHC difference in pigs of the two genotypes.

Meat from RN^{-} carriers, often termed "acid meat", is associated with low pHu, lower yields and leaner carcasses (reviewed by Rosenvold & Andersen, 2003), as well as with higher purge and cooking losses (Enfalt et al., 1997; Miller, Moeller, & Goodwin, 2000; Monin & Sellier, 1985). Additionally, dominant carriers have lower post-mortem muscle quality since they display the characteristic PSE attributes including decreased protein functionality, soft texture, insufficient WHC, and lighter colored meat (reviewed by McKeith et al., 1998). Lundström, Andersson, and Hanson (1996) found that RN^{-} carcasses compared to non-carriers had lower pH, higher surface and internal reflectance values, lower WHC, greater cooking loss, and smaller amount of extractable proteins. Other studies confirmed the inferior fresh meat quality and technological yield of the Hampshire breed compared to others breeds (Jensen, Craig, & Robinson, 1967; Monin & Sellier, 1985; Sayre et al., 1963a). On the other hand, some studies noted RN^{-} carcasses were leaner than non-carriers (Enfalt et al., 1997; LeRoy et al., 2000); and the meat was juicer, more tender, and flavorful in sensory evaluations (Jensen et al., 1967; Johansson, Lundström, Jönsall, & Lundh, 1999; Josell, von Seth, & Tornberg, 2003; Lundström et al., 1996); marking the importance of crossbreeding and genetic selection.

Fortunately, producers have recognized the quality problems that can arise from certain breeds and are now using genomic information to breed for pork quality. Some European countries have effectively reduced PSS by eliminating Halothane-positive boars in their breeding programs (Kauffman et al., 1992). Although the Hampshire breed is widely used for the terminal sire line in the U.S., DNA marker information has become so specific that producers can select against unfavorable genetic correlations between carcass and meat quality traits (Barbut et al., 2008). Pommier and Houde (1993) concluded that if Halothane-carrying hogs are used for pork production, then pre-slaughter conditions and handling must be improved to reduce PSE development.

Pre-harvest Management

Consumers are primarily responsible for the continued shaping of the U.S. pork industry. To keep up with the discriminating palates of today's consumers; the industry is abandoning its traditional way of moving pork from the producer's lot to the dinner table and adopting more high-tech methods (Barkema & Cook, 1993). Recently, consumers have taken issue with ethical animal production, animal welfare, organic farming, and sensory characteristics of the meat (Rosenvold & Andersen, 2003). As a result of consumers' demands and more restrictive legislation, the U.S. pork industry has become more concentrated and vertically integrated, and has established quality assurance programs. But how have these changes affected the current pork supply?

Nutrition

Feeding strategies have been used to manipulate pork quality and reduce stress in swine, thereby affecting WHC. For example, vitamin E supplementation has shown WHC improvement by reducing drip loss. Offer and Knight (1988) described drip loss as the result of post-mortem myofibril shortening caused by the pH decline, denaturation of myosin, and the formation of actomyosin at the onset of rigor mortis. It was hypothesized that α-tocopherol might have a preservative effect on muscle cell membranes by preventing membrane phospholipid oxidation during storage (Asghar et al., 1991; Jensen, Lauridsen, & Bertelsen, 1998a; Monahan et al., 1994). Some research even suggests that vitamin E supplementation can prevent PSE development by reducing the amount of Ca^{2+} released, in turn decreasing the rate of glycolysis, and thereby reducing exudates (Cheah, Cheah, & Krausgrill, 1995). On the other hand, some studies found no correlation between vitamin E supplementation and increased WHC (Cannon et al., 1996b; Corino, Oriani, Pantaleo, Pastorelli, & Salvatori, 1999; Dirinck, De Winne, Casteels, & Frigg, 1996; Jensen et al., 1997; Jensen, Flensted-Jensen, Skibsted, & Bertelsen, 1998b). These discrepancies may be due to the unknown Halothane gene status or other additional confounding variables in the studies.

Additionally, creatine monohydrate (CMH) supplementation may increase phosphocreatine muscle energy stores; which should delay post-mortem glycogen metabolism and affect the muscle pH decline (Rosenvold & Andersen, 2003). Halothane-positive pigs that were fed a 5-day supplementation of CMH showed increased weight gain, reduced early post-mortem pH decline, and less cooking losses (Berg & Allee, 2001; Maddock, Bidner, Carr, McKeith, Berg, & Savell, 2000; Stahl, Allee, & Berg, 2001). However, Stahl et al. (2001) also found that extended periods of CMH supplementation may have an inverse affect on meat functionality. The PSE-reducing effects of CMH might be attributed to its ability to more greatly affect functionality properties in meat from Halothane carries versus meat from non-carriers. When Maddock et al. (2000) repeated their experiment; the early post-mortem pH decline was less severe in Halothane carriers; however meat from treated animals showed no significant functionality improvements (Maddock, Bidner, Carr, McKeith, Berg, & Savell, 2002). Like vitamin E supplementation, CMH effects on pork quality may be affected by multiple factors and/or interactions.

Other feeding components can either directly or indirectly reduce the stress responses for these animals, thereby altering stress effects on pork quality. Neurotransmitters in the brain are released in response to stress factors, which arouse the nervous system and induce stress hormone release into the blood and may negatively stimulate muscle metabolism in relation to subsequent pork quality (Rosenvold & Andersen, 2003). Magnesium (Mg^{2+}) reportedly counteracts cathecholamine effects in stressful situations (D'Souza, Warner, Leury, & Dunshea, 1998). Several studies prove that Mg^{2+} diet supplementation can combat the negative PSE meat quality effects by darkening meat color and increasing WHC (Apple, Maxwell, deRodas, Watson, & Johnson, 2000; D'Souza, Warner, Dunshea, & Leury, 1999; D'Souza, Warner, Leury, & Dunshea, 2000; Schaefer, Murray, Tong, Jones, & Sather, 1993). However, these improvements may not be significant enough to increase meat functionality (Schaefer et al., 1993). Also, some inconsistencies exist when dietary Mg^{2+} supplementation effect was studied in Halothane positive versus Halothane negative animals (Apple et al., 2000; Caine, Schaefer, Aalhus, & Dugan, 2000). Results of these studies appear to indicate that the efficacy of dietary Mg^{2+} depends on genotype and diet.

A reduced concentration of the tryptophan-derived neurotransmitter serotonin has been shown in pigs displaying a certain degree of stress (Adeola & Ball, 1992). In accordance, increased dietary intake of tryptophan seems to enhance brain serotonin in several swine species (Adeola & Ball, 1992; Henry, Seve, Mounier, & Ganier, 1996). Correspondingly, the incidence of pre-slaughter aggressive acts was diminished along with the number of PSE carcasses in pigs that were supplemented with tryptophan (Henry et al., 1996; Li, Kerr, Kidd, & Gonyou, 2006; Warner, Eldridge, Hofmeyer, & Barnett, 1998). Other studies found tryptophan supplementation had no effect on meat quality (Guzik, Matthews, Kerr, Binder, & Southern, 2006; Peeters, Driessen, & Geers, 2006). The researchers explained that even though tryptophan might affect the stress response through its role in regulating serotonin, the effect on meat quality may not be advantageous since pigs are sometimes fasted for a long duration before harvest (Guzik et al., 2006). On the other hand, increased dietary tryptophan concentrations may play a role in stress coping during the transport to the slaughter facility and thus decrease the incidence of PSE pork (Peeters, Neyt, Beckers, De Smet, Aubert, & Geers, 2005).

Interestingly, when Panella-Riera et al. (2009) studied the effects of combining dietary Mg^{2+} with tryptophan, the supplementation had detrimental effects on carcass quality as well as meat quality, resulting in high pH, dark, firm and dry meat.

Handling

Besides genetic manipulation, improved pre-slaughter handling and management techniques can reduce the incidence of poor quality pork (Cannon, Morgan, Heavner, McKeith, Smith, & Meeker, 1995). Pre-slaughter handling includes mixing of unfamiliar animals, loading, transportation, and abattoir lairage. The stress placed on an animal before harvest directly influences meat quality. Grandin (1994) concluded that 10-15% of PSE meat resulted from discrepancies in handling practices at the processing facility. Pre-slaughter stress produces lactic acid, which reduces muscle pH even in live animals (Henckel, Karlsson, Oksbjerg, & Petersen, 2000); and ultimately causes the pale color and substandard WHC in the meat. Stress during loading and transportation, rest before stunning, stunning procedures, and carcass chilling can all impact pork quality since the maximum pH drop depends on these factors.

Transportation

Transit duration, load density, and climate during transportation from the producer to the processor affect the incidence of PSE in pigs. Berg (1998) stated that "changes in velocity, vibration, handling by unfamiliar persons, mixing with unfamiliar hogs, and establishment of a new social group all contribute to the total stress of transport." Therefore, pigs should be handled gently, taking care not to overheat or overexcite them.

Honkavaara (1989) proved that as transit distance increases, death losses and deficiencies in quality characteristics related to stress can also increase. It was determined that the lowest mortality rate was during less than 10-25 minutes in transit compared to 45-80 minutes, which had the highest mortality rate (Honkavaara, 1989). Assuming truck speeds of 60 mph, a transit of about 30 miles was recommended. The 1992 Pork Chain Quality Audit reported that average transportation distance was 93.7 miles (Cannon et al., 1996a).

Loading method and loading density also effects PSE development. In 2002, the National Pork Board (NPB) established the Trucker Quality Assurance Program, now referred to as the Transport Quality Assurance (TQA™) Program to assist "swine transporters, producers and handlers on how to handle, move and transport pigs and the potential impacts of those actions on pig well-being and/or pork quality" (NPB, 2008). Producers have reduced the possible development of PSE pork by creating an environment that familiarizes pigs with noises, people, and other hogs to help lower a stressful atmosphere during transportation and at the harvest facility. The TQA™ (NPB, 2008) recommends that handlers refrain from making loud noises, sudden movements, rough physical contact, and moving too many animals at a time. Grandin (1994) suggested that handlers play radios and walk through holding pens so that pigs are acquainted with noises and humans to diminish fear during handling. Instead of using electric prods to drive hogs, they can be directed with caps, nylon flags, shaker paddles, and sorting boards (Grandin, 1994; NPB, 2008).

The TQA guide suggested loading ramps have a 20-25 degree angle of incline and proper stair steps with non-slip surfaces to help avoid slipping (NPB, 2008). Overcrowding raises the ambient temperature in trucks; therefore, enough room, roughly 0.4 m^2/100kg pig (Berg, 1998), in their trailer should be allowed for each pig (Grandin, 1994). In cold weather, extra bedding can be provided for the animals and truck side-slats can be closed. The TQA™ handbook advises transporters to keep truck ventilation units open and to load and unload quickly to avoid heat buildup in hot weather conditions (NPB, 2008). Trucks can be lined with wet sand or shavings in warm (15˚C) weather or spayed with water prior to transport during hot (27˚C) weather (NPB, 2008). Pigs should be scheduled for delivery to the packing plant at night or in the early morning, especially if the Livestock Weather Safety Index is in the danger and emergency zone (NPB, 2008). Ultimately, the TQA™ manual asserts that "it is the transporters responsibility to protect pigs during all weather conditions" (NPB, 2008).

Additionally, pigs should be allowed a period of time to recover from stress encountered during loading, transport to, and unloading at the harvesting facility. Grandin (1994) recommended that transport trucks be scheduled for delivery at the packing plant to allow for 2 to 4 hours of rest for the pigs prior to harvest. During this time, hogs can be fasted, but given free access to water.

Fasting

Not only is feed withdrawal beneficial in terms of a microbiological impact, but fasting prior to harvesting has also been shown to reduce PSE development. Hogs that were subjected to short periods of fasting (less than 24 hours) prior to transport as well as fasting prior to slaughter, but were given free access to water, had lower muscle glycogen content, increased pHu, meat color intensity, and WHC, thereby counteracting PSE development (reviewed by Rosenvold & Andersen, 2003). In fact, Grandin (1994) recommended that hogs be off feed for 12 hours.

Fasting for more than 24 hours may deplete muscle glycogen stores in pigs prior to harvest to increase pHu, reducing PSE incidence, and thereby improving color, water binding, and meat firmness (Eikelenboom, Bolnik, & Sybesma, 1991; Fischer, Augustini, & McCormick, 1988; Wittmann, Ecolan, Levasseur, & Fernandez, 1994). However, this method of meat quality improvement is highly discouraged since fasting in itself compromises animal welfare as some studies have revealed this practice can increase fighting amongst pig groups (Kelly, McGlone, & Gaskins, 1980; Warriss &

Brown, 1985), and lower carcass yield (Eikelenboom et al., 1991; Murray, Robertson, Nattress, & Fortin, 2001; Warriss & Brown, 1983).

Stunning

Grandin (1994) believes that selecting for lean, heavy muscled animals inadvertently led to problems with excitable hogs, which “often have the worst meat quality problems.” Although Grandin (1994) acknowledged that vertical integration of some companies in the pork industry has helped eliminate the stress gene from those herds, excitability still remains a problem due to poor handling techniques and unchanged genetics from some producers.

Unlike cattle, pigs do not instinctively move in single file lines (Grandin, 1994); requiring plant employees to apply increasingly forceful practices to drive the animals down the stunning chute at a constant rate of at least 1,000 pigs per hour (Berg, 1998). This rough handling during the last few minutes prior to exsanguination is extremely stressful for pigs and contributes to PSE occurrence even in pigs that do not have the stress gene (Sayre, Briskey, & Hoekstra, 1963b). Again, alternative driving equipment should always be used in place of electric prods to coax the animals to the stunner. Ideally, using two stunning systems at 500 pigs per hour during harvest would definitely improve animal welfare and reduce meat quality problems (Berg, 1998). Grandin (1994) recommended moving small groups of pigs at a time and filling up the stunning area so that pigs can still move and turn, unfortunately this method is much less efficient than a side-by-side stunner.

Packers can either use captive bolt, carbon dioxide (CO_2), or the most common U.S. immobilization technique, electrical stimulation, to render the animal insensible. Captive bolt is more widely used for cattle processing rather than swine as it causes violent struggling in this species, leading to detrimental effects on meat quality (McLoughlin, 1964; Overstreet, Marple, Huffman, & Nachreiner, 1975). In general, electrically immobilized pigs have a faster pH decline early post-mortem and inferior water binding, increasing PSE incidence compared to CO_2 stunned animals (Channon et al., 2000, 2002; Velarde, Gispert, Faucitano, Manteca, & Diestre, 2000; Velarde, Gispert, Faucitano, Alonso, Manteca, & Diestre, 2001). These studies also showed that electrical stunning versus CO_2 does not affect pHu, muscle glycogen concentrations, or meat texture (Channon et al., 2000, 2002). Velarde et al. (2000, 2001) found no significant interactions between Halothane carriers and electrical versus CO_2 immobilization techniques. Bertram, Stødkilde-Jorgensen, Karlsson, and Andersen (2002b) found captive bolt stunning produced the highest drip losses in meat from those carcasses compared to the other two.

It is important to note that each of the afore mentioned stunning methods still cause stress to the animal; only the magnitude of stress differs. Additionally, none of these practices totally eliminate meat quality problems. Grandin (1994) asserted that the last five to ten minutes prior to immobilization are most important for reducing PSE development. PSE pork becomes a problem when hogs are stressed immediately before immobilization. Struggling at death will hasten the onset of rigor mortis and pH decline by diminishing the initial levels of ATP, glycogen, and phosphocreatine (McLoughlin, 1970; Overstreet et al., 1975). Glycolysis acceleration increases lactic acid production, producing low pH muscle and consequently, PSE meat (Carr, 1985; Greaser, 2001).

Chilling

Considering overall pork quality depends on the pH/temperature history of the carcass (Bendall & Swatland, 1988), chilling rate is another factor that affects meat quality (Offer, 1991). Since high carcass temperature, early post-mortem, in combination with the pH drop during rigor mortis, has proven to influence drip loss; reducing the initial post-mortem carcass temperature can improve the WHC of the meat. Offer (1991) showed a decrease in the percent of denatured proteins with an increase in the chilling rate due to anaerobic glycolysis hindrance and a slowed pH decline. Savell et al. (2005) recommended a more rapid chilling process to reduce PSE with the internal muscle temperature reaching 10˚C after 12 hours and 2-4˚C after 24 hours. Lowering the temperature of the carcass slows the biochemical pathways and lessens the rate of pH decline. By slowing the pH decline speed, less protein denaturation occurs and the color and WHC of the meat may be improved. Therefore, intensive and early carcass chilling may prevent PSE development by avoiding the combination of high temperature and low pH (Huff-Lonergan & Page, 2001).

Rapid chilling of carcasses, compared to conventional means, has been shown to prevent extreme pH variability and muscle structure damages, improving WHC in fresh tissue (Bertram, Dønstrup, Karlsson, Andersen, & Stødkilde-Jorgensen, 2001; Kerth et al., 2001; Taylor & Dant, 1971). This method slows post-mortem glycolysis resulting in higher ultimate muscle pH and reduced PSE pork incidence (Carr, 1985). On the other hand, several studies demonstrated no effect of rapid chilling on meat quality parameters (Gigiel, Butler, & Hudson, 1989; Gigiel & James, 1984; Jones, Jeremiah, & Robertson, 1993; Long & Tarrant, 1990); while some showed improved muscle color (James, Gigiel, & Hudson, 1983; Jones et al., 1993; Long & Tarrant, 1990; Milligan, Ramsey, Miller, Kaster, & Thompson, 1998). In extreme chilling conditions, the temperature of muscles near the exterior of the carcass can drop more quickly than other muscles, possibly causing tenderness issues due to cold-shortening (Van der Wal, Engel, van Beek, & Veerkamp, 1995; Huff-Lonergan & Page, 2001).

Bertam et al. (2001) postulated that the effect of chilling on WHC can be explained biochemically by a temperature effect on post-mortem energy metabolism, or structurally by a temperature-induced effect on the mobility and distribution of water in the meat, or by a combination of the two. Biochemically, since the coupling of pH and temperature effects post-mortem may relate to protein denaturation, the discrepancies in pH, and the temperature in muscles exposed to these cooling regimes are expected to influence the degree of denatured protein and in turn the WHC of the meat (Cheng & Sun, 2008). The post-mortem pH drop can be attributed to pH-temperature dependence, suggesting that any contribution from temperature-induced delayed lactate formation is negligible (Rosenvold & Andersen, 2003). The properties of water in muscle tissue have shown to be temperature dependent. Therefore, the improved WHC obtained with rapid chilling may be explained simply by a temperature effect on the chemical/physical state and distribution of water in the muscles (Cheng and Sun, 2008).

PSE Industry Impacts

Pork quality once meant fine-tuning production and carcass traits for leanness. Now, pork quality refers to eating characteristics, such as juiciness and tenderness, which are more valued by consumers (Vansickle, 2001). Today's consumers are more selective, often making purchasing decisions based on their perception of quality and quantity received for the price paid (Kauffman et al., 1992). Quality, a subjective attribute, is much more difficult to assess than quantity or price; especially as done by consumers. Over the years, consumers' perception of pork has continued to evolve. Pork that was once viewed as fatty and "greasy" is now perceived as a nutritious and wholesome meat source. After WWII, pork producers first attempted to change the negative perception of pork with specific breeding programs. Unfortunately, these breeding programs that produced leaner hogs also produced poor quality meat, which was later titled PSE meat (Kauffman et al., 1992). As a result, producers curtailed such rigorous breeding programs.

During the 1980s, consumers became more health conscious and aware of food choices, shifting demand towards leaner protein sources and causing a decline in pork consumption. Producers responded by renewing efforts to lower fat content of pigs even further (Kauffman et al., 1992). In 1987, the NPB began the "Pork: The Other White Meat" campaign to combat the declining demand for the meat and the rising popularity of poultry (NPB, 2005). Since the implementation of this successful campaign, 92% of consumers recognize this slogan; and nutritional awareness as well as the versatility of pork has risen (NPB, 2005).

Unfortunately, the same efforts to lower fat content of pigs that often led to PSE meat in the 1950's may now cause the PSE meat in today's market. Shortly after the NPB launched their marketing scheme, an overall increase in pork quality variation became evident. It appeared to researchers that the color of retail product was becoming less desirable, the texture seemed softer and more exudative, and the cooked product was drier and less juicy when consumed (Kauffman et al., 1992). In 1992, NPPC funded the Pork Chain Quality Audit to identify variation factors in pork quality. Fresh pork color, firmness/wetness, and marbling were traits identified as useful predictors of ultimate quality. Kauffman et al. (1992) stated, "At retail, the meat must have a normal bright color, be free of surface exudates, and firm in appearance. After cooking, the meat must smell good, be tender, and give a desirable sensation of flavor, texture, and juiciness in the mouth." Both fresh and cooked PSE pork, is opposite of all these quality traits; and RSE meat only differs by maintaining the normal red color in the fresh state.

Ironically, and despite the success of proclaiming pork as white meat, pale colored fresh pork comparable to poultry has been associated with objectionable pork quality (Norman, Berg, Heymann, & Lorenzen, 2003). Consumers who cooked pork chops in the lightest color category of the NPPC color scores, 1 and 2, rated those chops less tender and less juicy than darker colored pork chops (Norman et al., 2003). These ratings were confirmed by descriptive sensory panelists who found darker colored chops to be more tender and juicier than pale colored ones (Norman et al., 2003).

Researchers have found that pH plays a role in purchase intent and consumer satisfaction (Miller et al., 2000; Moeller, Miller, Zerby, Edwards, Logan, & Boggess, 2009). In 1997, the NPB and NPPC conducted a consumer sensory study to learn the effect of pork lean quality attributes and consumer acceptability. Consumers were not willing to pay premium prices for pork with a low pH (pH ~5.3); however, purchase intent was improved with an increase in marbling and tenderness. A follow-up study also found that consumer satisfaction was lower for pork at pH 5.4; but as pHu increased from 5.4 to 6.4, consumers rated pork chops more favorably for juiciness and tenderness (Moeller et al., 2009).

Since color is an indicator of meat quality, consumers use it in their purchasing decisions (Brewer, 1998). In another consumer study looking at fresh pork quality characteristics, researchers found that PSE samples that were in the "wouldn't buy" category were the lightest pink; however, as PSE pork color became more pink, purchase intent changed from "wouldn't buy" to "would buy" (Brewer & McKeith, 1999). Additionally, samples that appeared the wettest, a characteristic common in PSE meat, were in the "would buy" category (Brewer & McKeith, 1999). Brewer and McKeith (1999) concluded that consumers could discriminate between color and wet/dry appearance; which, in turn, influenced purchase intent.

The water content of meat products is one of the essential quality parameters for meat processors as it relates to the final yield of the end product (Bertram et al., 2003) and eating characteristics. Clearly, water loss negatively impacts the product weight, and possessors will incur a monetary loss (Cheng & Sun, 2008). However, it also has a significant impact on product quality, since an elevated drip loss lends to an expectation of a less then optimal quality due to shrinkage (Cheng & Sun, 2008). If this shrinkage is excessive, product appearance will also be influenced. Additionally, WHC substantially manipulates juiciness and tenderness (Bidner, Ellis, Brewer, Romans, & McKeith, 2003; Bidner, Ellis, Brewer, Campion, Wilson, & McKeith, 2004), and sensory perception if extremely diminished (Aaslyng, Bejerholm, Ertbjerg, Bertram, & Andersen, 2003). Therefore, severe water loss reduces product acceptability and decreases the consequent sale value (Davis, Love, & Miller, 2004; Person et al., 2005).

Christian (1995) conservatively estimated that a PSS carcass would have 5% shrink, equaling around $10/pig loss. In 2002, PSE pork accounted for $0.90/hog in discounts compared to $0.34/hog in 1992 (Meisinger, 2003). Considering approximately 98 million barrows and guilts were harvested in 2002 (Stetzer & McKeith, 2003), this accounts for $88.2 million in lost revenue; whereas nearly 88 million hogs were harvested in 1992 (Cannon et al., 1996a), accounting for almost $30 million in losses. In 2008, 116 million hogs were harvested (USDA, 2009). Clearly, if PSE meat continues to cause discounts for processors, the monetary losses will rise exponentially each year in the pork industry.

Cannon et al. (1995) claimed, “Producing leaner pigs to meet consumer demands is not likely to negatively influence the palatability characteristics of pork.” On the other hand, McKeith and Merkel (1991) asserted that flavor, juiciness, and texture of processed products can be adversely affected as hog carcasses become leaner. Either way, industry experts agree that pork that is an off-pink to grayish color and/or has excessive purge, is unappealing and less likely to be purchased. More importantly, if consumers purchase that product, they will likely notice the meat’s poor eating quality when cooked. Brewer, Jensen, Prestat, Zhu, and McKeith (2002) acknowledged that consumer satisfaction with quality and consistency result in repeat purchases, which in turn add value to the product. Since the average consumer typically “buys with their eyes”, it is extremely imperative to improve pork quality. In other words, meat that does not create a good first impression will cause a poor lasting impression. Therefore, in order to satisfy consumer desires, the pork industry must increase pH, improve WHC, and darken the color of the current fresh pork supply (Paterson, 2000).

Summary

PSE meat contributes to poor texture, decreased WHC, and undesirable colored products. Numerous research studies and review articles describe both ante- and post-mortem causes of PSE pork (Cheng & Sun, 2008; Honkavaara, 1989; Rosenvold & Andersen, 2003). Meisinger (1999) summarized that every aspect of the pork industry, from the farm to the packer, can contribute to PSE development. Improved producer, handler, and processor management have a direct impact on the incidence of PSE. Despite efforts to reduce PSS through the elimination of the Halothane and RN^{-} gene carriers from the commercial swine population, PSE meat continues to be a problem (Kauffman et al., 1992). Financial ramifications of PSE development affect every sector of the pork industry. Therefore, continued research into alternative post-mortem interventions is necessary to aid in reducing the quality variation of PSE pork in further processed products and increasing the value of this meat.

Meat Enhancement

Hamm (1960) was one of the first meat scientists to answer the why's and how's of enhancement properties by explaining the hydrating effect of alkaline salts and phosphates on muscle proteins. Anions from these compounds increased the net negative charge on protein, leading to an increased ionic strength in meat. Under alkaline conditions, strong intermolecular electrostatic repulsions increased between positively and negatively charged protein groups caused by the high net charge, decreasing protein: protein interactions, thereby resulting in loosened/ unfolded protein molecules (Hamm, 1960; Benjakul et al., 2000). This action caused muscle structure swelling, leading to increased hydration due to water absorption, and ultimately an increase in WHC (Hamm, 1960). The faster and more tightly the anions are bound, the higher the pH of the meat, shifting the pI to lower pH values (Hamm, 1960).

Results from the 1995 NPPC Consumer Preference Study indicated that a mere 23% of pork consumers were genuinely satisfied with their eating experience (Paterson, 2000). It quickly became clear to pork producers that something had to change. Packers soon turned to meat enhancement to improve consumer satisfaction. Non-meat ingredient additions to normal and PSE pork for improved meat quality and functionality has become a regular practice in the pork meat industry. Enhancement, as known in industry, is where non-meat ingredients are directly added to or injected into normal and PSE pork for improved meat quality and functionality. These non-meat ingredients can improve juiciness and/or tenderness, enhance flavor, improve color, and increase WHC (Miller, 1998). Paterson (2000) asserted that enhanced pork meets the desires that consumers have for fresh pork. This meat not only delivers a “great eating experience”, it also allows for a greater variety of products for different preparation methods, occasions, flavors, and serving sizes required by the consumer (Paterson, 2000). Therefore, enhanced pork has improved eating quality over non-enhanced meat.

In the 2002 “Benchmarking Value in the Pork Supply Chain” project, trained sensory panelists rated enhanced loin chops higher for juiciness, tenderness, amount of connective tissue, flavor intensity, and off-flavors compared to those that were not enhanced (Wright et al., 2005). Enhanced pork chops are priced approximately $0.35/kg more than non-enhanced (Wright et al., 2005). Brewer et al. (2002) found that almost 40% of consumers said they would buy enhanced pork. Frequent pork purchasers noted enhanced pork appearance was more acceptable than consumers who purchased pork less often (Brewer et al., 2002). The Pork Quality Benchmark Consumer Study showed consumer perceptions of pork eating quality and their purchase intent improved when pork loins were enhanced (Moeller et al., 2009). In this study, enhanced pork chops were rated higher in consumer preference for flavor, juiciness, tenderness, and overall-like than non-enhanced chops (Moeller et al., 2009). Wright et al. (2005) concluded that enhancing pork loins improved quality and palatability traits. Thus, the pork industry can definitely benefit from the opportunities of the large market for enhanced products.

Non-meat Ingredients

Food Safety and Inspection Service (FSIS), a division of the United States Department of Agriculture (USDA), regulates solution injections in meat. For enhanced products, the total amount of added ingredients generally ranges from 7 to 15% addition to the initial meat weight. Water is typically used as a carrier for non-meat ingredients since many are water-soluble. Today, enhancement solutions most commonly contain various salts and phosphates (Wright et al., 2005). However, recently the meat industry has been looking at alternatives to phosphates.

Sodium Phosphate

Alkaline sodium phosphates (SP) have become one of the most common ingredients in enhanced pork. As outlined by USDA, FSIS, fresh meat products may not contain over 0.5% SP in the final product. Several forms of SP can be used in meat products; however, sodium tripolyphospate is mainly added to meat systems. Most commercial SP are blends of several phosphates, meant to increase the functionality of phosphates. Phosphate companies have manufactured blends with salt to optimize the enhancement system for maximum meat quality.

Polyphosphates increase water binding and protein to protein interaction in processed meat products (Trout & Schmidt, 1983). The degree to which this takes place depends on the type and level of polyphosphate used and the amount of added salt (Trout & Schmidt, 1984). The ability to bind water depends on the pH and ionic strength of the system. Phosphates increase pH, ionic strength, bind proteins, and dissociate actomyosin (Hamm, 1960). Alkaline phosphates can raise the pH of a protein by moving the isoelectric curve to a more basic environment, thereby increasing the WHC (Trout & Schmidt, 1983). Water binding is lowest at the isoelectric point, pH ~5.4 in meat; therefore, raising the pH of meat increases the functional properties (Torely, D'Arcy, & Trout, 2000). The small pH increase produced by phosphates, roughly 0.1-

0.3 pH units (Ranken, 1976), resulted in a slight increase in water binding properties (Hellendoorn, 1962). Trout and Schmidt (1984) found that the pH increase in cooked products was approximately 0.05 to 0.3 pH units. Therefore, phosphates that can raise the pH of meat products to the upper limits of this range are most effective in increasing water binding (Trout & Schmidt, 1983).

Increasing the ionic strength of a meat system raises its WHC (Hellendoorn, 1962). However, the increase in ionic strength produced by phosphates is difficult to determine since phosphates do not fully dissociate in solution (Trout & Schmidt, 1983). With an increase in phosphate chain length comes a concurrent reduction in the degree of dissociation and ionic strength (Trout & Schmidt, 1983). The increase in WHC begins when the ionic strength is ~0.4 and continues to ~0.6 (Hellendoorn, 1962; Trout & Schmidt, 1984). Trout and Schmidt (1983) explained that although none of the phosphates can increase ionic strength to this extent, they would be most effective when used in conjunction with 1-2% salt (Bendall, 1954).

Phosphate binding to positively charged protein groups leads to an increase in the net negative charge of the protein, thereby resulting in extended protein-protein repulsion and consequently an increase in WHC (Hamm, 1960). Bendall (1954) suggested that the increase in WHC caused by pyrophosphate was due to the greater solubility of muscle proteins as a result of pyrophosphate-induced dissociation of actomyosin. Yasui, Fukazawa,Takahashi, Sakanishi, and Hashimoto (1964) found that tripolyphosphate is dephosphorylized to pyrophosphate by a phosphatase activity in myofibrils. Additionally, orthophosphate, tripolyphosphate, tetrametaphosphate, and hexametaphosphate have all been shown to effectively increase WHC (reviewed by Trout & Schmidt, 1983). When Trout and Schmidt (1984) took changes in ionic strength and pH into consideration, there was no difference in effectiveness of pyrophosphate, tripolyphosphate, tetrapolyphosphate, and hexametaphospahte. These researchers found that regardless of phosphate type or level, WHC was maximized when the pH was above 6.0 and the ionic strength was greater than 0.6.

One cannot argue the effectiveness of phosphates to improve meat quality. However, over the last two years, phosphate prices have dramatically increased, almost tripling in cost (Hills, 2009). Due to this recent increase in prices, and with no signs of improvement, meat processors are looking to other sources of functional ingredients. Although a number of phosphate alternatives have been identified for several years, for the food industry, these ingredients must be safe for food use as well. Also, if producers expect consumers to purchase their products, they must be conscientious of how the ingredient cost will affect product pricing. Some phosphate substitutes can cost over four times the price of phosphates, for example glucono-delta-lactone (GdL), and require much more to be added to the product in order to have the same functional properties as phosphates (Hills, 2009). Now, these replacers are becoming less expensive than phosphates. In addition to cost, manufacturers should consider any quality changes that may arise from using a different ingredient, for example the textural changes that come about with the use of textured soy protein.

Sodium Bicarbonate

Sodium bicarbonate (SB), commonly known as baking soda, is often used in the cereal industry as a leavening agent. An aqueous SB solution will slowly convert to sodium carbonate, carbon dioxide, and water; until completion when the temperature of the product reaches 100˚C (Lai, Guetzlaff, & Hoseney, 1989). SB improves expansion in extruded cereal products (Berrios, Woods, Whitehand, & Pan, 2004; Lai et al., 1989; Parsons, Hsief, & Huff, 1996) via bubbles created from carbon dioxide production. Since SB dissociates to sodium carbonate, Lai et al. (1989) hypothesized and confirmed that using sodium carbonate would produce the similar results on extrusion as SB.

Hydrogen (H^+) ion accumulation in exercised muscles is believed to cause fatigue. Athletes, as well as racing animals, practice “bicarbonate loading” via oral administration to delay the onset of H^+ accumulation. Plasma bicarbonate and hemoglobin provide a majority of the buffering capacity to counteract this fatigue in living muscle (Williams, 1995), however this counteraction mechanism ceases once exsanguination occurs.

“Bicarbonate loading” has been tested in hogs to prevent PSE development (Ahn, Patience, Fortin, & McCurdy, 1992; Boles, Patience, Schaefer, & Aalhus, 1994). Although SB generated a metabolic alkalosis and increased muscle pH, functional defects found in PSE meat were not significantly affected. However, Boles et al. (1994) noticed a slight relationship between meat quality indicators and blood gas measurements; suggesting the need to identify the optimum time and level of bicarbonate for quality improvement. Later SB infusion (direct injection) was compared to perfusion via the *iliac* artery (VanLaack, Kauffman, Pospiech, Greaser, Lee, & Solomon, 1998). This method produced higher pH and darker colored meat; however, researchers recommended additional studies to classify optimum SB concentration and delivery method (VanLaack et al., 1998). Finally, Kauffman et al. (1998) pointed to 0.3M SB directly injected into pre-rigor muscle would prevent PSE development.

Perhaps the first published research of SB addition effects on pH, texture, and WHC was from Draudt (1972). Draudt (1972) showed that SB significantly increased pH and WHC in cubed beef compared to control samples without having deleterious effects on meat texture. Recent research indicates this ingredient's superior improvement capabilities, even surpassing improvements resulting from SP additions (Kaufmann et al., 1998; Wynveen et al., 2001; Sheard & Tali, 2004). Use of SB as an added non-meat ingredient has shown improvements in color, texture, and WHC in pre-rigor and post-rigor muscle (Kaufman et al., 1998; Wynveen et al., 2001; Alvarado & Sams, 2003; Sheard & Tali, 2004; Sen, Naveena, Muthukumar, Babji, & Murthy, 2005). In other words, this ingredient is a superior marinating agent, which reduces drip loss as well as shear force and improves enhanced meat yield (Bertram et al., 2008; Kauffman et al., 1998; Sheard & Tali, 2004; Wynveen et al., 2001).

The poultry industry has used SB washing solutions for mechanically deboned poultry meat (MDPM) to remove/ reduce coloration from muscle proteins for use in restructured low pigment meat products (Dawson, Sheldon, & Ball, 1988, 1989; Yang & Froning, 1992, 1994). At 0.5% SB addition, researchers found that the alkaline washing conditions significantly removed heme pigments and increased lightness of the washed meat (Yang & Froning, 1992). SB also aided in WHC and textural properties of MDPM (Hernandez, Baker, & Hotchkiss, 1986; Yang & Froning, 1992).

Xiong and Delles (2009) explained that bicarbonate effectiveness is due to the ability to partially solubilize myofibrillar proteins and increase their electrostatic repulsion by raising the pH. This function causes a transverse swelling of myofibrils, permitting higher water absorption and retention. SB elevated the muscle pH by overcoming the buffering capacity of meat, changing the ionic strength of the muscle, and altering meat color by allowing more free water to bind to the muscle proteins. The increase in WHC from SB would result in the darkening of the meat as the light reflection was lowered and more water was bound to the protein (Fernandez-Lopez, Sayas-Barbera, Perez-Alvarez, & Aranda-Catala, 2004). Kauffman et al. (1998) documented an improvement to CIE L* color values and drip loss in pork muscle injected with SB 24h post-mortem. SB is a GRAS substance, or generally recognized as safe, and can be used as a SP replacement.

Sodium Carbonate

Sodium carbonate (SC) is a high alkaline salt used in the food industry as an anti-caking, leavening, and stabilizing agent. In the meat industry, this compound has been used to extract protein from animal bones. Although substituting SB for SC in an extruded cereal product produced similar results (Lai et al., 1989), limited research has been conducted to describe functional properties of SC as an added ingredient in meat systems. Currently, SC is used to give seafood products, such as minced cod or rehydrated dried squid, a characteristic texture. Researchers noted that pH, moisture content, and swelling increased as the concentration of SC increased (Benjakul et al., 2000; Kolakowski et al., 1994). Xiong and Delles (2009) explained that since SC lowers the H^+ ion concentration, the pH of the intramuscular aqueous phase shifts away from the isoelectric point of myosin; thereby increasing electrostatic repulsion leading to the expansion of myofilament lattices. This expansion would increase protein surface to promote hydrogen bonding and electrostatic interactions between water and muscle proteins (Xiong & Delles, 2009).

SC may possess functional properties similar or superior to SP and SB, so that it can be used as an inexpensive substitute for SP in meat products. Both SC and SB have potassium alternatives, potassium bicarbonate (PB) and potassium carbonate (PC), for use in products where sodium reduction is desired.

Summary

Extensive research has been conducted proving the effectiveness of phosphates in improving meat functionality. However, with the current rise in phosphate prices, identifying other ingredients to serve as phosphate replacers is becoming more imperative. Recent work shows SB to be just as effective, if not more effective, than SP to improve pork quality. Now, promising results of SC use in protein systems seem to characterize SC as another ingredient that may replace SP. Additional work must be conducted to determine this ingredient's effect on PSE pork in addition to the sensory properties of meat. Such research may prove to be monumental for the meat industry.

Texture Profile Analysis

Numerous instrumental methods have been developed in an effort to objectively assess textural properties of food products (reviewed by Friedman, Whitney, & Szczesniak, 1963). In 1963, a major break though in texture profile analysis (TPA) came with the development of the Texturometer by General Foods (Friedman et al., 1963; Szczesniak, Brandt, & Friedman, 1963), which imitated mastication via a 2-cycle compression and the measurement of force-time relationships.

TPA falls into the imitative test class for texture measurement. Szczesniak (1963) originally identified and defined texture characteristics important for determining how food behaves in the mouth. Fifteen years later, after adapting TPA to an Instron Universal Testing Machine, Bourne (1978) modified these characteristics to the current parameters: fracturability, hardness, cohesiveness, adhesiveness, springiness, gumminess, and chewiness. Bourne, Kenny, and Barnard (1978) also defined Work 1 and Work 2. Fracturability, originally termed brittleness was defined as the force with which a sample crumbles, cracks, or shatters (Szczesniak et al., 1963). However, Bourne et al. (1978) defined fracturability as the first significant decrease in force. In comminuted products like frankfurters, Bourne et al. (1978) considered the fracturability peak to be ingenuine since the sample more slowly tears rather than rapidly shatters. Additionally, nearly 50% of frankfurter samples showed no discontinuity in the force-distance curve (Bourne et al., 1978).

Hardness 1, or Hardness 1st- bite, is the maximum force during the first compression (Bourne, 1978). Hardness 2 is defined as the peak force during the second bite (Bourne et al., 1978). Cohesiveness is calculated as a ratio of the positive force area during the second compression over area under the first peak (A_2:A_1) (Bourne, 1978). This parameter describes the amount of product recovery between compressions. Szczesniak (1963) described sensorial cohesiveness as "the strength of the internal bonds making up the body of the product" and springiness as "the rate at which a deformed material goes back to its undeformed condition after the deforming force is removed". Springiness is considered to be the height the sample recovers in between the first and second bite (Bourne, 1978). Chewiness is the product of hardness 1, cohesiveness, and springiness (Bourne, 1978) since it comprises hardness, cohesiveness, and elasticity (Szczesniak et al., 1963). Work 1, the amount of work exerted to compress the food during the first bite is considered the area under the curve, to the left of the maximum force (Bourne et al., 1978). Similarly, Work 2 is a measurement of the area under the curve of the peak force during the second bite (Bourne et al., 1978).

Szczesniak et al. (1963) correlated TPA to sensory panel evaluations. Szczesniak and Hall (1975) used the general food texturometer to characterize attributes that might be present in frankfurters, including hardness, cohesiveness, springiness, and chewiness. Other studies have demonstrated TPA to effectively predict sensory texture properties of foods, including meat gels (Calhoun, Eilert, & Mandigo, 1996; Shand, Sofos, & Schmidt, 1993). Keeton, Foegeding, and Patana-Anake (1984) studied phosphates and non-meat protein sources effects on sensory and texture characteristics in frankfurters.

In this study, sodium tripolyphosphate did not affect TPA parameters for chewiness, or sensory springiness (Keeton el al., 1984). Hargett, Blumer, Hamann, Keeton, and Monroe (1980) found that sodium acid pyrophosphate helped with skin formation in frankfurters. TPA measurements showed this ingredient affected frankfurter texture by making them springier and more firm (Hargett et al., 1980).

Bechtel, Oreskovich, McKeith, Martin, and Novakofski (1989) found that bicarbonate addition improved hardness of frankfurters compared to those formulated with phosphates. SB has also been used in MDCM to improve shear force and TPA attributes (Yang & Froning, 1992). Cohesiveness and shear force was reduced with increasing levels of SB in cod minces (Kolakowski et al., 1994). Additionally, SB improved the texture of whole muscle products and by reducing shear force values compared to controls (Draudt, 1972; Sheard & Tali, 2004; Wynveen et al., 2001). Shear force values were also reduced in products containing carbonates (Dolota, Piotrowska, & Krywdziska, 1991; Benjakul et al., 2000).

Conclusion

PSE pork receives its name from an acronym of descriptors. This meat is pale in color, soft in texture, and exudative in WHC properties. Undoubtedly, the PSE condition can be caused by a multitude of factors. This type of meat is not only unsightly and texturally undesirable to consumers but packers and processors alike find faults with PSE pork. Due to these shortcomings, PSE pork causes significant economic impacts for the pork industry. Fortunately, though, this condition can be prevented through combined efforts from all participants in the business. Should the development of PSE pork still occur, processors can enhance this meat with certain non-meat ingredients, namely SP and SB. Upcoming research also indicates SC may also be used to increase PSE meat functionality.

Color, pH, and WHC assessments provide an objective insight into the characteristics of a product. Through the use of TPA, researchers are able to roughly predict sensory assessment of products without subjecting panelists to something that is potentially undesirable. This combined information can be used for product developers in determining possible uses of a meat that was once undesirable.

CHAPTER III

MEAT FUNCTIONALITY ASSESMENT

Materials and Methods

Treatment solutions were made with no added solutions (control), double-distilled deionized water (ddW), sodium phosphates (SP; Brifisol® 85 Instant, BK Giulini Corp., Simi Valley, CA, USA) at 0.1, 0.2, and 0.3%; potassium bicarbonate (PB), sodium bicarbonate (SB), potassium carbonate (PC), and sodium carbonate (SC) solutions were made with 0.1, 0.2, and 0.3M concentrations of their respective ingredient. This approximates 0.1, 0.2, 0.3% addition in the final product. Since SP is a commercial product used in pork enhancement solutions, levels were similar to added levels of industrial use. Carbonate and bicarbonate ingredients were chemical grade ingredients and addition levels were added by molarity so that if these ingredients are used, actual level of addition could be calculated. Enhancement ingredients, at respective concentration levels, were solubilized in 100mL of double-distilled deionized water. Prior to analysis, solutions were allowed to equilibrate to room temperature.

Meat gel preparation methods were adapted from Booren and Miller (2008a). Fresh, whole *Longissimus dorsi* (LD) muscles were selected and separated according to normal (pH 5.6-5.9) or PSE (pH < 5.4) meat type at Columbia Packing Co., Inc. in Dallas, TX. Pork loins were transported to the Kleberg Center at Texas A&M University, College Station, TX under refrigeration (4˚C). After approximately 48 hours of aging, loins were trimmed of all *subcutaneous* fat and connective tissue. A Minolta

CR-300 Colorimeter (light source C and 0˚ view angle; Minolta, Ramsey, NJ, USA), calibrated daily using a white tile (Y=93.24, x=0.3137, y=0.3196) to ensure consistency among days, was used to measure CIE L*, a*, and b* color space values, in triplicate at the anterior LD muscle surface. In duplicate, pH was determined internally on the anterior LD muscle to verify pH selection by inserting a probe (IQ Scientific Instrument, Model IQ150, IQ Scientific Instrument, Inc., Carlsbad, CA, USA) approximately 2.54cm into the LD muscle. Within meat type, loins were ground to 1.27cm then to 0.476cm (Hobart Corporation, Model 4612, Troy, OH, USA), segmented into 300g portions and stored at 4˚C. Within each normal or PSE ground sample, the 300g portions were randomly assigned to a treatment solutions prepared within 12h of a processing day. Solutions were added at 12% of ground weight to simulate injection of treatment into a whole muscle system, and were homogenized for 60 seconds in a food processor (KitchenAid, Hobart Corporation, Troy, OH, USA). Homogenized meat samples were placed onto foam trays (#2, Pactive Advanced Packing Solutions, Lake Forrest, IL, USA) and bagged in oxygen impermeable vacuum bags (OTR $1cm^3/m^2/24h$ atm @ 4.4˚C, 0% RH; WVTR g/100 $in^2/24h$ @ 37.8˚C, 100% RH), vacuum packaged, and stored at 4˚C.

Five, approximately, 15.00g aliquots of homogenized meat sample were stuffed into disposable polystyrene 15mL culture tubes (17mm outer diameter x 100mm length, constant wall thickness) for cook yield and texture profile analysis (TPA). One 45.0g aliquot of homogenized meat sample was stuffed into 50mL polystyrene centrifuge tubes for cooked color and pH determination. Tubes were capped and centrifuged (Garver

Electrifuge, Model 54; Garver Manufacturing Co., Union City, IN, USA) at 600 x g for 30 min to further remove air pockets and firmly pack the aliquots. Sample tubes then were uncapped and heated to 75˚C in a water bath (Neslab GP-400, Neslab Instruments, Inc., Newington, NH, USA) with a heating rate of approximately 0.75˚C/min. Sample temperatures were monitored by inserting copper constantan wire thermocouple (Omega Engineering, Inc., type T thermocouple, Stamford, CT, USA) in the geometric center of a randomly selected sample tube with one thermocoupled tube per rack. Temperature was monitored with an electronic thermometer (Omega Engineering, Inc., Model HH501BT, Stamford, CT, USA). Once the 75˚C target temperature was reached, samples were removed from the water bath, capped, and stored for at least 8 hrs at 4˚C.

Prior to vacuum packaging, homogenized meat samples were placed on foam trays (#2, Pactive Advanced Packing Solutions, Lake Forrest, IL, USA) and wrapped with foodservice film (Reynolds® Foodservice Film 914, Reynolds Food Packaging, LLC, Richmond, VA, USA). Raw CIE L*, a*, and b* color space values were measured, in triplicate, with a Minolta CR-300 Colorimeter (light source C and 0˚ view angle; Minolta, Ramsey, NJ, USA), that was calibrated daily (Y=93.24, x=0.3137, y=0.3196) to ensure consistency among days. Raw pH was measured with a pH meter that was calibrated daily with 4.0 and 7.0 pH buffer solutions (IQ Scientific Instrument, Model IQ150, IQ Scientific Instrument, Inc., Carlsbad, CA, USA).

Cooked meat gels were removed from 50mL polystyrene tubes and cut in half, length-wise. In triplicates, cooked CIE L*, a*, and b* color space values were determined in duplicate as previously defined.

Percent moisture was calculated using the AOAC (1995) oven drying method for moisture determination. Approximately 2g of meat sample was placed into pre-folded oven-dried filter paper (9cm Whatman™ No. 1; Whatman International, Ltd., Maidstone, Kent, UK), weighed and placed into 100˚C ovens for at least 16 hours. Upon removal from the oven, samples were cooled for approximately 1 hour in a glass desiccator containing silicone desiccant. After cooling, these samples were reweighed to determine moisture loss. All determinations were in triplicate and only samples that were within 10% of each other were accepted. All unacceptable samples were reanalyzed until acceptable values were obtained. Moisture equations were as follows:

% moisture = (undried meat (g)/ dried meat (g)) x 100.

Total moisture (mg) = % moisture x meat sample

An adapted version of the press method for WHC determination developed by Wierbicki and Deatherage (1958) was used. Approximately 5mg of sample was weighed onto filter paper (9cm Whatman™ No. 1; Whatman International, Ltd., Maidstone, Kent, UK) that was stored in a desiccator with a 4M KCl saturated atmosphere. One filter paper with meat sample was placed in between two- 10.2cm^2 metal sheets and pressed (Model C; Carver Laboratory Press, Wabash, IN, USA) at 500psi for 60sec. Immediately after pressing, the inner meat ring was traced on the filter paper with a wax pencil so as to preserve ring outline after the paper had dried. The filter paper was then carefully removed from the metal sheet and placed out to dry over night. Eight divisions were drawn on the dried filter paper and diameters were measured, eight of the inner and eight of the outer ring, for a total of sixteen diameters.

Determinations were conducted in triplicate. Diameters (d) were then determined as a mean of the three samples. The WHC calculations were as follows; for a cylindrical sample area (πr^2), with the radius (r=d/2) and

$$\% \text{ Free water} = \frac{(\text{total surface area} - \text{meat film area}) \times 24.06}{\text{Total moisture (mg) of meat sample} \times 100}$$

% Bound water (WHC) = 100 - % free water

Raw weights of five, approximately, 15.00g homogenized samples were calculated as a mean weight of that sample. Once samples had been cooked, meat gels were removed from their tubes and patted dry with a paper towel to remove excess purge. Meal gels were then weighed and the cooked weights of those samples were also calculated as a mean weight. Cook yield was calculated as follows:

Cook yield (%) = (raw wt/ cook wt) x 100

Texture profile analysis (TPA) was conducted as described by Bourne (1978) using a TA-XT2i Texture Analyzer (Texture Technologies Corp., Scarsdale, NY, USA) with Texture Expert Exceed (Stable Micro Systems, Ltd., 2003, Godalming, Surrey, UK) software with 50mm diameter plunger and 25kg load cell. Meat gels were removed from 15mL tubes and allowed to equilibrate to room temperature (~22˚C). Five meat gels samples were cut into 1:1 (diameter to length, 1.4cm) ratio and tested within 20 min to prevent sample integrity loss as a result of evaporation. Pre-test, test, and post-test speed were set at 1mm/s. Samples were pressed twice at 75% of initial sample length with a 5sec delay between compressions. Hardness 1 (N), hardness 2 (N), cohesiveness, springiness (mm), chewiness (N*mm), work 1 (J), and work (J) were determined.

The study was repeated in triplicate. Data was analyzed using the Proc GLM procedure of SAS (version 9.2, SAS Institute, Inc., 2008, Cary, NC, USA) as a 2 x 17 factorial arrangement with meat type (normal, PSE), treatments, and interaction of meat type and treatments as main effects. Processing week was included as a block. A significance level of $P<0.05$ was used. Least squares means were determined and where Analysis of Variance indicated significance, least squares means were separated by the pdiff function of SAS using $\alpha<0.05$. A second analysis was conducted that included cook yield as a covariate. This analysis was used to determine if main and interaction effects were influenced by cook yield, especially for color and texture attributes. Pearson correlation coefficients were calculated for color, pH, WHC, and cook yield with texture attributes.

Results and Discussion

Color and pH Analysis

Pork loins differed ($P<0.05$) across processing weeks in pH and L* color space values due to the normal and PSE meat type (Table A-1). As expected, the pH of the normal loins was higher ($P<0.05$) than PSE loins. Additionally, PSE loins were lighter ($P<0.05$) than normal loins. While the PSE loins displayed characteristic low pH and lighter color, they were similar ($P>0.05$) in redness and yellowness to the normal loins (Table A-1).

Raw meat gel color and pH differed ($P<0.05$) across processing weeks as a result of variation within normal and PSE loins used to produce gels. However, cooked CIE color space values were not affected (P>0.05) by processing week interactions. As expected, the pH of normal gels were higher (P<0.05) than the PSE gels (Table A-1).

Treatments affected (P<0.05) raw and cooked pH as well as raw color space values. Similar to the findings of Booren and Miller (2008a, b), the additions of alkaline solutions increased meat gel pH compared to control and ddW gels (Figure B-2a). SP gels had lower pH and higher L*, a*, and b* color space values, compared to PB, SB, PC, and SC at respective levels (Figure B-2). Gels treated with 0.1 or 0.2% SP did not differ (P>0.05) in pH or color from control and ddW gels (Figure B-2). Raw gels with 0.3% SP were higher in pH than ddW and control gels, but pH of 0.2 and 0.3M SB or PB raw gels had higher pH (Figure B-2a) as similarly reported by Sheard and Tali (2004). Bertram et al. (2008) asserted that a phosphate concentration of approximately 0.3% or higher is needed to raise the pH of the meat in order to shift the isoelectric point.

With increasing levels of treatment, gels were higher in pH and lower in L*, a*, and b* color space values (Figures B-2, B-3, and B-4). In agreement with results from Sen et al. (2005), raw and cooked meat gel pH increased as levels of PB and SB treatments increased (Figures B-2a and B-3a). Kolakowski et al. (1994) found that as levels of SB addition increased, pH also increased; and similar to the outcomes of this project, pH increases resulting from SC addition surpassed pH increases from SB addition. Benjakul et al. (2000) also found significant increases in pH from carbonate ingredients as levels of addition increased; however, pH did not differ in treatments above 0.1M SC.

Likewise, as treatment levels of PC and SC increased, raw and cooked pH also increased, surpassing pH values resulting from similar levels of PB or SB addition (Figures B-2a and B-3a). Gels with 0.3M PC or SC were highest in pH and lowest in L*, a*, and b* color space values. These gels were darker, less red, and less yellow than other meat gels.

The results of the present study coincide with Hernandez et al. (1986) who washed MDPM with alkaline buffer solutions and found that as pH of the sample increased, the samples were less red. Palombo and Wijingaards (1990) noted that protein gels subjected to alkaline conditions produced a more translucent wash mince, however with lower L* color space values. Sen et al. (2005) also found that SB treated meat had lower L* values, however SB treatments had higher a* and b* color space values than SP treated meat.

In contrast to the results of the present study, Hernandez et al. (1986) found that mechanically deboned turkey samples treated with increasing pH buffer solutions lead to higher L* color space values. MDCM treated with 0.5% SB washing solution had higher L* and lower a* color space values than SP and control samples (Dawson et al., 1988; Yang & Froning, 1992, 1994). Additionally, color of cod sausages treated with 0.15 or 0.3% of SB became more yellow and white, while a* color space values remained unchanged (Cardoso, Mendes, & Nunes, 2009).

Cooked L* color space values did not differ (P>0.05) across meat types (Table A-1). In a similar study, Booren and Miller (2008b) had similar L* and b* and different a* values between PSE and normal cooked pork gels. In our study, cooked PSE and normal gels had similar lightness and redness but PSE gels were slightly more yellow than normal gels.

Meat type by treatment interactions were significant (P<0.05) for cooked a* and b*color space values (Figure B-4); however, no definitive trend for a* was found. Cooked PSE gels with 0.3M SB and PB were redder than PSE ddW gels (Figure B-4a). For both meat types, SP, PB, and SB treated gels did not differ (P>0.05) in b* color space values across treatment levels (Figure B-4b). Cooked PSE gels with 0.3M SC and PC were less yellow than control and ddW gels of both meat types (Figure B-4b).

Water Binding Ability

Percent moisture, WHC, and cook yield differed (P<0.05) across weeks due to the inherent variation in normal and PSE pork between processing weeks (data not presented). Normal and PSE meat type did not differ (P>0.05) in percent moisture, but PSE gels had lower WHC and cook yield (Table A-2). Treatments affected (P<0.05) percent moisture because of the added solutions to the meat (Figure B-5a). Control gels contained approximately 75% moisture, the typical amount present in lean muscle. Although significantly different, all meat samples that received treatment solutions ranged between 77.07 to 77.72% moisture.

WHC was affected (P<0.05) by treatments (Figure B-5b). Control gels had higher WHC than ddW and SP gels, and had similar WHC compared to PB, SB, 0.1M PC, and 0.1M SC gels. As control gels had no added water, it would be expected that WHC would be higher than ddW gels. These gels essentially contained more meat and less water that could be pressed out during WHC measurement.

SP addition would have expectantly increased WHC in comminuted meat systems as reported by several authors (Kuo, Wang, & Huang, 1987; Li, Bowers, Craig, & Perng, 1993; Regenstein, Jauregui, & Baker, 1984; Young, Lyon, Searcy, & Wilson, 1987). However, it was reported that when NaCl was added in conjunction with SP, WHC further increased (Regenstein et al., 1984; Schwartz & Mandigo, 1976; Young et al., 1987). Kuo et al. (1987) noted that using a phosphate blend also improved WHC compared to single phosphate type used alone. Additionally, other authors have concluded that the type of phosphate used in the meat system will also impact WHC (Baublits, Pohlman, Brown, & Johnson, 2005; Kuo et al., 1987; Regenstein et al., 1984). The results from these previous studies demonstrate that several factors influence the water binding potential of phosphates.

Although there was a trend for gels containing 0.3% SP to increase in WHC, this was not significantly different from ddW gels and 0.1 and 0.2% SP gels. In meat products SP addition is commonly used with NaCl to increase WHC. These results show SP effects without additional ingredients. Gels containing 0.3M PB or SB had similar WHC to control gels. These results indicate that PB or SB addition at 0.3M allowed the pork gels to bind water similarly to non-water added controls. Gels containing 0.1M PC or SC did not differ ($P>0.05$) in WHC from non-water added control gels. However, 0.2 and 0.3M addition of PC or SC resulted in higher WHC than non-water added controls.

SP treated gels did not differ from ddW gels and had lower WHC compared to all PC and SC gels as well as PB and SB gels at their respective levels (Figure B-5b). Gels with 0.2 and 0.3M PB or SB had higher WHC than ddW gels but did not differ from control gels (Figure B-5b). Bechtel, McKeith, Martin, Basgall, and Novakofski (1985) who similarly found that WHC of frankfurters with 2% SB significantly surpassed positive controls. Bechtel et al. (1989) also found that WHC increased as levels of PB or SB increased in frankfurters. Additionally, WHC for PB gels was similar to SB gels at their respective levels, surpassing WHC for SP gels (Bechtel et al., 1989). On the other hand, Yang and Froning (1992) noted that MDPM treated with 0.5% SB did not differ in WHC compared to control gels. In a follow up study, Yang and Froning (1994) found that MDPM gels treated with 0.5% SB had lower WHC than 0.1M NaCl treated gels. While the results of the current study correspond to those from Bechtel et al. (1989), the MDPM from Yang and Froning (1992, 1994) may have been too denatured to reap the benefits of SB addition.

Cook yield was used as a covariate for WHC to determine if increased cook yields from PB, SB, PC, and SC addition were related to WHC. Meat type and treatments effects were no longer significant ($P>0.05$) for WHC. Therefore, WHC measurements were related to cook yields. This result reveals that improved WHC due to bicarbonate or carbonate addition resulted in cook yield improvements.

Meat type by treatment interactions affected ($P<0.05$) cook yield (Figure B-6). For control gels, PSE gels had lower cook yields. When ddW was added, cook yield decreased as expected since other ingredients were not included. The addition of 0.1 and

0.2% SP to PSE gels resulted in similar cook yield as ddW PSE controls. When PSE gels contained 0.3% SP, cook yield was similar to ddW normal pork gels. Interestingly, 0.3% SP gels had similar cook yield as normal gels containing 0.1 and 0.2% SP or ddW. These results indicate that higher levels of SP can assist in improving cook yield in PSE meat, but this effect did not reach cook yields of normal control gels. The addition of PB and SB at 0.1 and 0.2M to PSE meat resulted in cook yield similar to ddW, 0.1 and 0.2% SP normal gels. These results indicate that adding PB or SB to PSE meat at lower levels improved the ability of gels to bind water during cooking and provided some added WHC to PSE meat. PSE gels containing 0.1M PC or SC had similar cook yield as the previously discussed gels; however, when PC and SC was added at 0.2M in PSE gels, cook yield were similar to normal control gels. These results indicate that less PC or SC ingredient was required to improve PSE gel cook yields to those of normal, non-water added, control gels.

When SB and PB were added to normal meat, as level increased, cook yield concomitantly increased. Intermediate levels of PB and SB (0.2M) in normal meat had similar cook yield as normal control gels. When 0.3M PB or SB were added to normal gels, cook yield was higher than normal control gels. PC and SC addition resulted in the highest cook yield across meat types. Normal PC and SC gels had concomitantly increased in cook yield as level of addition increased. In PSE meat, the addition of 0.3M PC and SC to gels resulted in similar cook yield as normal gels containing 0.2 and 0.3M PC and SC. These results indicate that PSE pork can have similar cook yield when 0.3M

PC and SC is added to the meat and the addition of 0.3M PC and SC to normal pork would have the same cook yield.

Bertram et al. (2008) found 3% SB enhanced pork loins had the highest cook yields compared to 5% SP and control loins. Sen et al. (2005) also found an increase in WHC and cook yield in 3% SP treated meat compared to controls, but the same measurements of 3% SB treated meat surpassed that of SP meat. On the other hand, Sheard and Tali (2004) found cook yields for 5% SP injected pork loins did not differ from 3% SB injected loins at their respective treatment levels.

Cook yields were negatively correlated with raw L* color space values and positively correlated with pH (Table A-4). In agreement with other studies, this suggests that lighter colored meat that was lower in pH resulted in decreased cook yields (Allen, Fletcher, Northcutt, & Russell, 1998; Barbut, 1993; Bouton, Harris, & Shorthose, 1971). On the other hand, WHC was negatively correlated with raw L* and positively correlated with pH (Table A-4). Coinciding with results from previous research, darker colored meat that was higher in pH resulted in increased WHC (Allen et al., 1998; Barbut, 1993).

Similar to the results of this project, Dolota et al. (1991) found that sausages treated with carbonates had higher WHC and yield compared to controls. Additionally, Kolakowski et al. (1994) found that the addition of SC “markedly reduced” cook loss compared to controls. When dried squid was soaked in PC solutions, Kugino, Kugino, and Wu (1993) found a significant increase in treatment absorption paralleled with the degree of swelling as pH and soak time increased.

The higher pH of the SC gels may elucidate this significant increase in cook yield and WHC (Bouton, Harris, & Shorthose, 1982; Honikel, Hamid, Fischer, & Hamm, 1981). To explain an increase in solution uptake and tissue swelling, Benjakul et al. (2000) postulated that due to the alkaline environment, strong intermolecular electrostatic forces from the high net charge most likely resulted in either a weakened protein structure or the unfolding of protein molecules. Therefore, the association of potassium or sodium cations with muscle protein led to an electrostatic repulsion among molecules; thereby loosening the protein network to allow for increased water absorption (Benjakul et al., 2000). This finding corresponds to the electrostatic repulsion theory first described by Hamm (1960) and later supported by several other authors.

On the other, while Bertram et al. (2008) also noticed this swelling phenomenon was more pronounced in SB treatments compared to SP and controls, the authors noted that simply using pH as the sole factor in describing the influence of marinades on WHC was incorrect since the pH of the sodium tripolyphosphate solution was higher than the SB treatment. Therefore, it is the specific ingredients' interactions with meat proteins as well as the pH of the marinades that manipulate WHC (Bertram et al., 2008).

Texture Profile Analysis

Due to natural variation within normal and PSE pork loins between processing weeks, meat by processing week interactions were significant ($P<0.05$) for TPA assessments (data not presented). A two-cycle compression TPA graph performed on a normal control pork gel sample is shown in Figure B-1. As expected, PSE gels were harder, more cohesive, gummier, chewier, and higher in work 1 and 2 (Table A-3). All

TPA attributes measured were affected (P<0.05) by meat by treatment interactions, however trends for springiness were unclear (Figures B-7, B-8, and B-9). No discernable trends were established for PSE gels treated with SP, PB, or SB. TPA measurements for normal SP gels did not differ (P>0.05) across treatment levels. Keeton et al. (1984) found that hardness and fracturability increased in 0.5% SP treated frankfurters but other TPA attributes were not affected.

As treatment level increased (P<0.05), TPA values decreased for normal PB, SB, and all PC, SC gels. PSE control gels had higher hardness 1, were gummier, and chewier than normal control gels. The addition of ddW or treatments resulted in gels that had lower hardness 1 and 2; were less springy, and chewy; and required less work 1 and 2. Treatment effects on texture were in general reverse of cook yield results. As a result, gels with highest cook yields were softer, less cohesive, and chewy, and required less work 1 and 2 to compress.

Gels of both meat types with 0.3M PC or SC were over 20 newtons less in hardness 1 than the normal, non-water added, control gels. This dramatic change in texture may translate to detrimental sensory characteristics. Similar differences between normal control gels and 0.3M PC or SC gels were noted for hardness 2, cohesiveness, and chewiness. On the other hand, PSE gels with 0.1M PC or SC were similar (P>0.05) to normal ddW gels for hardness 1, hardness 2, and work 1. PSE gels with 0.3M SB were also similar (P>0.05) to normal ddW gels for hardness 1, hardness 2, cohesiveness, chewiness, work 1, and work 2. These similarities and differences between meat type by treatment interactions and texture attributes demonstrate added ingredients affected texture attributes. However, the impact of these changes in a finished product is not known and should be examined.

With the exception on springiness and work 1, texture attributes were negatively correlated with both raw and cooked pH as well as WHC and cook yield (Table A-5). Therefore, as pH, WHC, and cook yield increased, texture measurements decreased.

Hardness deceased as meat gel pH increased (Figures B-3a and B-7). Similarly, Matulis, McKeith, Sutherland, and Brewer (1995) reported that as pH increased, hardness decreased. Bechtel et al. (1989) found that frankfurters treated with SP were harder than other treated samples; whereas those containing increasing levels of PB or SB were respectively softer. Hernandez et al. (1986) noted that adding MDPM treated with high pH buffer solutions to breast meat resulted in a softer product texture.

For both meat types, as treatment levels increased, cohesiveness decreased. On the other hand, although sausages treated with carbonates had lower absolute values than controls; these samples were not statistically different compared to the control (Dolata et al., 1999). However, Dolota et al. (1999) compressed samples to 50% of their initial height instead of the 75% compression that was used in this study. Kolakowski et al. (1994) also found that cohesiveness decreased with SB addition.

Normal 0.3M PB and SB gels were softer, less cohesive, and chewy than ddW gels (Figures B-7, B-8, and B-9). Likewise, MDCM washed with 0.5% SB had improved hardness, springiness, and chewiness over SP and positive control samples (Yang & Froning, 1992). Since bicarbonate is a reducing agent, it interferes with the sulfyl-hydryl bonding of meat proteins, thereby weakening the protein gel strength (Yang &

Froning, 1992). Although, Cardoso et al. (2009) also found that increasing SB addition in cod sausages decreased gel strength; in contrast to the results of the present study, the sausages were harder, springier, and more cohesive. Although not statistically significant, chewiness followed similar trends (Cardoso et al., 2009).

To understand if texture differences in pork gels were related to increased cook yields found when PB, SB, PC, and SC were added, texture data were reanalyzed using cook yield as a covariate. Cook yield was a significant ($P<0.05$) for hardness 1, cohesiveness, chewiness, and work 1. Additionally, significant meat type effects for hardness 2 and work 2 were no longer significant; whereas springiness was no longer significant for meat by treatment interactions. These results indicate that the improved water holding capacity related to alkaline non-meat ingredient addition resulted in texture changes. These texture changes may not be important or they may be detected in pork products. The changes in texture due to alkaline ingredient addition need to be further researched.

The results of the present study are supported by Hamm (1986), who noted that meat becomes harder with lower pH values due to the increased intermolecular myosin linkages between negatively and positively charged groups. Ruiz-Ramirez, Arnau, Serra, and Gou (2005) assert that Hamm's (1986) pH/ myosin hardness relationship, in conjunction with Szczesniak's (1963) textural definitions, explain the higher cohesiveness and springiness with lower pH values.

Summary

The SP ingredient used in this study was not a pure chemical, but rather a commercial food-grade formulation that is held by the manufacturer. This detail along with the lower levels of SP addition used may explain the negligible effects on SP treated gels.

The color space values of the meat samples decreased compared to the controls due to a dilution effect of the added solutions. The increase in pH of the added solutions caused the darkening or decreased L* color space values of the gels. While this increase in pH does not account for the decreased redness (a* values) or yellowness (b* values), it is possible that the carbonate and bicarbonate ingredients are responsible for these changes. Since these two ingredients dramatically improve WHC, perhaps this increase in bound water is causing a pronounced dilution effect of the added solutions. This conclusion should be further investigated.

Yang and Froning (1994) noted that washing MDPM under alkaline conditions caused “great swelling and hydration” of myofibrillar proteins. As previously discussed, it is well known that the moisture binding improvements with the addition of phosphates, bicarbonates, and carbonates can be attributed to increased in pH and ionic strength, the binding of these ingredients to muscle proteins, and the dissociation of actomyosin into actin and myosin (Hamm, 1960). Since ionic strength is related to the amount of ions in solution, phosphates, bicarbonates, and carbonates will increase the number of ions that react with the proteins to increase hydration (Wynveen et al., 2001). Alkali metal linkages between proteins during the ion-protein interaction weaken to allow water to migrate into the muscle structure (Wynveen et al., 2001). However, Wyvneen et al. (2001) and Bertram et al. (2008) noted that this phenomenon only partially explained the increase in WHC due to buffer ingredients. Therefore, it is necessary to discern the exact mechanisms of bicarbonate and carbonate ingredients' role in moisture retention.

Carbonate and bicarbonate containing samples will produce carbon dioxide gas during thermal processing (Berrios et al., 2004; Sheard & Tali, 2004). Sheard and Tali (2004) postulated that this gas production affected the texture and reduced shear force values of SB injected pork loins. Additionally, Berrios et al. (2004) reported the expansion of black bean extrudates with an increase in SB concentration. It is possible that the production of CO_2 gas is aiding in the swelling of the protein matrix in meat to allow for increased water retention. The release of this gas as well as water during cooking would concentrate the bicarbonate and potassium or sodium ions which would cause increased protein repulsion, thereby leading to increased water binding.

Potassium and sodium carbonate in solution will dissociate into K^+ or Na^+ ions, CO_3^{-2}, water, and potassium or sodium hydroxide, respectively (Frary & Nietz, 1915; Jones, 2009). Similar to SB, the products produced from SC dissociation would aid in water uptake, however the NaOH, a strong base, would keep the pH high to allow for increased WHC surpassing that of SB treated meat. Additionally, Na_2CO_3 does not have a hydrogen ion like SB does; so, more sodium ions are available to cause repulsion effects in the meat.

The alkaline solutions most likely had protein-network weakening effect resulting in significantly softer textures. Scanning micrograph images of SB or SC treated meat (Figures B-11, B-12, B-13, and B-14) revealed that these meat samples had a less dense protein matrix, muscle fibers appeared to be less interwoven and randomly arranged, and interfibril space was increased compared to control samples (Benjakul et al., 2000; Bertram et al., 2008; Kugino et al., 1993; Yang & Froning, 1994). Yang and Froning (1994), who treated MDPM gels with 0.5%, also noted this phenomenon but these meat gels had reduced WHC compared to control gels. The alkaline treatments of the meat gels in the current study may have reduced cross linking and destabilized the molecular structure of myosin enough to cause softer textures, yet still uphold superior water binding abilities.

CHAPTER IV

CONCLUSIONS AND FURTHER RESEARCH

The functionality of PSE pork was improved with increasing levels of PB and SB; however, improvement was much greater with PC or SC. PC or SC addition to PSE pork improved quality effects to be similar to or higher than normal pork in a gel system. Therefore, PC and SC are feasible alternatives to replace SP in pork gel systems without loss of WHC, color, or pH.

While extensive sensory research has been conducted on SP treated meats, and some has been conducted on SB treated meats; sensory studies should be performed for SC treated meat. There is a concern that 0.2 and 0.3M PC and SC gels are too different from the controls used in this study. Although these two ingredients showed the greatest improvements in WHC and cook yield compared to other samples, the apparent differences in texture may ultimately translate to an undesirable product. Trained and consumer studies should especially be conducted on meats using these treatments. Additionally, microbial evaluation should be preformed to characterize any potential antimicrobial properties of carbonates.

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APPENDIX A

TABLES

Table 1
Least squares means for meat type effects on color and pH of pork gels.

Effect	P-value[d]	Meat Type Normal	Meat Type PSE	RMSE[e]
Raw loins				
pH	<0.0001	5.77[b]	5.34[a]	0.092
L*[c]	0.0056	54.63[a]	57.54[b]	2.968
a*[c]	0.0832	5.24	5.85	1.045
b*[c]	0.1068	3.55	4.20	0.107
Raw gels				
pH	<0.0001	6.28[b]	6.08[a]	0.098
L*	0.0037	64.60[a]	65.18[b]	0.970
a*	0.0057	8.16[a]	8.59[b]	0.754
b*	0.1385	9.26	9.52	0.875
Cooked gels				
pH	<0.0001	6.29[b]	6.09[a]	0.059
L*	0.1197	78.51	78.77	0.810
a*	0.4040	7.62	7.55	0.398
b*	0.0231	9.31[a]	9.54[b]	0.503

[ab]Mean values within a row and effect with different superscripts differ (P<0.05).
[c]CIE color space value.
[d]P-value from analysis of variance tables.
[e]Root Mean Square Error.

Table 2
Least squares means for meat type effects on water binding ability of pork gels.

Effect	P-value[c]	Meat type Normal	Meat type PSE	RMSE[d]
Moisture (%)	0.2398	77.15	77.24	0.382
WHC	<0.0001	67.72[a]	64.79[b]	2.803
Cook yield (%)	<0.0001	89.84[a]	85.36[b]	1.424

[ab]Mean values within a row a effect with different superscripts differ (P<0.05).
[c]P-value from analysis of variance tables.
[d]Root Mean Square Error.

Table 3

Least squares means for meat type effects on TPA attributes of cooked pork gels.

Effect	P-value[c]	Meat type: Normal	Meat type: PSE	RMSE[d]
Hardness 1 (N)	<0.0001	47.30[a]	51.07[b]	3.952
Hardness 2 (N)	<0.0001	39.52[a]	42.04[b]	2.911
Cohesiveness	<0.0001	0.3295[a]	0.3386[b]	0.01449
Springiness (mm)	0.1038	1.296	1.303	0.0463
Chewiness (N*mm)	<0.0001	20.36[a]	22.68[b]	2.335
Work 1 (J)	<0.0001	0.1555[a]	0.1620[b]	0.01225
Work 2 (J)	<0.0001	0.0513[a]	0.0549[b]	0.00428

[ab]Mean values within a row and effect with different superscripts differ (P<0.05).
[c]P-value from analysis of variance tables.
[d]Root Mean Square Error Table.

Table 4
Pearson correlation coefficients between pH, color, moisture, WHC, and cook yield of pork gels.

	RL*	Ra*	Rb*	CpH	CL*	Ca*	Cb*	Moisture (%)	WHC	Cook Yield (%)
R[a]pH	-0.81†	-0.73†	-0.70†	0.92†	-0.67†	0.08	-0.54†	0.18	0.78†	0.86†
RL*		0.79†	0.85†	-0.80†	0.62†	0.00	0.48†	-0.14	-0.69†	-0.76†
Ra*			0.96†	-0.75†	0.46†	0.08	0.39†	-0.27††	-0.61†	-0.66†
Rb*				-0.74†	0.53†	0.06	0.43†	-0.19	-0.60†	-0.65†
C[b]pH					-0.77†	0.04	-0.70†	0.13	0.76†	0.89†
CL*						-0.17	0.70†	0.05	-0.67†	-0.77†
Ca*							0.36†	-0.07	0.10	0.14
Cb*								0.13	-0.45†	-0.63†
Moisture (%)									0.01	-0.61
WHC										0.85†

[a]Raw pH and CIE color space values.
[b]Cooked pH and CIE color space values.
Significance levels: †P≤0.001, ††P≤0.01.

Table 5

Pearson correlation coefficients of effects of pH, color, moisture, WHC, and cook yield on texture of pork gels.

	Hardness 1 (N)	Hardness 2 (N)	Cohesiveness	Springiness (mm)	Chewiness (N*mm)	Work 1 (J)	Work 2 (J)
R[a]pH	-0.61[†]	-0.49[†]	-0.61[†]	-0.02	-0.60[†]	-0.22[†††]	-0.44[†]
RL*	0.44[†]	0.31[††]	0.38[†]	-0.02	0.41[†]	0.13	0.27[††]
Ra*	0.38[†]	0.25[†††]	0.34[†]	-0.06	0.35[†]	0.08	0.21[†††]
Rb*	0.38[†]	0.26[†††]	0.35[†]	-0.04	0.35[†]	0.09	0.22[†††]
C[b]pH	-0.65[†]	-0.55[†]	-0.72[†]	0.04	-0.66[†]	-0.21[†††]	-0.47[†]
CL*	0.51[†]	0.45[†]	0.66[†]	-0.01	0.54[†]	0.13	0.39[†]
Ca*	-0.03	0.03	-0.06	-0.09	-0.06	0.05	0.01
Cb*	0.51[†]	0.50[†]	0.73[†]	-0.08	0.55[†]	0.14	0.42[†]
Moisture (%)	-0.07	-0.05	0.18	-0.01	-0.01	-0.17	-0.06
WHC	-0.39[†]	-0.28[††]	-0.48[†]	0.10	-0.38[†]	-0.02	-0.22[†††]
Cook Yield (%)	-0.64[†]	-0.52[†]	-0.69[†]	-0.04	-0.65[†]	-0.21[†††]	-0.46[†]

[a]Raw pH and CIE color space values.

[b]Cooked pH and CIE color space values.

Significance levels: [†]P≤0.001, [††]P≤0.01, [†††]P≤0.05.

Table 6

Least squares means for treatment effects on pH and color for raw pork gels.

Effect		Raw pH	Raw CIE color space values		
			L*	a*	b*
Treatment					
Solution[m]	Level	<0.0001[k]	<0.0001[k]	<0.0001[k]	<0.0001[k]
Control		5.79[ab]	66.78[hi]	10.03[j]	10.96[i]
ddW		5.78[a]	67.93[j]	9.47[ij]	10.81[hi]
SP	0.1%	5.85[abc]	67.40[ij]	9.31[hij]	10.66[hi]
	0.2%	5.90[bcd]	65.87[gh]	8.96[fghi]	9.98[efghi]
	0.3%	5.95[cde]	64.71[def]	9.12[ghi]	9.87[defgh]
PB	0.1M	5.98[de]	66.42[hi]	8.75[efghi]	10.10[fghi]
	0.2M	6.20[f]	65.11[fg]	8.22[bcdef]	9.17[cdef]
	0.3M	6.38[ghi]	63.86[bcde]	8.32[cdefg]	9.31[cdef]
SB	0.1M	6.04[e]	66.72[hi]	9.03[fghi]	10.39[ghi]
	0.2M	6.16[f]	64.62[def]	7.84[bcd]	8.95[bcd]
	0.3M	6.31[gh]	63.44[bc]	7.47[bc]	8.42[bc]
PC	0.1M	6.22[fg]	64.87[efg]	7.88[bcde]	8.98[bcde]
	0.2M	6.41[hi]	62.82[ab]	7.52[bc]	8.32[bc]
	0.3M	6.73[j]	62.15[a]	6.55[a]	7.15[a]
SC	0.1M	6.24[fg]	64.52[cdef]	8.52[defgh]	9.45[defg]
	0.2M	6.46[i]	63.67[bcd]	8.04[bcde]	8.99[bcde]
	0.3M	6.63[j]	62.16[a]	7.36[ab]	8.11[ab]
RMSE[l]		0.098	0.970	0.754	0.875

[abcdefghij]Mean values within a column and effect followed by the same letter are not significantly different ($P > 0.05$).

[k]P-value from analysis of varience tables.

[l]Root Mean Square Error.

[m]Control: no added solution; ddW: double-distilled deionized water; SP: sodium phosphate; PB: potassium bicarbonate; SB: sodium bicarobonate; PC: potassium carbonate; SC: sodium carbonate.

Table 7
Least squares means for treatment effects on pH and color of cooked pork gels.

Effect		Cooked pH	Cooked CIE Color Space Values L*	a*	b*
Treatment					
Solution[k]	Level	<0.0001[i]	<0.0001[i]	0.0042[i]	<0.0001[i]
Control		5.84[a]	79.27[def]	7.88[ef]	9.68[bcdef]
ddW		5.90[ab]	80.93[h]	7.51[abcde]	10.03[efg]
SP	0.1%	5.83[a]	80.41[gh]	7.62[bcdef]	10.28[g]
	0.2%	5.89[a]	79.87[fg]	7.14[a]	9.67[bcdef]
	0.3%	5.96[b]	78.84[cde]	7.41[abcd]	9.66[bcdef]
PB	0.1M	6.06[c]	80.11[fgh]	7.89[ef]	10.22[fg]
	0.2M	6.17[d]	79.51[efg]	7.58[abcde]	9.87[defg]
	0.3M	6.31[e]	78.31[c]	7.80[def]	9.64[bcde]
SB	0.1M	6.11[cd]	79.52[efg]	7.72[cdef]	9.58[bcde]
	0.2M	6.16[d]	80.26[gh]	7.31[abc]	9.71[cdefg]
	0.3M	6.30[e]	78.48[cd]	7.62[bcde]	9.35[bcd]
PC	0.1M	6.13[d]	79.59[efg]	7.50[abcde]	9.81[cdefg]
	0.2M	6.49[f]	76.75[b]	7.86[def]	9.11[b]
	0.3M	6.79[g]	74.68[a]	7.47[abcde]	7.50[a]
SC	0.1M	6.12[cd]	79.66[efg]	7.25[ab]	9.48[bcde]
	0.2M	6.45[f]	76.28[b]	8.08[f]	9.25[bc]
	0.3M	6.76[g]	74.39[a]	7.34[abc]	7.38[a]
RMSE[j]		0.059	0.810	0.398	0.503

[abcdefgh]Mean values within a column and effect followed by the same letter are not significantly different ($P > 0.05$).
[i]P-value from analysis of varience tables.
[j]Root Mean Square Error.
[k]Control: no added solution; ddW: double-distilled deionized water; SP: sodium phosphate; PB: potassium bicarbonate; SB: sodium bicarbonate; PC: potassium carbonate; SC: sodium carbonate.

Table 8
Least squares means for meat type by treatment interactions for cook yield and a* and b* color space values of cooked pork gels.

Effect		Cook Yield (%)	CIE Color Space Values a*	CIE Color Space Values b*
Solution[n]	Level	0.0014[l]	0.0450[l]	0.0069[l]
Normal				
Control		89.37[ijk]	8.15[jk]	9.99[fghi]
ddW		83.18[defg]	8.08[ijk]	10.67[i]
SP	0.1%	83.70[defg]	7.83[efghijk]	10.48[hi]
	0.2%	83.77[defg]	7.07[abcd]	9.34[def]
	0.3%	85.23[fgh]	7.52[abcdefghij]	9.48[def]
PB	0.1M	85.48[gh]	8.04[hijk]	10.45[ghi]
	0.2M	88.81[ij]	7.63[defghijk]	9.90[efghi]
	0.3M	93.17[lm]	7.77[efghijk]	9.19[cde]
SB	0.1M	85.00[efgh]	7.54[abcdefghij]	9.48[def]
	0.2M	88.78[ij]	6.98[abc]	9.34[def]
	0.3M	94.05[mn]	7.55[abcdefghij]	9.01[cd]
PC	0.1M	89.13[ij]	7.60[bcdefghijk]	9.63[defg]
	0.2M	97.11[o]	7.70[defghijk]	8.50[bc]
	0.3M	97.76[o]	7.38[abcdefg]	7.33[a]
SC	0.1M	88.97[ij]	7.54[abcdefghij]	9.45[def]
	0.2M	95.78[no]	7.94[fghijk]	8.94[cd]
	0.3M	97.90[o]	7.21[abcde]	7.07[a]
PSE				
Control		83.07[def]	7.61[cdefghijk]	9.36[def]
ddW		80.04[ab]	6.94[a]	9.38[def]
SP	0.1%	80.25[abc]	7.41[abcdefgh]	10.08[fghi]
	0.2%	79.62[a]	7.22[abcde]	10.00[fghi]
	0.3%	82.61[d]	7.30[abcdef]	9.83[efgh]
PB	0.1M	82.64[d]	7.75[efghijk]	9.99[fghi]
	0.2M	82.38[cd]	7.52[abcdefghij]	9.83[efgh]
	0.3M	85.45[gh]	7.83[efghijk]	10.10[fghi]
SB	0.1M	82.17[bcd]	7.89[fghijk]	9.69[defgh]
	0.2M	83.96[defg]	7.63[defghijk]	10.08[fghi]
	0.3M	87.32[hi]	7.68[defghijk]	9.70[defgh]
PC	0.1M	82.85[de]	7.40[abcdefgh]	9.98[efghi]
	0.2M	90.96[jkl]	8.02[ghijk]	9.71[defgh]
	0.3M	96.32[no]	7.56[abcdefghij]	7.67[a]
SC	0.1M	83.29[defg]	6.95[ab]	9.52[def]
	0.2M	91.55[kl]	8.22[k]	9.56[def]
	0.3M	96.63[o]	7.47[abcdefghi]	7.69[ab]
RMSE[m]		1.423	0.398	0.503

[abcdefghijk]Mean values within a column and effect followed by the same letter are not significantly different ($P > 0.05$).
[l]P-value from analysis of variance tables.
[m]Root Mean Square Error.
[n]Control: no added solution; ddW: double-distilled deionized water; SP: sodium phosphate; PB: potassium bicarbonate; SB: sodium bicarbonate; PC: potassium carbonate; SC: sodium carbonate.

Table 9

Least squares means for treatment effects on water binding ability of pork gels.

Effect		Moisture (%)	WHC	Cook Yield (%)
Treatment				
Solution[m]	Level	<0.0001[k]	<0.0001[k]	<0.0001[k]
Control		74.98[a]	66.57[efg]	86.22[e]
ddW		77.57[cde]	59.72[a]	81.61[a]
SP	0.1%	77.14[bcd]	59.71[a]	81.98[ab]
	0.2%	77.13[bc]	60.52[ab]	81.70[a]
	0.3%	77.26[bcd]	62.84[abcd]	83.92[c]
PB	0.1M	77.39[bcde]	63.65[bcde]	84.06[cd]
	0.2M	77.60[de]	64.52[cdef]	85.60[de]
	0.3M	77.33[bcde]	67.89[gh]	89.31[f]
SB	0.1M	77.72[e]	61.68[abc]	83.59[bc]
	0.2M	77.58[de]	66.01[defg]	86.37[e]
	0.3M	77.23[bcd]	67.23[fg]	90.68[f]
PC	0.1M	77.42[bcde]	65.84[defg]	85.99[e]
	0.2M	77.27[bcd]	71.08[hi]	94.03[g]
	0.3M	77.07[b]	75.81[j]	97.04[h]
SC	0.1M	77.27[bcd]	66.19[efg]	86.13[e]
	0.2M	77.28[bcde]	71.81[i]	93.67[g]
	0.3M	77.10[b]	75.25[j]	97.27[h]
RMSE[l]		0.382	2.803	1.424

[abcdefghij]Mean values within a column and effect followed by the same letter are not significantly different (P> 0.05).
[k]P-value from analysis of variance tables.
[l]Root Mean Square Error.
[m]Control: no added solution; ddW: double-distilled deionized water; SP: sodium phosphate; PB: potassium bicarbonate; SB: sodium bicarbonate; PC: potassium carbonate; SC: sodium carbonate.

Table 10

Least squares means for meat type by treatment interactions on TPA attributes of cooked pork gels.

Effect		Hardness 1 (N)	Hardness 2 (N)	Cohesiveness	Springiness (mm)	Chewiness (N*mm)	Work 1 (J)	Work 2 (J)
Solution[t]	Level	<0.0001[r]	<0.0001[r]	<0.0001[r]	<0.0001[r]	<0.0001[r]	<0.0001[r]	<0.0001[r]
Normal								
Control		63.93^{m}	53.25^{m}	0.3446^{ghijk}	1.359^{lm}	29.95^{p}	0.2103^{l}	0.0724^{m}
ddW		51.22^{ghijk}	42.46^{hij}	0.3362^{efgh}	1.268^{abcde}	21.87^{fghijk}	0.1605^{efghi}	0.0540^{fg}
SP	0.1%	48.69^{defg}	39.48^{efg}	0.3393^{efghi}	1.258^{abc}	20.80^{efgh}	0.1466^{bc}	0.0497^{cd}
	0.2%	48.85^{defgh}	39.16^{efg}	0.3408^{fghijk}	1.304^{fghij}	21.80^{fghijk}	0.1502^{bcd}	0.0512^{def}
	0.3%	47.17^{d}	38.40^{de}	0.3378^{efghi}	1.327^{jkl}	21.17^{fghij}	0.1510^{bcd}	0.0509^{def}
PB	0.1M	51.38^{ghijk}	42.50^{hij}	0.3399^{fghij}	1.307^{ghij}	22.84^{jkl}	0.1634^{ghi}	0.0555^{ghij}
	0.2M	47.43^{de}	39.66^{efg}	0.3422^{fghijk}	1.299^{efghij}	21.12^{fghi}	0.1506^{bcd}	0.0515^{def}
	0.3M	43.99^{bc}	36.88^{cd}	0.3246^{d}	1.289^{cdefgh}	18.47^{cd}	0.1465^{bc}	0.0476^{abc}
SB	0.1M	50.62^{fghij}	42.09^{hi}	0.3426^{fghijk}	1.307^{ghij}	22.69^{ijkl}	0.1608^{efghi}	0.0550^{ghi}
	0.2M	48.85^{defgh}	40.49^{efgh}	0.3443^{ghijk}	1.324^{ijk}	22.30^{hijk}	0.1558^{defgh}	0.0536^{efg}
	0.3M	42.78^{ab}	38.75^{def}	0.3292^{de}	1.259^{abcd}	17.78^{bcd}	0.1483^{bcd}	0.0488^{bcd}
PC	0.1M	47.04^{d}	39.48^{efg}	0.3320^{def}	1.291^{cdefgh}	20.22^{ef}	0.1537^{bcdef}	0.0510^{def}
	0.2M	41.76^{ab}	35.73^{abc}	0.3094^{c}	1.273^{abcdef}	16.48^{ab}	0.1470^{bcd}	0.0455^{a}
	0.3M	41.07^{a}	34.49^{ab}	0.2940^{a}	1.309^{ghij}	15.89^{a}	0.1534^{bcdef}	0.0452^{a}
SC	0.1M	46.13^{cd}	38.97^{efg}	0.3343^{defg}	1.261^{abcd}	19.44^{de}	0.1472^{bcd}	0.0491^{bcd}
	0.2M	42.61^{ab}	35.96^{abc}	0.3123^{c}	1.292^{defghi}	17.21^{abc}	0.1490^{bcd}	0.0465^{ab}
	0.3M	40.58^{a}	34.00^{a}	0.2977^{ab}	1.313^{ghij}	16.06^{a}	0.1499^{bcd}	0.0448^{a}
PSE								
Control		67.22^{n}	54.54^{m}	0.3459^{hijkl}	1.376^{m}	31.98^{q}	0.2175^{l}	0.0751^{m}
ddW		51.66^{hijk}	41.79^{hi}	0.3326^{def}	1.280^{bcdefg}	22.07^{hijk}	0.1608^{efghi}	0.0535^{efg}
SP	0.1%	46.05^{cd}	36.25^{bc}	0.3343^{defg}	1.243^{a}	19.24^{de}	0.1348^{a}	0.0452^{a}
	0.2%	52.65^{ijkl}	42.49^{hij}	0.3561^{lm}	1.248^{ab}	23.40^{klm}	0.1492^{bcd}	0.0530^{efg}
	0.3%	51.19^{ghijk}	40.88^{gh}	0.3474^{ijklm}	1.296^{efghij}	23.07^{klm}	0.1528^{bcde}	0.0530^{efg}
PB	0.1M	50.47^{fghi}	40.60^{fgh}	0.3391^{efghi}	1.298^{efghij}	22.31^{hijk}	0.1556^{defgh}	0.0528^{efg}
	0.2M	55.45^{l}	45.72^{l}	0.3459^{hijkl}	1.350^{klm}	25.93^{o}	0.1784^{k}	0.0617^{l}
	0.3M	53.48^{jkl}	44.89^{kl}	0.3422^{fghijk}	1.317^{hijk}	24.09^{lmn}	0.1730^{jk}	0.0591^{kl}

Table 10
(continued)

Effect		Hardness 1 (N)	Hardness 2 (N)	Cohesiveness	Springiness (mm)	Chewiness (N*mm)	Work 1 (J)	Work 2 (J)
Solution[t]	Level	<0.0001[r]	<0.0001[r]	<0.0001[r]	<0.0001[r]	<0.0001[r]	<0.0001[r]	<0.0001[r]
PSE								
SB	0.1M	50.94[ghij]	40.70[fgh]	0.3364[efgh]	1.351[klm]	23.22[klm]	0.1626[ghi]	0.0548[gh]
	0.2M	52.75[ijkl]	44.36[jkl]	0.3500[jklm]	1.302[fghij]	24.04[lmn]	0.1651[ij]	0.0577[hijk]
	0.3M	50.09[efghi]	42.19[hi]	0.3342[defg]	1.307[ghij]	21.90[ghijk]	0.1649[ij]	0.0551[ghi]
PC	0.1M	53.79[kl]	44.82[kl]	0.3504[klm]	1.301[fghij]	24.60[mno]	0.1664[ij]	0.0584[jk]
	0.2M	46.74[cd]	39.64[efg]	0.3472[ijklm]	1.279[bcdefg]	20.77[efgh]	0.1462[bc]	0.0507[de]
	0.3M	41.30[ab]	34.61[ab]	0.3073[bc]	1.290[cdefgh]	16.46[ab]	0.1452[b]	0.0447[a]
SC	0.1M	53.32[jkl]	43.60[ijk]	0.3572[m]	1.326[jkl]	25.32[no]	0.1620[fghi]	0.0579[ijk]
	0.2M	47.89[def]	40.74[fgh]	0.3241[d]	1.304[fghij]	20.27[efg]	0.1641[hi]	0.0531[efg]
	0.3M	43.20[ab]	36.81[cd]	0.3057[bc]	1.284[cdefgh]	16.96[abc]	0.1548[cdefg]	0.0473[abc]
RMSE[s]		3.952	2.912	0.01449	0.0463	2.335	0.01225	0.00428

[abcdefghijklmnopq]Mean values within a column and effect followed by the same letter are not significantly different (P>0.05).
[r]P – value from analysis of varience tables.
[s]Root Mean Square Error.
[t]Control: no added solution; ddW: double-distilled deionized water; SP: sodium phosphate; PB: potassium bicarbonate; SB: sodium bicarbonate; PC: potassium carbonate; SC: sodium carbonate.

APPENDIX B

FIGURES

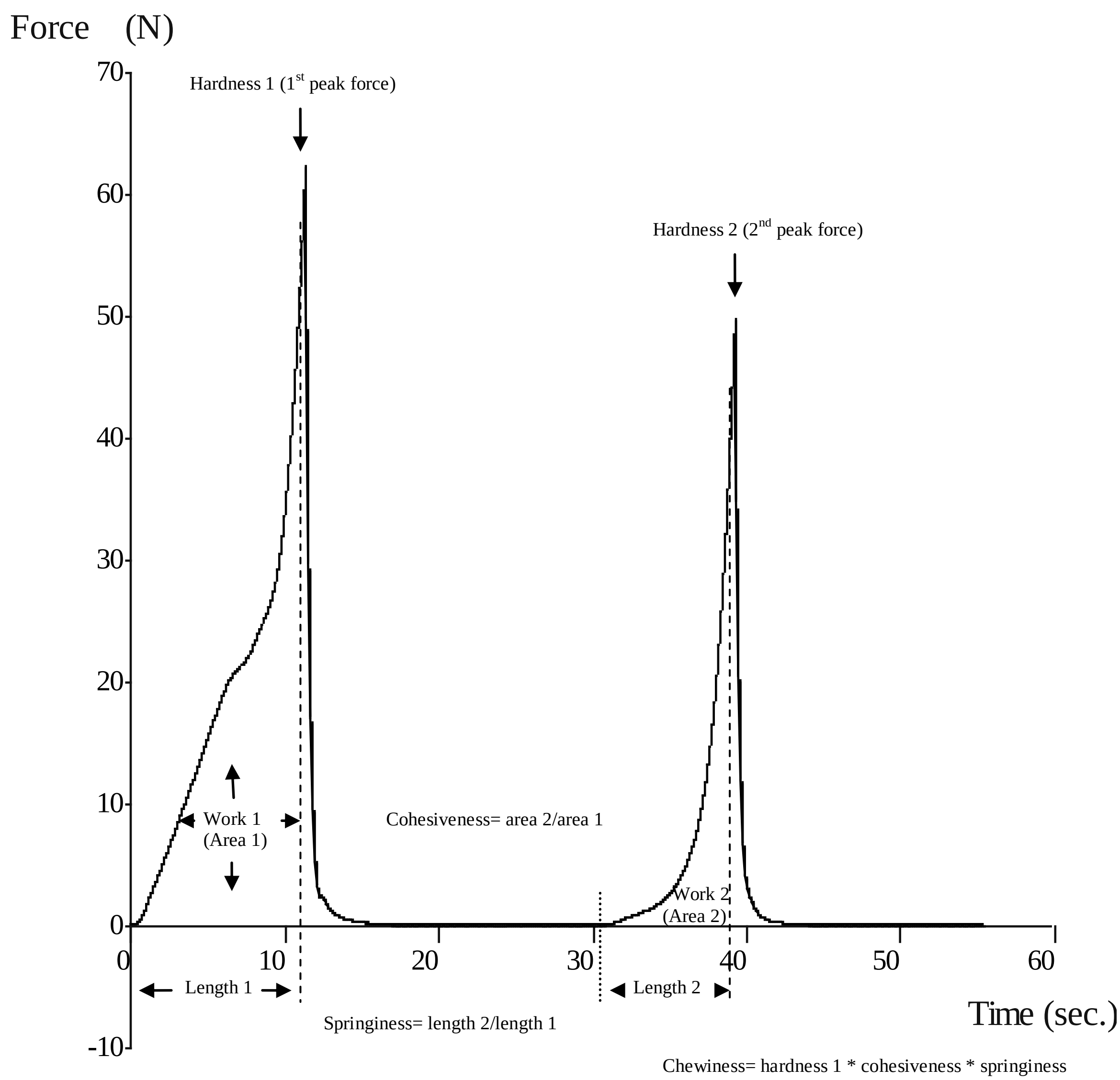

Figure 1: TPA graph a two-cycle compression performed on a cooked normal control pork gel sample.

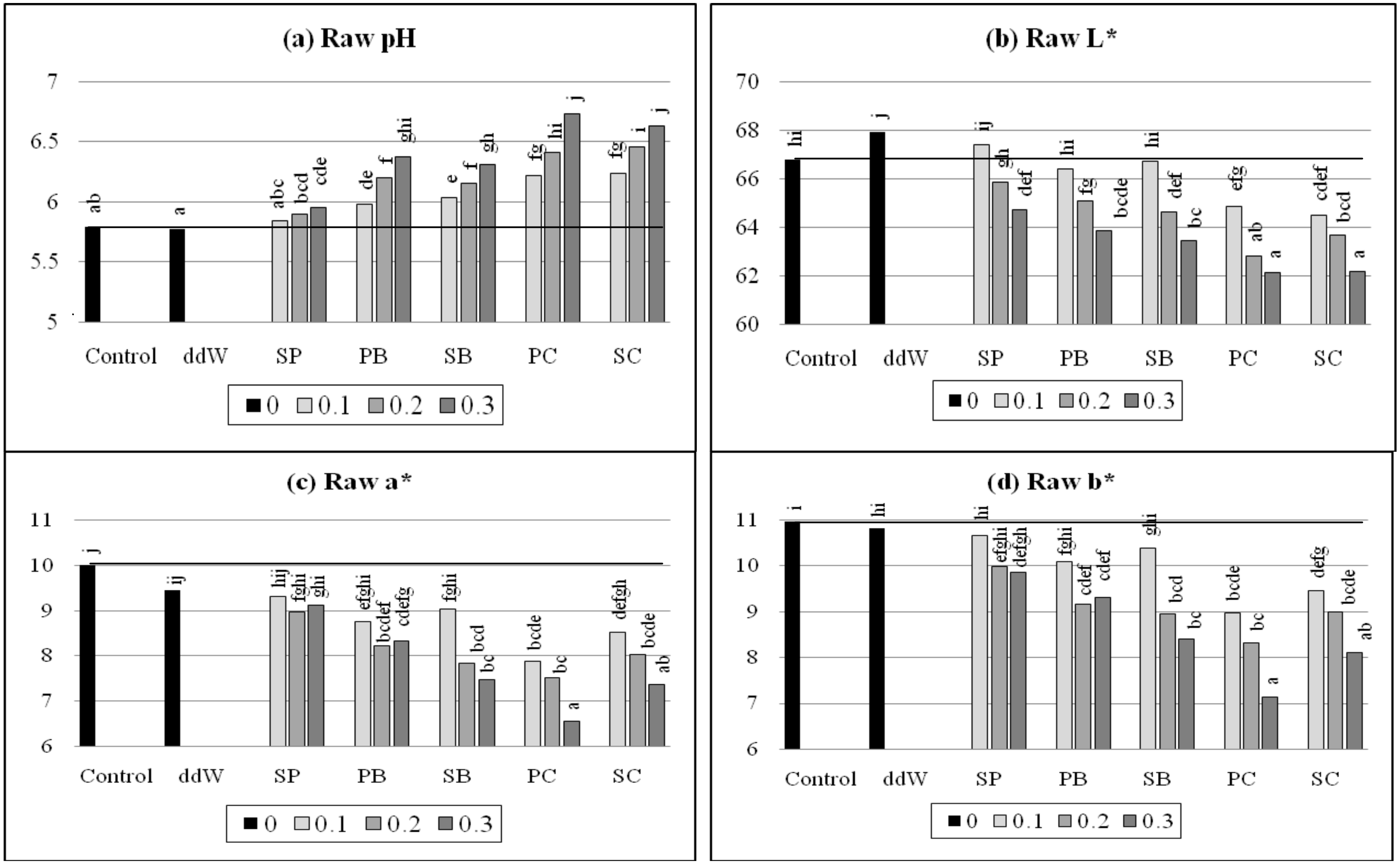

Figure 2. Treatment effects on (a) pH (P<0.0001) and (b, c, d) color (P<0.0001) of raw pork gels. ddW: double-distilled deionized water; SP: sodium phosphates; PB: potassium bicarbonate; SB: sodium bicarbonate; PC: potassium carbonate; SC: sodium carbonate.

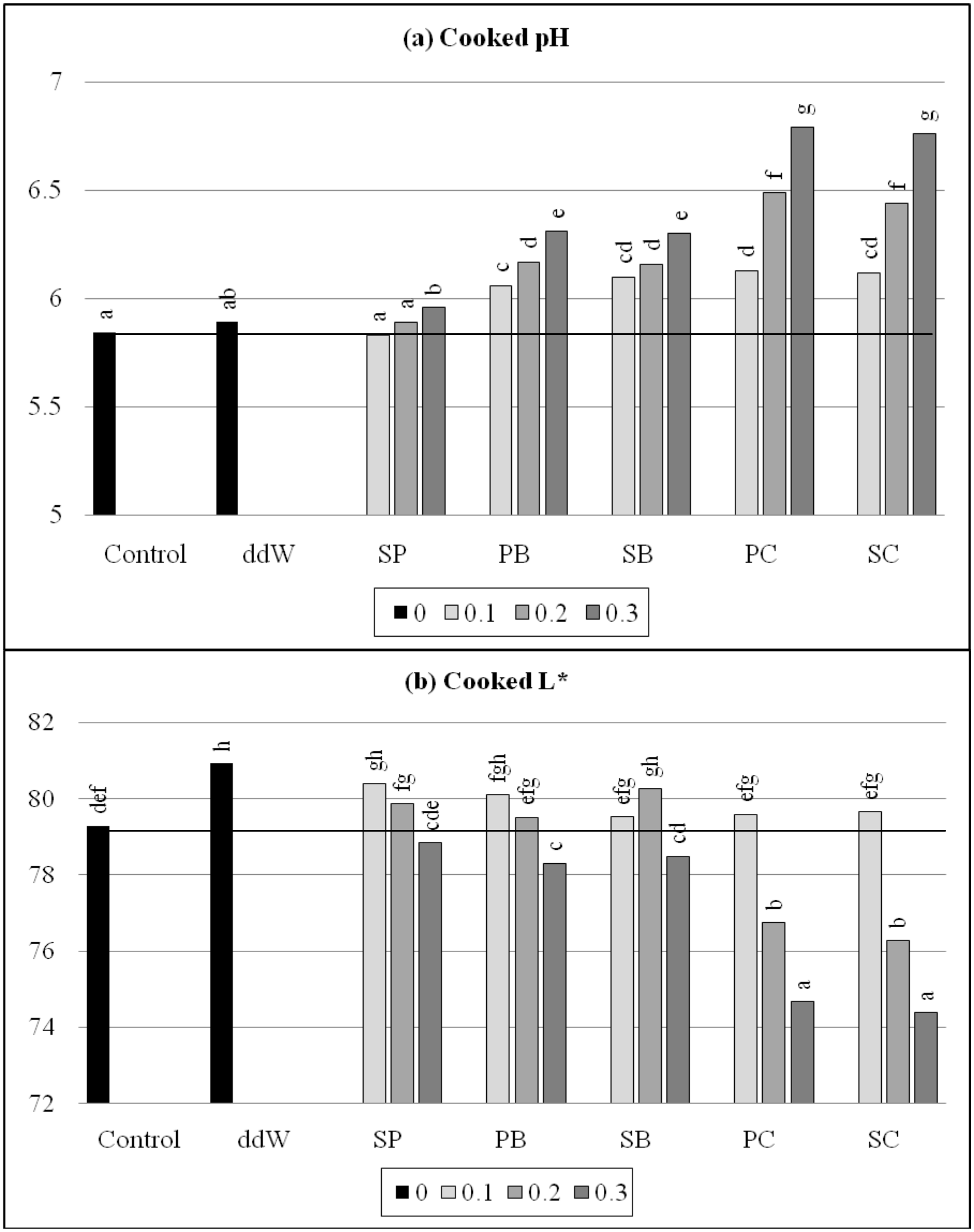

Figure 3. Treatment effects on (a) pH (P<0.0001) and (b) L* color space values (P<0.0001) of cooked pork gels. ddW: double-distilled deionized water; SP: sodium phosphates; PB: potassium bicarbonate; SB: sodium bicarbonate; PC: potassium carbonate; SC: sodium carbonate.

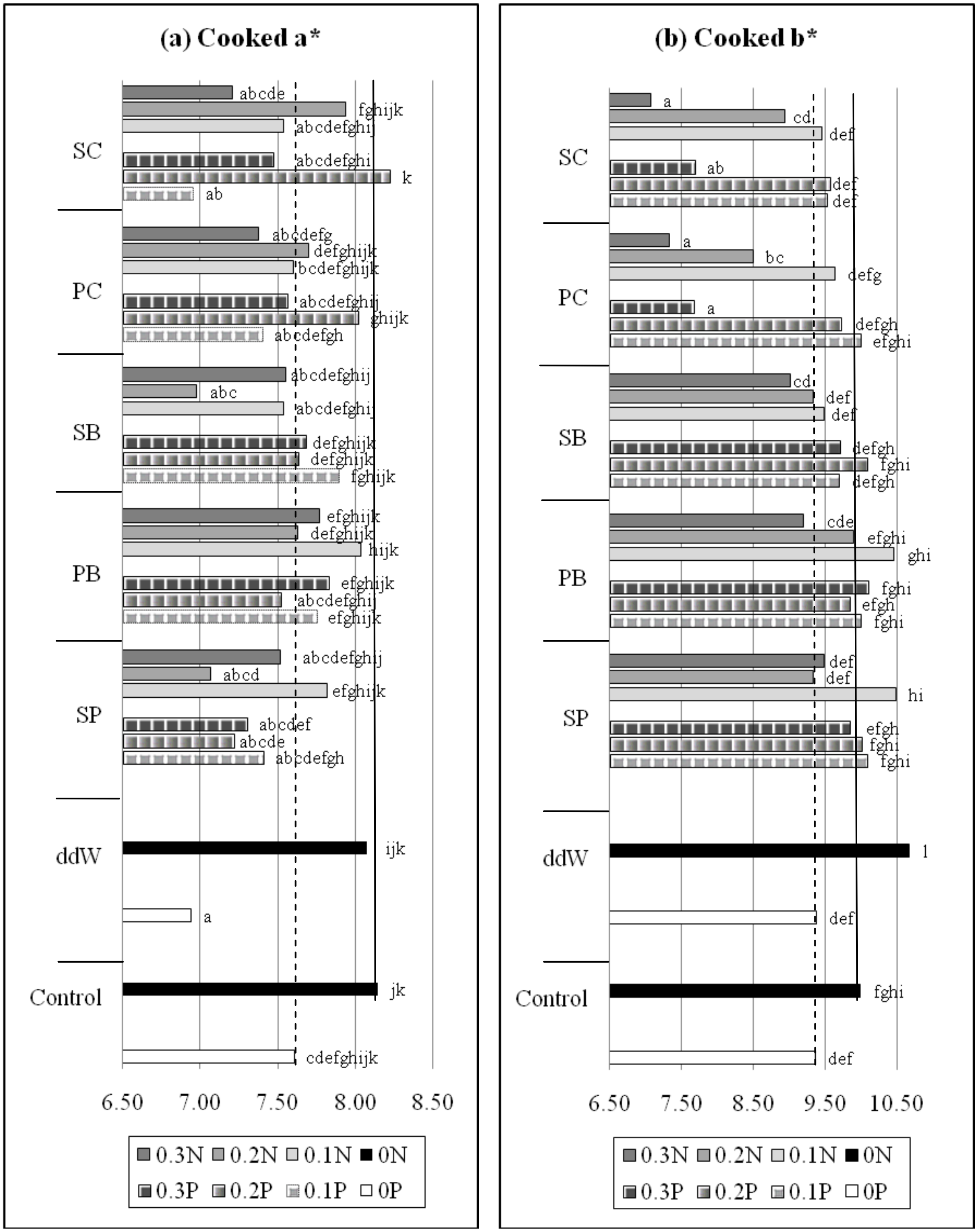

Figure 4. Meat by treatment interactions for (a) a* (P=0.0450) and (b) b* (P=0.0069) color space values of cooked pork gels. N: normal; P: PSE; ddW: double-distilled deionized water; SP: sodium phosphates; PB: potassium bicarbonate; SB: sodium bicarbonate; PC: potassium carbonate; SC: sodium carbonate.

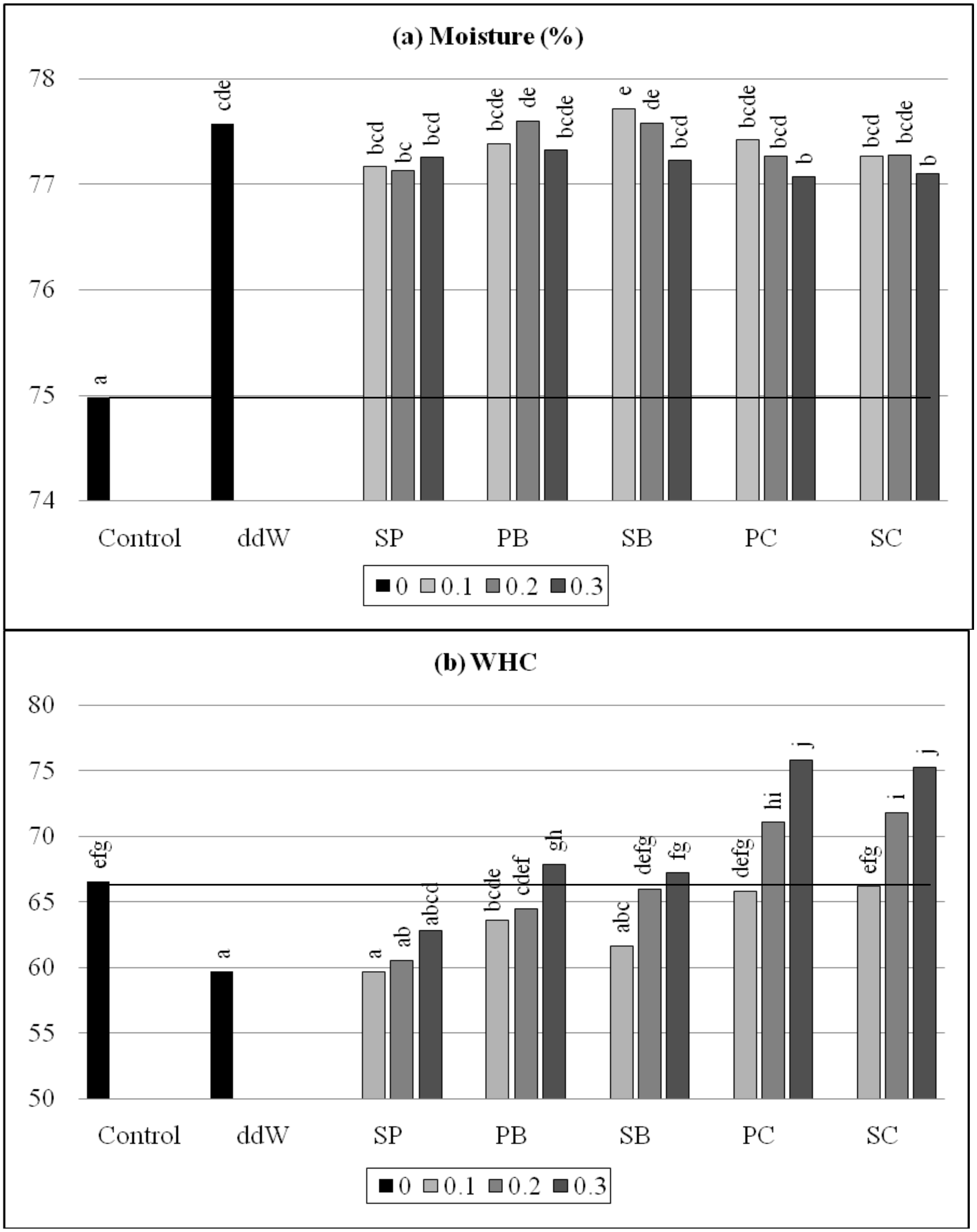

Figure 5. Treatment effects on (a) moisture (%) (P<0.0001) and (b) WHC (P<0.0001) of raw pork gels. ddW: double-distilled deionized water; SP: sodium phosphates; PB: potassium bicarbonate; SB: sodium bicarbonate; PC: potassium carbonate; SC: sodium carbonate.

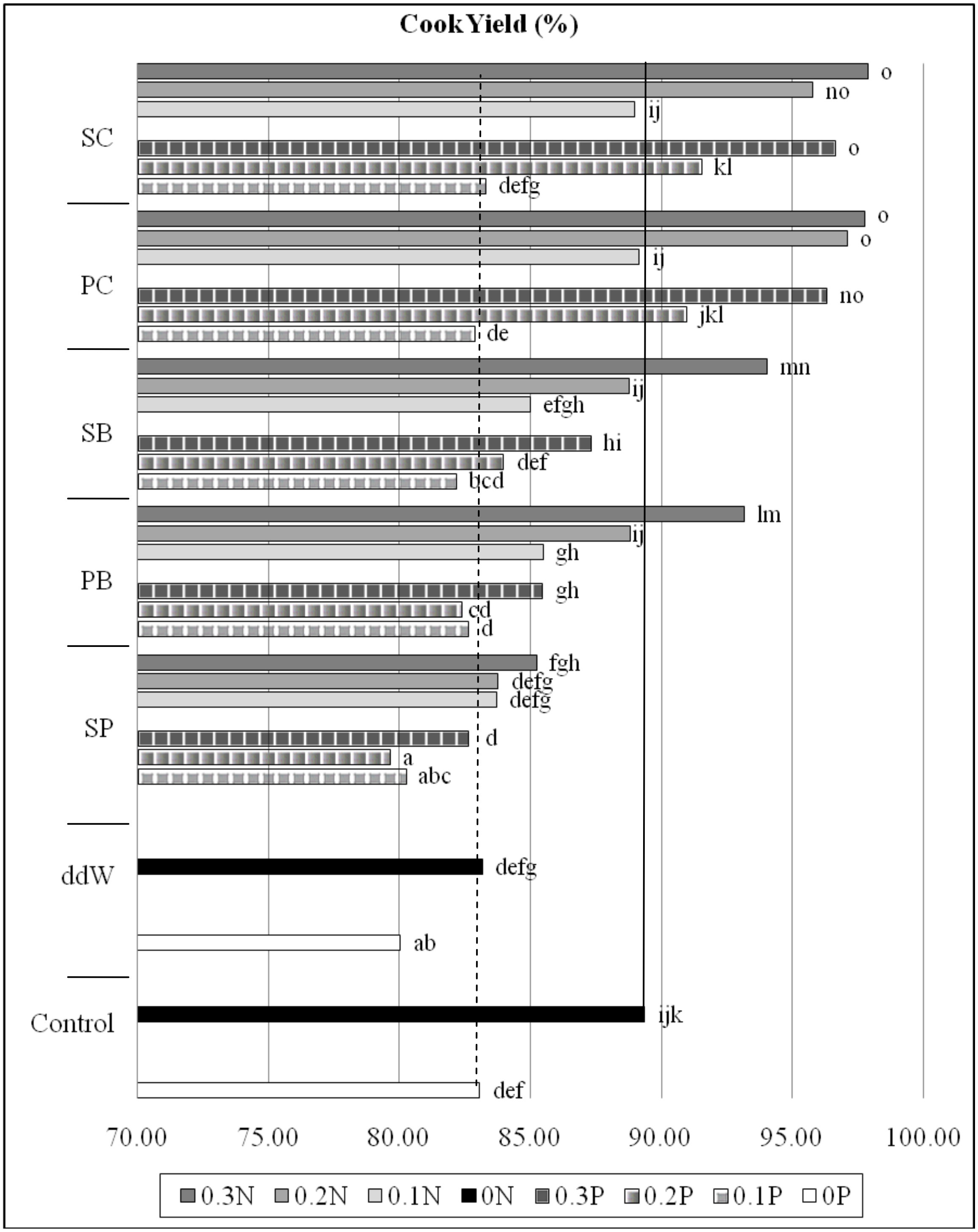

Figure 6. Meat type by treatment interactions for cook yield (P=0.0014) of cooked pork gels. N: normal, P: PSE; ddW: double-distilled deionized water; SP: sodium phosphates; PB: potassium bicarbonate; SB: sodium bicarbonate; PC: potassium carbonate; SC: sodium carbonate.

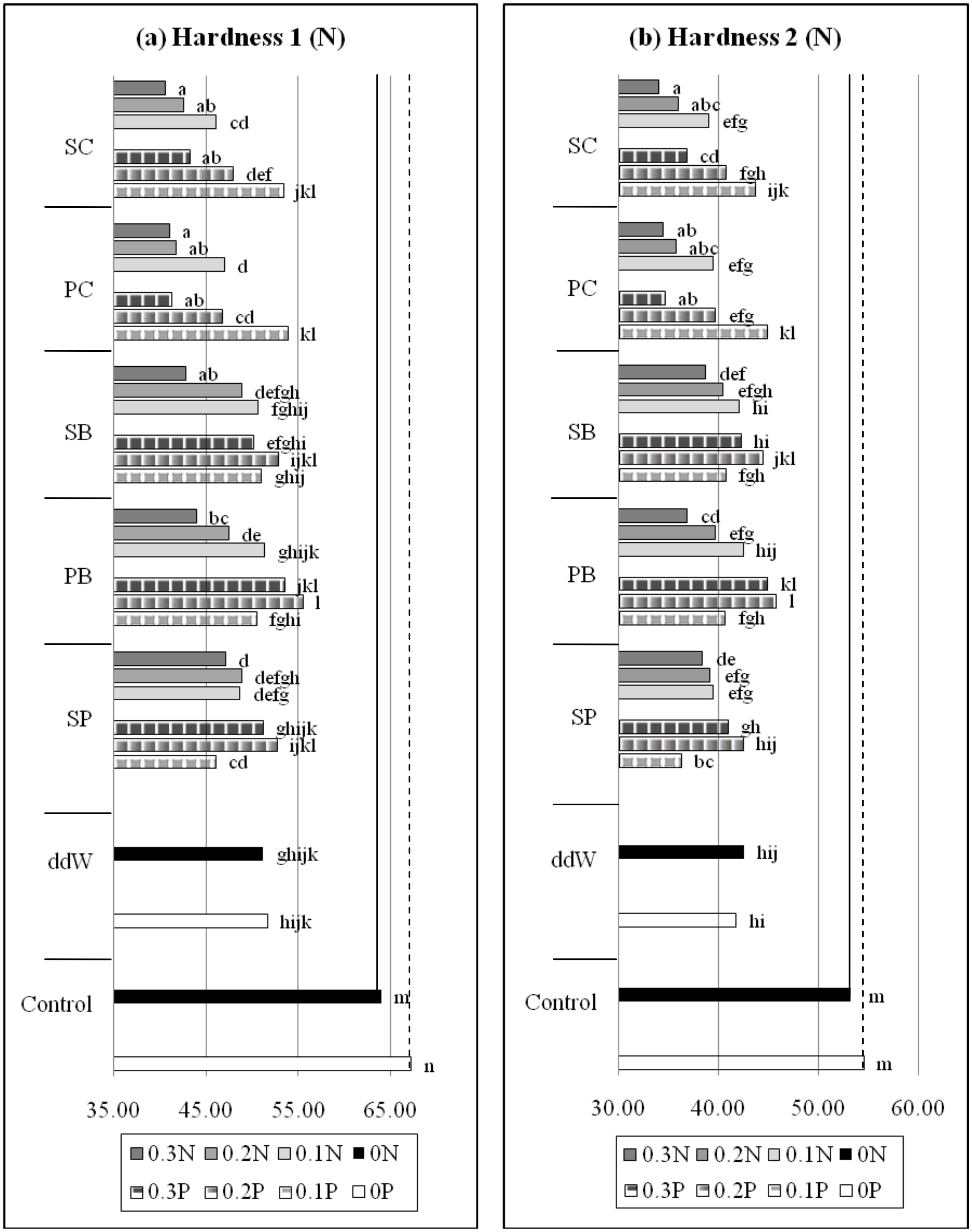

Figure 7. Meat type by treatment interactions for (a) hardness 1 ($P<0.0001$) and (b) hardness 2 ($P<0.0001$) TPA attributes of cooked pork gels. N: normal; P: PSE; ddW: double-distilled deionized water; SP: sodium phosphates; PB: potassium bicarbonate; SB: sodium bicarbonate; PC: potassium carbonate; SC: sodium carbonate.

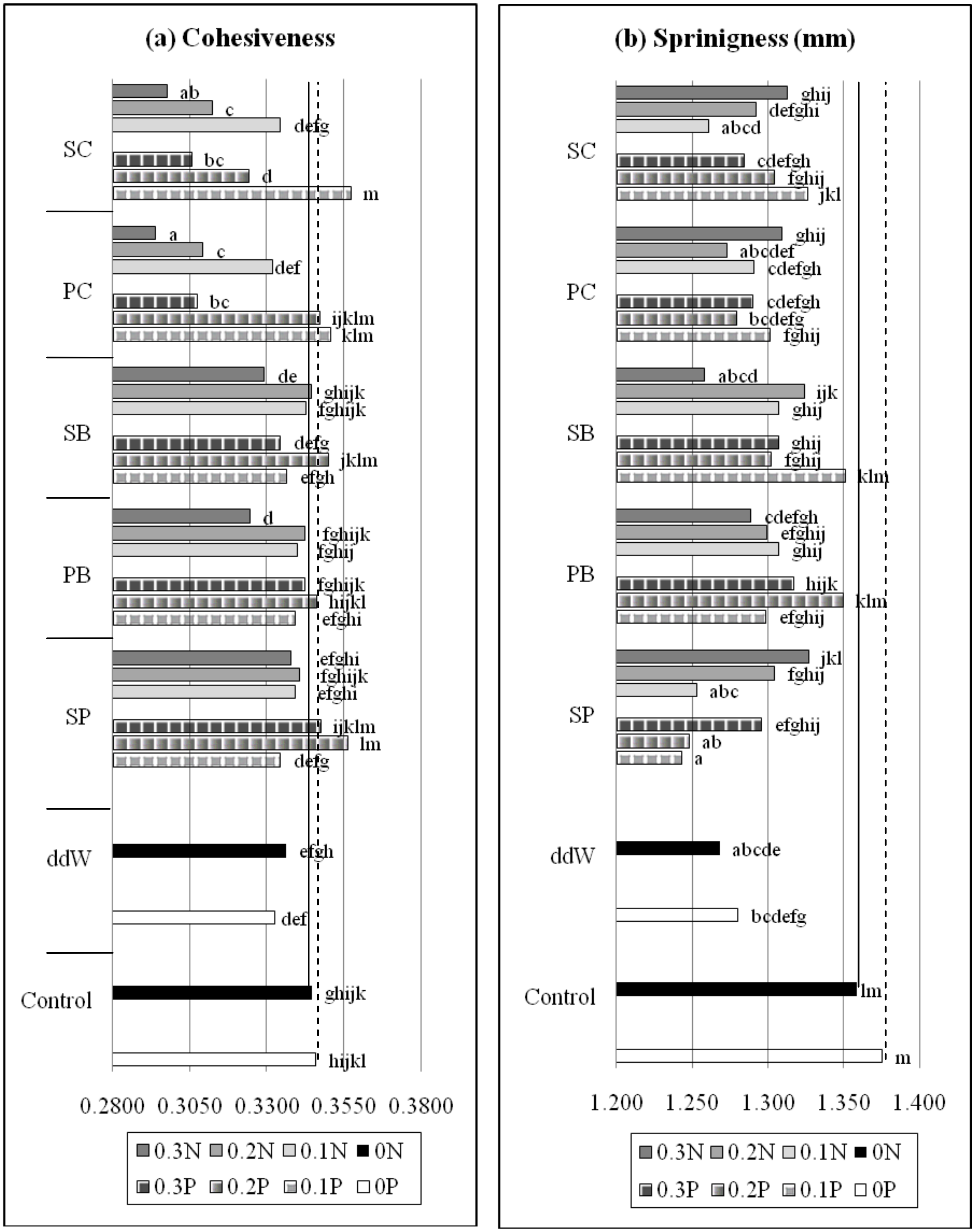

Figure 8. Meat type by treatment interactions for (a) cohesiveness (P<0.0001) and (b) springiness (P<0.0001) TPA attributes of cooked pork gels. N: normal; P: PSE; ddW: double-distilled deionized water; SP: sodium phosphates; PB: potassium bicarbonate; SB: sodium bicarbonate; PC: potassium carbonate; SC: sodium carbonate.

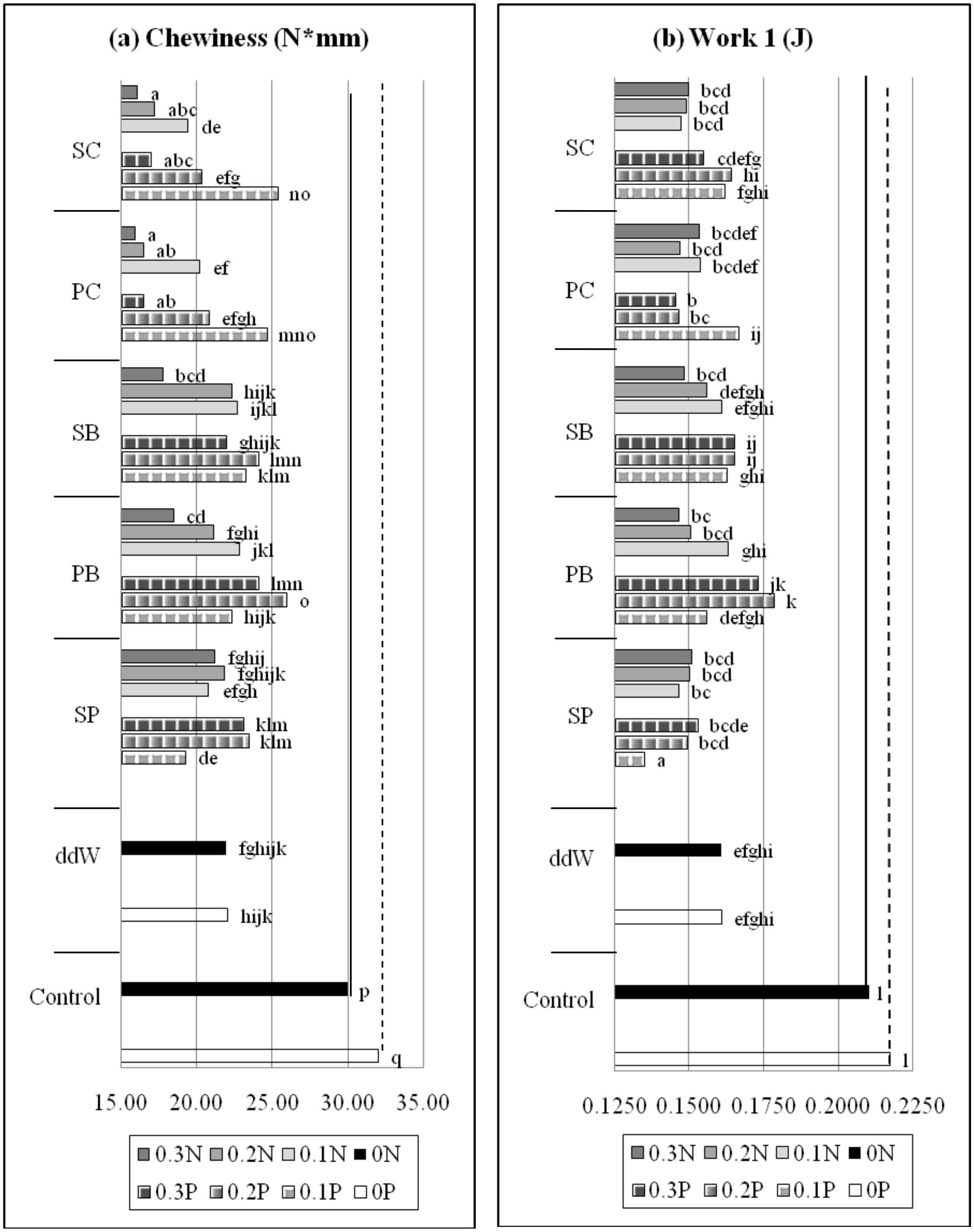

Figure 9. Meat type by treatment interactions for (a) chewiness (P<0.0001) and (b) work 1 (P<0.0001) TPA attributes of cooked pork gels. N: normal; P: PSE; ddW: double-distilled deionized water; SP: sodium phosphates; PB: potassium bicarbonate; SB: sodium bicarbonate; PC: potassium carbonate; SC: sodium carbonate.

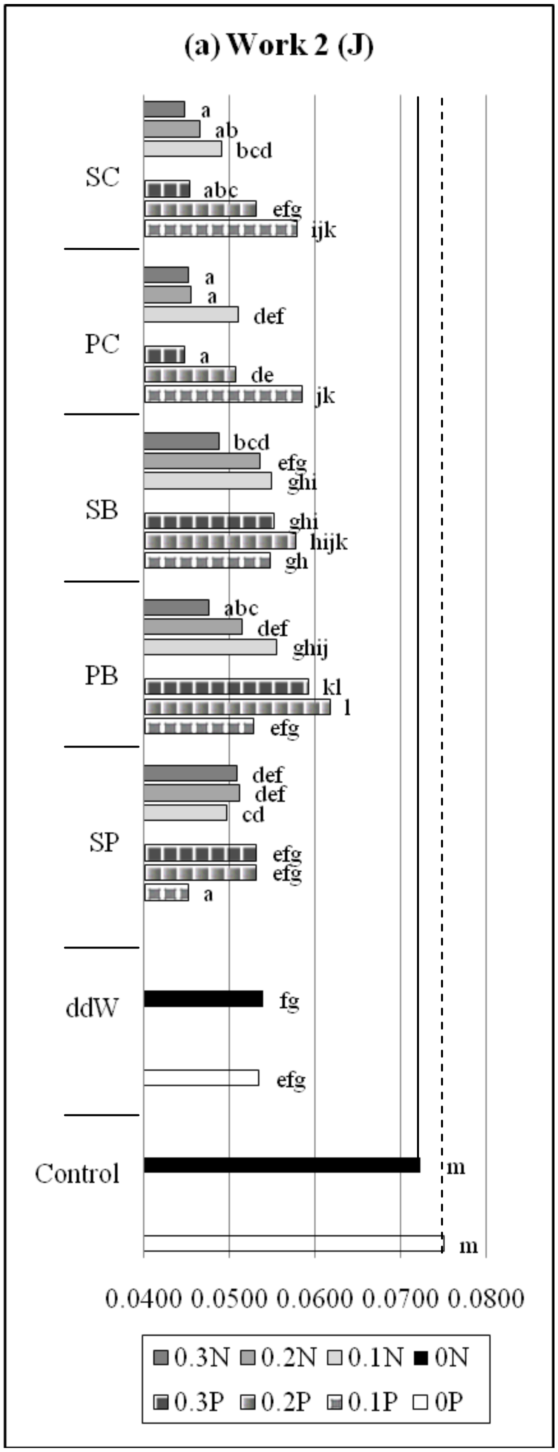

Figure 10. Meat type by treatment interactions for (a) work 2 ($P<0.0001$) TPA attribute of cooked pork gels. N: normal; P: PSE; ddW: double-distilled deionized water; SP: sodium phosphates; PB: potassium bicarbonate; SB: sodium bicarbonate; PC: potassium carbonate; SC: sodium carbonate.

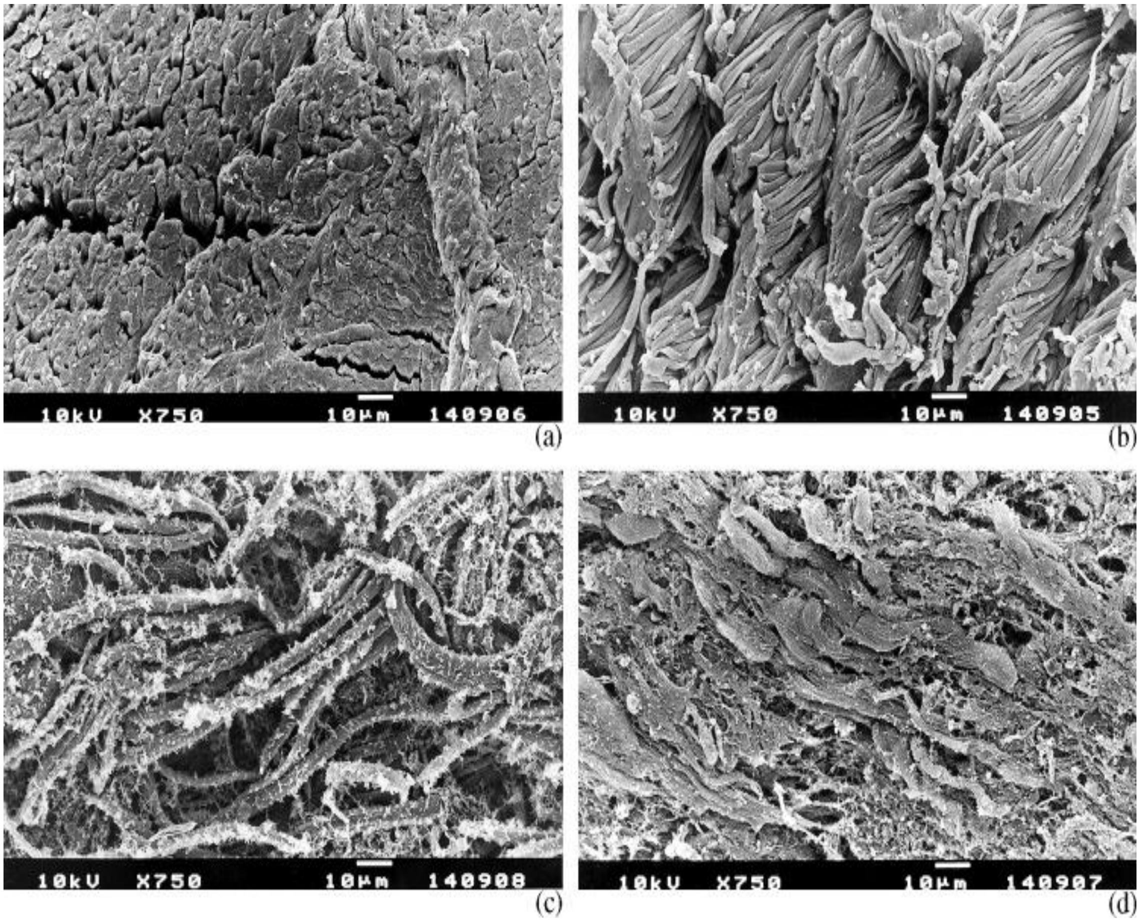

Figure 11. Scanning electron micrographs of dried squid mantle. (a), soaked in water for 20h (b), soaked in 0.15molkg Na_2CO_3 for 20h (c) and soaked in 0.15molkg NaOH for 20h (d). Data from Benjakul et al. (2000).

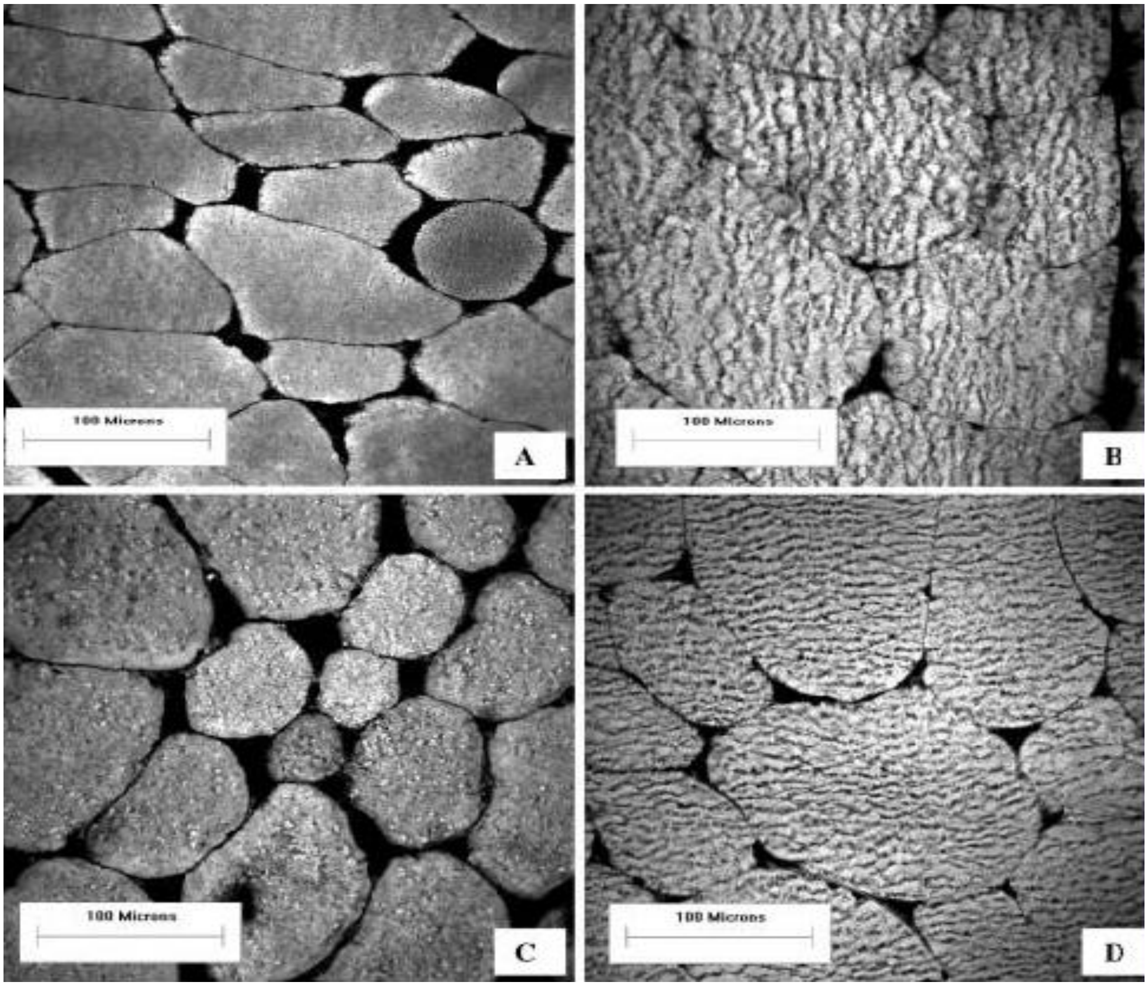

Figure 12. CLSM images of unheated pork samples. (a) control sample, 40× magnification; (b) sodium bicarbonate-treated sample, 40× magnification; (c) sodium chloride-treated sample, 40× magnification; (d) sodium pyrophosphate-treated sample, 40× magnification. Data from Bertram et al. (2008).

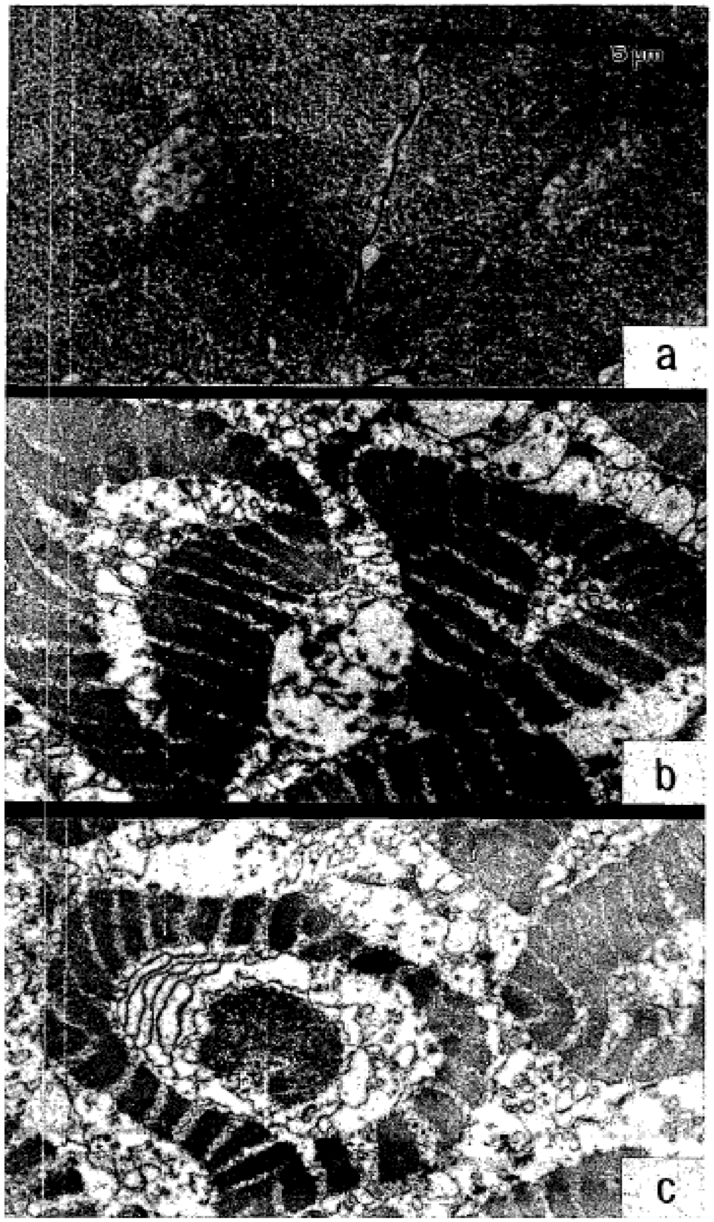

Figure 13. Electron micrographs of dried squid mantle muscle after softening. (a) musculature of raw squid; (b) Musculature of dried squid softened in the steps of presoaking (12 hr), alkali-soaking (pH 11, 2 hr), and post-soaking (6 hr); (c) musculature of dried squid softened in the steps of presoaking (12 hr), alkali-soaking (pH- 11, 6 hr), and post-soaking (6 hr). Data from Kugino et al. (1993).

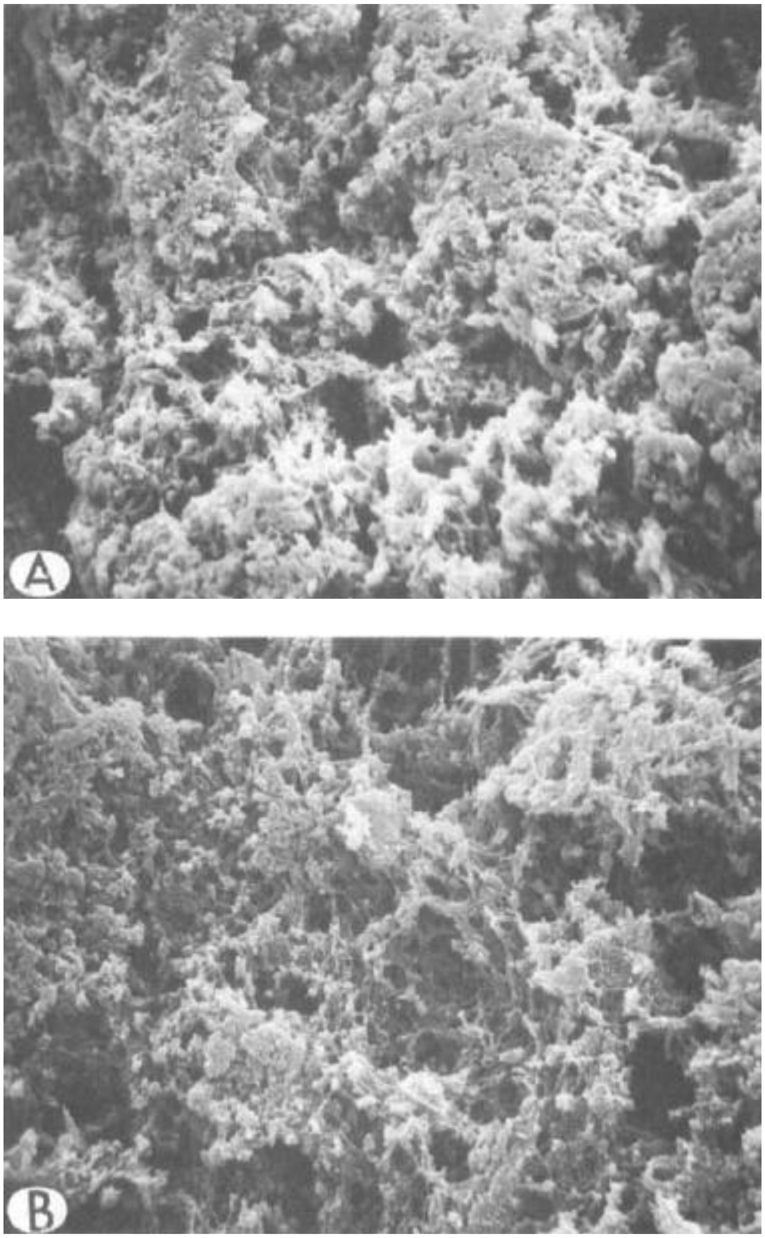

Figure B-14. Scanning electron micrographs showing protein gelation structure of MDPM. (a) 0.5% $NaHCO_3$-washed, and (b) 0.1M NaCl-washed (magnification x4000). Data from Yang and Froning (1994).

APPENDIX C

CARVER PRESS WATER HOLDING CAPACITY PROCEDURES

EQUIPMENT:
Gloves
Desiccator
Whatman® #1 filter paper, 9 cm
Scale
Carver Press with 2- 10.2cm^2 metal or plexiglass plates
Ruler
Wax pencil

REAGENTS:
KCl, saturated solution

PROCEDURE:

1. Place Whatman filter paper in a desiccator containing the KCl saturated solution (RH=80%) for at least 8 hours.
2. Remove a sheet of the 9cm filter paper from the desiccator with the KCl solution.
3. Tare the filter paper on the scale.
4. Add 500mg of meat sample to the paper. Record the weight of the sample.
5. Place filter paper containing meat sample between two metal plates.
6. Place plates on Carver Lab Press and press the sample at 500psi for 1 minute.
7. Trace around the outer edge of the pressed meat sample and the outer edge of the pressed moisture with a wax pencil.
8. Measure the inner and outer diameters of the meat and moisture edge in centimeters with a ruler.
9. Repeat in triplicate.
10. Leave samples out overnight to dry.
11. Using a companion sample, determine the % moisture of the meat sample using the CEM or AOAC Air Drying Oven Method.
12. Repeat in triplicate.
13. Calculate the % Free Water and % Bound Water (WHC)

    Area= πr^2

    $$\% \text{ Free Water} = \frac{[(\text{Total surface area} - \text{Meat film area})\ 24.06 \times 100]}{\text{Total moisture (mg) of meat sample}}$$

    % Bound Water (WHC)= 100 - % Free Water

APPENDIX D

AOAC AIR DRYING OVEN METHOD FOR MOISTURE IN MEAT

EQUIPMENT:

Gloves
Whatman® filter paper #1, 125mm
Stapler with staples
#2 pencil
Desiccator with desiccant
Analytical balance/ Scale
Convection oven

PROCEDURE:

1. Construct thimbles from Whatman #1 filter paper folded into a sleeve open at one end and stapled at the other end
2. Label thimbles with #2 pencil.
3. Dry thimbles for at least 12 hours at 100˚C using an air dry oven.
   Note: Only 1 pan per shelf and not stacked on desiccant. Metal pans should not touch the walls of the oven.
4. Ensure desiccator is properly equipped with functional desiccant, sealant, and is not over filled with thimbles/ samples.
5. Desiccator should be opened by sliding lid to remove thimbles/ samples and then immediately sealed.
6. Transfer dried thimbles to desiccator.
7. Cool thimbles in desiccator for 30 minutes.
8. Record dried thimble weight and 1 staple to the nearest 0.0001g
   Note: This is the "initial thimble weight". See #5 for opening/closing desiccator and place thimble immediately on the scale. Record 1st weight.
9. Put 2-3 grams of powdered homogenous meat sample into thimble and record the weight plus 1 staple to the nearest 0.0001g.
   Note: This is the "initial thimble/sample weight". See #5 for opening/closing desiccator and place thimble immediately on the scale. Record 1st weight.
10. Repeat in triplicate.
11. Fold over open end of the thimble and seal with a staple.
12. Place thimble on clean metal pan. Samples should be laid flat and not overlapping.
    Note: Only 1 pan per shelf and not stacked on desiccant. Metal pans should not touch the walls of the oven.
13. Dry in 100˚C dry oven for 16-18 hours.
14. Cool in desiccator for at least 1 hour. #4 should still be true.

15. Record dried thimble weight and 1 staple to the nearest 0.0001g.
    Note: This is the "dried thimble/ sample weight". See #5 for opening/closing desiccator and place thimble immediately on the scale. Record 1st weight.
16. Calculate % Moisture.

$$\% \text{ Moisture} = \frac{(B-C) \times 100}{A}$$

A: Sample weight = (Initial thimble/sample weight – Initial thimble weight)
B: Initial thimble/sample weight
C: Dried thimble/sample weight

APPENDIX E

AOV TABLES

Table E-1. ANOVA table for pH of raw pork loins.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	1.93231958	0.64410653	76.10	<0.0001
Error	33	0.27930475	0.00846378		
Corrected Total	36	2.21162432			

R-Square	Coeff Var	Root MSE	pHL Mean
0.873711	1.650163	0.091999	5.575135

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	0.26665900	0.13332950	15.75	<0.0001
PSENorm	1	1.61883500	1.61883500	191.27	<0.0001

Table E-2. ANOVA table for L* of raw pork loins.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	109.0913612	36.3637871	4.13	0.0137
Error	33	290.6848890	8.8086330		
Corrected Total	36	399.7762503			

R-Square	Coeff Var	Root MSE	LL Mean
0.272881	5.302824	2.967934	55.96894

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	25.19438227	12.59719113	1.43	0.2537
PSENorm	1	77.44705770	77.44705770	8.79	0.0056

Table E-3. ANOVA table for a* of raw pork loins.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	8.06548789	2.68849596	2.46	0.0801
Error	33	36.07773257	1.09326462		
Corrected Total	36	44.14322046			

R-Square	Coeff Var	Root MSE	aL Mean
0.182712	18.98767	1.045593	5.506696

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	4.69307172	2.34653586	2.15	0.1329
PSENorm	1	3.48864780	3.48864780	3.19	0.0832

Table E-4. ANOVA table for b* of raw pork loins.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	3.96827425	1.32275808	0.93	0.4353
Error	33	46.73564285	1.41623160		
Corrected Total	36	50.70391710			

R-Square	Coeff Var	Root MSE	bL Mean
0.078264	30.92405	1.190055	3.848316

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	0.02312464	0.01156232	0.01	0.9919
PSENorm	1	3.89291243	3.89291243	2.75	0.1068

Table E-5. ANOVA table for raw pH of pork gels.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	11.76700956	0.33620027	35.17	<0.0001
Error	66	0.63086029	0.00955849		
Corrected Total	101	12.39786985			

R-Square	Coeff Var	Root MSE	RpH Mean
0.949115	1.582187	0.097768	6.179265

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	2.72123971	1.36061985	142.35	<0.0001
PSENorm	1	1.00505515	1.00505515	105.15	<0.0001
Trt	16	7.92460735	0.49528796	51.82	<0.0001
PSENorm*Trt	16	0.11610735	0.00725671	0.76	0.7237

Table E-6. ANOVA table for raw L* of pork gels.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	426.6458339	12.1898810	12.97	<0.0001
Error	66	62.0375737	0.9399632		
Corrected Total	101	488.6834076			

R-Square	Coeff Var	Root MSE	RL Mean
0.873052	1.494185	0.969517	64.88599

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	101.5205043	50.7602522	54.00	<0.0001
PSENorm	1	8.5404201	8.5404201	9.09	0.0037
Trt	16	299.6079150	18.7254947	19.92	<0.0001
PSENorm*Trt	16	16.9769945	1.0610622	1.13	0.3485

Table E-7. ANOVA table for raw a* of pork gels.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	102.8020227	2.9372006	5.16	<0.0001
Error	66	37.5533085	0.5689895		
Corrected Total	101	140.3553312			

R-Square	Coeff Var	Root MSE	Ra Mean
0.732441	9.006728	0.754314	8.375006

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	17.70694772	8.85347386	15.56	<0.0001
PSENorm	1	4.64422590	4.64422590	8.16	0.0057
Trt	16	77.16075136	4.82254696	8.48	<0.0001
PSENorm*Trt	16	3.29009776	0.20563111	0.36	0.9868

Table E-8. ANOVA table for raw b* of pork gels.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	126.6852250	3.6195779	4.73	<0.0001
Error	66	50.4805482	0.7648568		
Corrected Total	101	177.1657732			

R-Square	Coeff Var	Root MSE	Rb Mean
0.715066	9.314841	0.874561	9.388898

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	13.0830866	6.5415433	8.55	0.0005
PSENorm	1	1.7202877	1.7202877	2.25	0.1385
Trt	16	105.1539026	6.5721189	8.59	<0.0001
PSENorm*Trt	16	6.7279481	0.4204968	0.55	0.9090

Table E-9. ANOVA table for cooked pH of pork gels.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	10.52919044	0.30083401	87.01	<0.0001
Error	66	0.22819608	0.00345752		
Corrected Total	101	10.75738652			

R-Square	Coeff Var	Root MSE	CpH Mean
0.978787	0.949561	0.058801	6.192402

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	1.09623725	0.54811863	158.53	<0.0001
PSENorm	1	1.05123554	1.05123554	304.04	<0.0001
Trt	16	8.29929069	0.51870567	150.02	<0.0001
PSENorm*Trt	16	0.08242696	0.00515169	1.49	0.1304

Table E-10. ANOVA table for cooked L* of pork gels.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	379.5092666	10.8431219	16.51	<0.0001
Error	66	43.3496112	0.6568123		
Corrected Total	101	422.8588778			

R-Square	Coeff Var	Root MSE	CL Mean
0.897484	1.030567	0.810440	78.64017

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	0.5382072	0.2691036	0.41	0.6655
PSENorm	1	1.6323192	1.6323192	2.49	0.1197
Trt	16	370.0073892	23.1254618	35.21	<0.0001
PSENorm*Trt	16	7.3313511	0.4582094	0.70	0.7861

Table E-11. ANOVA table for cooked a* of pork gels.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	11.31029607	0.32315132	2.04	0.0064
Error	66	10.46281052	0.15852743		
Corrected Total	101	21.77310659			

R-Square	Coeff Var	Root MSE	Ca Mean
0.519462	5.248371	0.398155	7.586259

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	0.11294290	0.05647145	0.36	0.7017
PSENorm	1	0.11182858	0.11182858	0.71	0.4040
Trt	16	6.43863559	0.40241472	2.54	0.0042
PSENorm*Trt	16	4.64688900	0.29043056	1.83	0.0450

Table E-12. ANOVA table for cooked b* of pork gels.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	74.17782815	2.11936652	8.39	<0.0001
Error	66	16.67947282	0.25271929		
Corrected Total	101	90.85730097			

R-Square	Coeff Var	Root MSE	Cb Mean
0.816421	5.333540	0.502712	9.425484

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	0.53694258	0.26847129	1.06	0.3515
PSENorm	1	1.36635355	1.36635355	5.41	0.0231
Trt	16	62.59259596	3.91203725	15.48	<0.0001
PSENorm*Trt	16	9.68193605	0.60512100	2.39	0.0069

Table E-13. ANOVA table for moisture (%) of pork gels.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	39.68856565	1.13395902	7.77	<0.0001
Error	66	9.63571721	0.14599572		
Corrected Total	101	49.32428286			

R-Square	Coeff Var	Root MSE	pmoisture Mean
0.804646	0.494942	0.382094	77.19971

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	3.23976424	1.61988212	11.10	<0.0001
PSENorm	1	0.20539112	0.20539112	1.41	0.2398
Trt	16	34.83461152	2.17716322	14.91	<0.0001
PSENorm*Trt	16	1.40879877	0.08804992	0.60	0.8702

Table E-14. ANOVA table for WHC of pork gels.

Dependent Variable: BoundWater

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	3901.863001	111.481800	14.19	<0.0001
Error	66	518.676627	7.858737		
Corrected Total	101	4420.539628			

R-Square	Coeff Var	Root MSE	BoundWater Mean
0.882667	4.231247	2.803344	66.25337

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	1194.586440	597.293220	76.00	<0.0001
PSENorm	1	219.205652	219.205652	27.89	<0.0001
Trt	16	2347.149925	146.696870	18.67	<0.0001
PSENorm*Trt	16	140.920984	8.807562	1.12	0.3554

Table E-15. ANOVA table for cook yield (%) of pork gels.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	3528.873614	100.824960	49.75	<0.0001
Error	66	133.749715	2.026511		
Corrected Total	101	3662.623329			

R-Square	Coeff Var	Root MSE	CkYield Mean
0.963483	1.625096	1.423556	87.59826

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	346.639520	173.319760	85.53	<0.0001
PSENorm	1	510.764355	510.764355	252.04	<0.0001
Trt	16	2578.661202	161.166325	79.53	<0.0001
PSENorm*Trt	16	92.808538	5.800534	2.86	0.0014

Table E-16. ANOVA table for hardness 1 of pork gels.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	18556.60043	530.18858	33.95	<0.0001
Error	471	7356.48503	15.61886		
Corrected Total	506	25913.08547			

R-Square	Coeff Var	Root MSE	Hardness1 Mean
0.716109	8.031827	3.952071	49.20513

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	1578.98376	789.49188	50.55	<0.0001
PSENorm	1	1801.52748	1801.52748	115.34	<0.0001
Trt	16	13750.54399	859.40900	55.02	<0.0001
PSENorm*Trt	16	1407.90029	87.99377	5.63	<0.0001

Table E-17. ANOVA table for hardness 2 of pork gels.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	11070.84454	316.30984	37.31	<0.0001
Error	471	3993.42197	8.47860		
Corrected Total	506	15064.26651			

R-Square	Coeff Var	Root MSE	Hardness2 Mean
0.734908	7.137748	2.911804	40.79444

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	847.901045	423.950522	50.00	<0.0001
PSENorm	1	801.849819	801.849819	94.57	<0.0001
Trt	16	8284.415695	517.775981	61.07	<0.0001
PSENorm*Trt	16	1131.437778	70.714861	8.34	<0.0001

Table E-18. ANOVA table for cohesiveness of pork gels.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	0.13623444	0.00389241	18.54	<0.0001
Error	471	0.09888971	0.00020996		
Corrected Total	506	0.23512415			

R-Square	Coeff Var	Root MSE	Cohesiveness Mean
0.579415	4.338083	0.014490	0.334016

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	0.00869548	0.00434774	20.71	<0.0001
PSENorm	1	0.01047454	0.01047454	49.89	<0.0001
Trt	16	0.10151508	0.00634469	30.22	<0.0001
PSENorm*Trt	16	0.01504715	0.00094045	4.48	<0.0001

Table E-19. ANOVA table for springiness of pork gels.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	0.54596247	0.01559893	7.27	<0.0001
Error	471	1.01125748	0.00214704		
Corrected Total	506	1.55721995			

R-Square	Coeff Var	Root MSE	Springiness Mean
0.350601	3.564822	0.046336	1.299818

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	0.07985808	0.03992904	18.60	<0.0001
PSENorm	1	0.00570445	0.00570445	2.66	0.1038
Trt	16	0.32550953	0.02034435	9.48	<0.0001
PSENorm*Trt	16	0.13318269	0.00832392	3.88	<0.0001

Table E-20. ANOVA table for chewiness of pork gels.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	7355.115794	210.146166	38.55	<0.0001
Error	471	2567.737880	5.451673		
Corrected Total	506	9922.853674			

R-Square	Coeff Var	Root MSE	Chewiness Mean
0.741230	10.84426	2.334882	21.53103

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	756.729131	378.364566	69.40	<0.0001
PSENorm	1	684.676627	684.676627	125.59	<0.0001
Trt	16	5308.828671	331.801792	60.86	<0.0001
PSENorm*Trt	16	588.754003	36.797125	6.75	<0.0001

Table E-21. ANOVA table for work 1 of pork gels.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	0.14776213	0.00422178	28.12	<0.0001
Error	471	0.07070898	0.00015013		
Corrected Total	506	0.21847112			

R-Square	Coeff Var	Root MSE	A1Work Mean
0.676346	7.713915	0.012253	0.158837

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	0.01164087	0.00582044	38.77	<0.0001
PSENorm	1	0.00522544	0.00522544	34.81	<0.0001
Trt	16	0.11536791	0.00721049	48.03	<0.0001
PSENorm*Trt	16	0.01572029	0.00098252	6.54	<0.0001

Table E-22. ANOVA table for work 2 of pork gels.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	35	0.02574205	0.00073549	40.19	<0.0001
Error	471	0.00861917	0.00001830		
Corrected Total	506	0.03436122			

R-Square	Coeff Var	Root MSE	A2Work Mean
0.749160	8.052462	0.004278	0.053124

Source	DF	Type III SS	Mean Square	F Value	Pr > F
week	2	0.00246076	0.00123038	67.24	<0.0001
PSENorm	1	0.00161173	0.00161173	88.07	<0.0001
Trt	16	0.01919242	0.00119953	65.55	<0.0001
PSENorm*Trt	16	0.00245986	0.00015374	8.40	<0.0001

Table E-23. ANOVA table for raw pH of pork gels with cook yield (%) as a covariate.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	36	11.34156290	0.31504341	32.68	<0.0001
Error	60	0.57843091	0.00964052		
Corrected Total	96	11.91999381			

R-Square	Coeff Var	Root MSE	RpH Mean
0.951474	1.585070	0.098186	6.194433

Source	DF	Type III SS	Mean Square	F Value	Pr > F
CkYield	1	0.04573742	0.04573742	4.74	0.0333
week	2	0.75476772	0.37738386	39.15	<0.0001
PSENorm	1	0.07343127	0.07343127	7.62	0.0077
Trt	16	0.87722058	0.05482629	5.69	<0.0001
PSENorm*Trt	16	0.12737843	0.00796115	0.83	0.6522

Table E-24. ANOVA table for raw L* of pork gels with cook yield (%) as a covariate.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	36	412.4772405	11.4577011	12.06	<0.0001
Error	60	56.9982111	0.9499702		
Corrected Total	96	469.4754516			

R-Square	Coeff Var	Root MSE	RL Mean
0.878592	1.504097	0.974664	64.80061

Source	DF	Type III SS	Mean Square	F Value	Pr > F
CkYield	1	0.61111151	0.61111151	0.64	0.4257
week	2	43.88009628	21.94004814	23.10	<0.0001
PSENorm	1	4.07207521	4.07207521	4.29	0.0427
Trt	16	62.03544501	3.87721531	4.08	<0.0001
PSENorm*Trt	16	17.13841522	1.07115095	1.13	0.3520

Table E-25. ANOVA table for raw a* of pork gels with cook yield (%) as a covariate.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	36	89.8925317	2.4970148	4.46	<0.0001
Error	60	33.5648400	0.5594140		
Corrected Total	96	123.4573716			

R-Square	Coeff Var	Root MSE	Ra Mean
0.728126	9.014646	0.747940	8.296941

Source	DF	Type III SS	Mean Square	F Value	Pr > F
CkYield	1	0.43456174	0.43456174	0.78	0.3816
week	2	8.62098547	4.31049274	7.71	0.0011
PSENorm	1	2.69941471	2.69941471	4.83	0.0319
Trt	16	17.98124494	1.12382781	2.01	0.0270
PSENorm*Trt	16	2.96771638	0.18548227	0.33	0.9914

Table E-26. ANOVA table for raw b* of pork gels with cook yield (%) as a covariate.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	36	116.6299196	3.2397200	4.50	<0.0001
Error	60	43.2435790	0.7207263		
Corrected Total	96	159.8734986			

R-Square	Coeff Var	Root MSE	Rb Mean
0.729514	9.113705	0.848956	9.315158

Source	DF	Type III SS	Mean Square	F Value	Pr > F
CkYield	1	0.31585740	0.31585740	0.44	0.5105
week	2	8.34365384	4.17182692	5.79	0.0050
PSENorm	1	1.56706254	1.56706254	2.17	0.1456
Trt	16	22.29028521	1.39314283	1.93	0.0344
PSENorm*Trt	16	6.96639929	0.43539996	0.60	0.8681

Table E-27. ANOVA table for cooked pH of pork gels with cook yield (%) as a covariate.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	36	10.10694541	0.28074848	108.15	<0.0001
Error	60	0.15575562	0.00259593		
Corrected Total	96	10.26270103			

R-Square	Coeff Var	Root MSE	CpH Mean
0.984823	0.820755	0.050950	6.207732

Source	DF	Type III SS	Mean Square	F Value	Pr > F
CkYield	1	0.00004620	0.00004620	0.02	0.8943
week	2	0.52718246	0.26359123	101.54	<0.0001
PSENorm	1	0.22727233	0.22727233	87.55	<0.0001
Trt	16	0.74639137	0.04664946	17.97	<0.0001
PSENorm*Trt	16	0.03990042	0.00249378	0.96	0.5090

Table E-28. ANOVA table for cooked L* of pork gels with cook yield (%) as a covariate.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	36	381.3712973	10.5936471	16.82	<0.0001
Error	60	37.7854270	0.6297571		
Corrected Total	96	419.1567243			

R-Square	Coeff Var	Root MSE	CL Mean
0.909854	1.009513	0.793572	78.60939

Source	DF	Type III SS	Mean Square	F Value	Pr > F
CkYield	1	1.64955170	1.64955170	2.62	0.1108
week	2	1.31452013	0.65726006	1.04	0.3585
PSENorm	1	0.49223434	0.49223434	0.78	0.3802
Trt	16	46.30288016	2.89393001	4.60	<0.0001
PSENorm*Trt	16	10.02258807	0.62641175	0.99	0.4745

Table E-29. ANOVA table for cooked a* of pork gels with cook yield (%) as a covariate.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	36	11.42659188	0.31740533	2.07	0.0063
Error	60	9.21935865	0.15365598		
Corrected Total	96	20.64595052			

R-Square	Coeff Var	Root MSE	Ca Mean
0.553454	5.177694	0.391990	7.570741

Source	DF	Type III SS	Mean Square	F Value	Pr > F
CkYield	1	0.46522417	0.46522417	3.03	0.0870
week	2	0.55673466	0.27836733	1.81	0.1722
PSENorm	1	0.21379638	0.21379638	1.39	0.2428
Trt	16	6.35622986	0.39726437	2.59	0.0041
PSENorm*Trt	16	4.65120209	0.29070013	1.89	0.0393

Table E-30. ANOVA table for cooked b* of pork gels with cook yield (%) as a covariate.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	36	72.81285298	2.02257925	7.52	<0.0001
Error	60	16.13206763	0.26886779		
Corrected Total	96	88.94492061			

R-Square	Coeff Var	Root MSE	Cb Mean
0.818629	5.511996	0.518525	9.407202

Source	DF	Type III SS	Mean Square	F Value	Pr > F
CkYield	1	0.00492507	0.00492507	0.02	0.8928
week	2	0.15975550	0.07987775	0.30	0.7441
PSENorm	1	0.39308667	0.39308667	1.46	0.2314
Trt	16	18.87644086	1.17977755	4.39	<0.0001
PSENorm*Trt	16	8.45935898	0.52870994	1.97	0.0310

Table E-31. ANOVA table for moisture (%) of pork gels with cook yield (%) as a covariate.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	36	19.86811326	0.55189204	3.93	<0.0001
Error	60	8.42340711	0.14039012		
Corrected Total	96	28.29152037			

R-Square	Coeff Var	Root MSE	Pmoisture Mean
0.702264	0.484838	0.374687	77.28082

Source	DF	Type III SS	Mean Square	F Value	Pr > F
CkYield	1	0.42582689	0.42582689	3.03	0.0867
week	2	3.19866659	1.59933330	11.39	<0.0001
PSENorm	1	0.07973304	0.07973304	0.57	0.4540
Trt	16	13.95751371	0.87234461	6.21	<0.0001
PSENorm*Trt	16	1.08063025	0.06753939	0.48	0.9471

Table E-32. ANOVA table for WHC of pork gels with cook yield (%) as a covariate.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	36	3813.792083	105.938669	13.01	<0.0001
Error	60	488.552955	8.142549		
Corrected Total	96	4302.345038			

R-Square	Coeff Var	Root MSE	BoundWater Mean
0.886445	4.307125	2.853515	66.25104

Source	DF	Type III SS	Mean Square	F Value	Pr > F
CkYield	1	9.6059340	9.6059340	1.18	0.2818
week	2	350.0354945	175.0177473	21.49	<0.0001
PSENorm	1	13.9766526	13.9766526	1.72	0.1951
Trt	16	134.5845718	8.4115357	1.03	0.4371
PSENorm*Trt	16	115.1927383	7.1995461	0.88	0.5894

Table E-33. ANOVA table for hardness 1 of pork gels with cook yield (%) as a covariate.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	36	3812.889861	105.913607	17.04	<0.0001
Error	65	404.121561	6.217255		
Corrected Total	101	4217.011421			

R-Square	Coeff Var	Root MSE	Hardness1 Mean
0.904169	5.068431	2.493442	49.19555

Source	DF	Type III SS	Mean Square	F Value	Pr > F
CkYield	1	99.850173	99.850173	16.06	0.0002
week	2	383.476164	191.738082	30.84	<0.0001
NPSE	1	0.067319	0.067319	0.01	0.9174
Trt	16	1757.740829	109.858802	17.67	<0.0001
NPSE*Trt	16	124.705036	7.794065	1.25	0.2543

Table E-34. ANOVA table for hardness 2 of pork gels with cook yield (%) as a covariate.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	36	2266.654281	62.962619	16.74	<0.0001
Error	65	244.436983	3.760569		
Corrected Total	101	2511.091264			

R-Square	Coeff Var	Root MSE	Hardness2 Mean
0.902657	4.754140	1.939219	40.79010

Source	DF	Type III SS	Mean Square	F Value	Pr > F
CkYield	1	53.005438	53.005438	14.10	0.0004
week	2	218.616863	109.308432	29.07	<0.0001
NPSE	1	0.543054	0.543054	0.14	0.7052
Trt	16	1276.253259	79.765829	21.21	<0.0001
NPSE*Trt	16	135.626144	8.476634	2.25	0.0113

Table E-35. ANOVA table for cohesiveness of pork gels with cook yield (%) as a covariate.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	36	0.02751168	0.00076421	7.06	<0.0001
Error	65	0.00704088	0.00010832		
Corrected Total	101	0.03455256			

R-Square	Coeff Var	Root MSE	Cohesiveness Mean
0.796227	3.115446	0.010408	0.334069

Source	DF	Type III SS	Mean Square	F Value	Pr > F
CkYield	1	0.00020856	0.00020856	1.93	0.1700
week	2	0.00183955	0.00091977	8.49	0.0005
NPSE	1	0.00006523	0.00006523	0.60	0.4406
Trt	16	0.00584773	0.00036548	3.37	0.0003
NPSE*Trt	16	0.00274588	0.00017162	1.58	0.0987

Table E-36. ANOVA table for springiness of pork gels with cook yield (%) as a covariate.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	36	0.11625507	0.00322931	4.84	<0.0001
Error	65	0.04339319	0.00066759		
Corrected Total	101	0.15964826			

R-Square	Coeff Var	Root MSE	Springiness Mean
0.728195	1.987844	0.025838	1.299786

Source	DF	Type III SS	Mean Square	F Value	Pr > F
CkYield	1	0.00676188	0.00676188	10.13	0.0022
week	2	0.02274499	0.01137250	17.04	<0.0001
NPSE	1	0.00334424	0.00334424	5.01	0.0286
Trt	16	0.07194591	0.00449662	6.74	<0.0001
NPSE*Trt	16	0.01862585	0.00116412	1.74	0.0601

Table E-37. ANOVA table for chewiness of pork gels with cook yield (%) as a covariate.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	36	1512.104985	42.002916	19.90	<0.0001
Error	65	137.212652	2.110964		
Corrected Total	101	1649.317637			

R-Square	Coeff Var	Root MSE	Chewiness Mean
0.916806	6.748791	1.452916	21.52853

Source	DF	Type III SS	Mean Square	F Value	Pr > F
CkYield	1	41.4409659	41.4409659	19.63	<0.0001
week	2	184.7552395	92.3776198	43.76	<0.0001
NPSE	1	0.1598850	0.1598850	0.08	0.7840
Trt	16	643.0140016	40.1883751	19.04	<0.0001
NPSE*Trt	16	49.8940814	3.1183801	1.48	0.1359

Table E-38. ANOVA table for work 1 of pork gels with cook yield (%) as a covariate.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	36	0.03056406	0.00084900	12.90	<0.0001
Error	65	0.00427936	0.00006584		
Corrected Total	101	0.03484342			

R-Square	Coeff Var	Root MSE	A1Work Mean
0.877183	5.109778	0.008114	0.158793

Source	DF	Type III SS	Mean Square	F Value	Pr > F
CkYield	1	0.00096256	0.00096256	14.62	0.0003
week	2	0.00327613	0.00163807	24.88	<0.0001
NPSE	1	0.00016954	0.00016954	2.58	0.1134
Trt	16	0.02327957	0.00145497	22.10	<0.0001
NPSE*Trt	16	0.00165766	0.00010360	1.57	0.1019

Table E-39. ANOVA table for work 2 of pork gels with cook yield (%) as a covariate.

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	36	0.00530814	0.00014745	20.19	<0.0001
Error	65	0.00047471	0.00000730		
Corrected Total	101	0.00578285			

R-Square	Coeff Var	Root MSE	A2Work Mean
0.917911	5.087746	0.002702	0.053117

Source	DF	Type III SS	Mean Square	F Value	Pr > F
CkYield	1	0.00016057	0.00016057	21.99	<0.0001
week	2	0.00064624	0.00032312	44.24	<0.0001
NPSE	1	0.00000982	0.00000982	1.34	0.2504
Trt	16	0.00323182	0.00020199	27.66	<0.0001
NPSE*Trt	16	0.00023237	0.00001452	1.99	0.0273

APPENDIX F

RAW DATA

Raw loin pH & color

Date	Week	Loin	pH1	pH2	PSENorm	L1	A1	B1	L2	A2	B2	L3	A3	B3
12/2/2008	1	2	5.28	5.47	P	59.78	5.11	5.17	59.14	4.64	3.95	59.18	4.29	4.39
12/2/2008	1	3	5.34	5.40	P	61.80	4.50	4.07	55.61	5.56	4.22	56.79	4.94	4.39
12/2/2008	1	4	5.25	5.54	P	59.25	7.18	7.30	59.89	4.47	4.69	63.34	5.28	6.21
12/2/2008	1	5	5.38	5.42	P	60.14	3.30	2.46	56.51	4.92	3.95	54.25	5.46	3.93
12/2/2008	1	6	5.35	5.34	P	52.97	5.45	2.40	54.63	6.41	4.10	53.20	5.03	2.24
12/2/2008	1	7	6.10	5.91	N	56.02	5.64	4.62	62.02	4.60	5.70	54.28	7.71	4.79
12/2/2008	1	8	5.89	5.96	N	58.82	3.33	2.69	56.85	2.95	2.01	66.39	2.23	3.71
12/2/2008	1	9	5.98	6.10	N	49.39	5.67	3.51	52.15	4.14	2.97	54.20	5.30	3.81
12/2/2008	1	10	5.74	6.15	N	52.25	5.00	3.74	51.54	4.98	2.93	50.85	3.68	1.46
12/2/2008	1	11	6.04	6.14	N	48.73	4.45	1.50	57.59	4.74	4.07	54.02	5.50	3.41
12/2/2008	1	12	5.75	5.77	N	52.14	5.21	3.20	50.68	5.34	2.52	47.37	6.85	3.17
12/8/2008	2	20	5.33	5.30	P	60.74	6.66	5.76	56.97	5.34	3.81	57.00	4.75	2.77
12/8/2008	2	21	5.34	5.38	P	59.31	4.83	4.88	56.95	5.92	3.05	54.64	7.54	4.18
12/8/2008	2	22	5.37	5.40	P	49.49	10.66	5.08	54.05	5.04	3.37	58.96	7.55	5.48
12/8/2008	2	23	5.43	5.25	P	52.52	9.32	5.10	53.08	3.77	0.21	54.49	3.61	1.04
12/8/2008	2	27	5.59	5.77	N	57.00	6.62	5.52	61.02	4.36	3.72	56.92	7.19	4.89
12/8/2008	2	28	5.75	5.70	N	55.80	5.73	4.24	56.81	7.64	6.33	56.73	8.33	5.50
12/8/2008	2	29	5.66	5.69	N	49.94	6.52	4.09	54.19	4.59	3.11	53.59	5.20	3.88
12/8/2008	2	30	5.35	5.43	P	55.27	5.52	3.51	55.65	5.19	2.75	55.46	8.49	4.97
12/8/2008	2	31	5.87	5.91	N	52.79	3.53	0.90	51.13	4.86	2.50	51.46	3.94	2.47
12/8/2008	2	32	5.89	5.81	N	57.31	4.33	3.42	60.25	5.76	5.85	54.62	6.74	5.14
12/8/2008	2	34	5.83	5.80	N	50.42	5.36	3.32	55.20	5.04	3.64	51.46	5.48	3.92
1/12/2009	3	41	5.65	5.69	N	51.91	5.17	2.44	53.25	3.58	1.03	54.96	3.04	0.72
1/12/2009	3	42	5.57	5.57	N	58.42	5.03	4.92	56.44	3.91	2.38	58.18	6.51	5.33
1/12/2009	3	45	5.31	5.27	P	53.41	8.64	5.12	53.59	7.82	5.23	54.17	7.80	4.81
1/12/2009	3	47	5.77	5.50	N	59.01	7.19	6.20	60.95	8.43	7.56	58.33	4.69	3.65
1/12/2009	3	48	5.56	5.64	N	51.94	6.30	3.53	52.25	5.68	2.98	56.73	5.32	4.24
1/12/2009	3	49	5.23	5.32	P	62.93	5.94	5.28	60.51	5.23	3.23	63.14	5.16	4.75
1/12/2009	3	50	5.29	5.33	P	55.29	6.00	3.09	56.21	5.44	2.44	59.77	5.94	3.71
1/12/2009	3	52	5.34	5.22	P	67.64	4.29	5.40	60.88	7.18	5.88	60.36	5.22	4.71
1/12/2009	3	54	5.6	5.62	N	54.60	3.02	0.60	56.54	3.64	1.69	49.51	4.13	1.60
1/12/2009	3	57	5.26	5.32	P	60.92	6.66	5.25	58.95	3.76	2.15	57.34	5.44	3.12

Raw pH & color

Date	Week	Sample	PSENorm	Trt	Level	RpH1	RpH2	RL1	RA1	RB1	RL2	RA2	RB2	RL3	RA3	RB3
12/2/08	1	1	N	SP	0.3	6.33	6.29	63.85	9.06	10.05	61.58	8.99	9.32	63.93	9.27	10.17
12/2/08	1	2	P	SC	0.2	6.39	6.73	60.34	6.57	7.04	61.25	7.63	8.26	62.28	7.24	8.41
12/2/08	1	3	P	PB	0.2	6.29	6.19	64.10	6.79	7.48	64.19	7.58	8.87	62.08	7.92	8.83
12/2/08	1	4	P	SB	0.3	6.48	6.41	62.28	7.02	7.96	62.74	7.57	8.87	63.68	6.49	7.87
12/2/08	1	5	N	SB	0.1	6.38	6.44	64.50	9.09	10.42	65.25	8.63	9.91	64.92	9.41	11.02
12/2/08	1	6	N	SC	0.1	6.63	6.63	64.11	9.13	10.34	63.08	9.18	10.28	63.80	9.36	10.67
12/2/08	1	7	N	SC	0.2	6.64	6.93	62.00	8.09	8.90	63.12	8.75	9.69	64.05	8.70	10.20
12/2/08	1	8	N	PB	0.3	6.72	6.64	62.18	9.09	9.94	62.89	9.00	10.28	63.45	9.55	11.19
12/2/08	1	9	P	PB	0.3	6.49	6.30	61.32	6.72	7.44	61.51	6.71	7.19	63.62	6.90	8.11
12/2/08	1	10	P	SP	0.2	6.01	5.94	65.26	7.78	9.04	65.33	8.23	9.62	63.50	7.70	8.55
12/2/08	1	11	P	SB	0.1	6.15	6.11	64.10	7.90	9.02	68.47	7.84	10.21	66.95	8.83	10.62
12/2/08	1	12	N	PB	0.2	6.48	6.56	63.48	8.27	9.14	63.06	8.46	9.62	65.78	8.55	10.26
12/2/08	1	13	P	SB	0.2	6.25	6.25	65.90	7.30	9.10	65.13	6.37	8.00	63.26	6.11	7.07
12/2/08	1	14	N	SP	0.1	6.29	6.21	65.77	9.09	10.61	65.26	8.96	10.12	64.56	9.49	11.07
12/2/08	1	15	P	PC	0.1	6.38	6.29	65.61	7.51	9.34	64.78	6.62	7.63	61.53	6.11	6.79
12/2/08	1	16	N	PC	0.2	6.78	6.94	61.80	7.85	8.91	66.95	6.33	7.74	61.83	8.06	9.24
12/2/08	1	17	N	PB	0.1	6.25	6.43	63.68	8.54	9.69	64.86	9.03	10.82	62.81	8.42	9.54
12/2/08	1	18	P	ddW	0	5.98	5.91	68.48	9.29	10.93	67.77	10.06	12.08	68.06	9.33	10.87
12/2/08	1	19	P	SP	0.3	6.08	5.97	64.30	8.90	10.37	64.78	9.18	10.61	65.11	8.88	9.99
12/2/08	1	20	P	PC	0.2	6.31	6.51	59.99	5.90	6.08	60.70	6.20	6.42	57.28	5.99	5.57
12/2/08	1	21	N	SB	0.3	6.47	6.73	62.30	6.14	6.83	61.91	6.74	8.28	61.35	5.82	6.35
12/2/08	1	22	P	Control	0	5.95	5.93	65.28	10.20	10.98	62.90	9.44	10.16	67.72	9.81	10.71
12/2/08	1	23	N	SP	0.2	6.24	6.23	63.29	7.73	9.14	63.52	8.44	9.82	64.68	8.12	9.72
12/2/08	1	24	N	Control	0	6.14	5.82	67.53	10.70	13.03	65.96	9.06	10.55	65.47	9.59	11.10
12/2/08	1	25	N	SC	0.3	6.48	7.15	58.83	6.22	6.20	57.54	5.75	6.19	60.74	6.74	7.96
12/2/08	1	26	N	PC	0.3	7.07	7.26	62.34	5.86	6.73	60.06	5.16	5.33	60.75	6.28	7.34
12/2/08	1	27	N	PC	0.1	6.56	6.50	63.98	6.75	8.17	63.97	7.20	8.95	61.09	6.05	7.26
12/2/08	1	28	P	PB	0.1	5.97	6.11	67.21	8.30	10.10	65.72	7.39	8.50	67.01	7.74	9.69
12/2/08	1	29	P	SP	0.1	5.85	5.95	66.96	9.24	10.91	66.52	8.54	9.96	67.36	8.92	10.31
12/2/08	1	30	N	SB	0.2	6.52	6.55	63.01	5.66	6.63	62.53	6.66	7.94	63.33	6.03	6.91
12/2/08	1	31	N	ddW	0	6.19	6.15	67.69	7.61	10.23	65.05	8.91	10.03	64.84	8.30	9.98
12/2/08	1	32	P	PC	0.3	6.20	6.96	62.25	6.78	7.49	60.53	6.21	6.57	60.22	6.62	7.37

12/2/08	1	33	P	SC	0.1	6.35	6.36	62.90	7.01	7.64	61.91	6.83	6.96	63.99	7.56	8.41
12/2/08	1	34	P	SC	0.3	6.32	6.37	61.63	6.30	6.87	61.36	6.15	6.16	59.84	7.62	8.63
12/8/08	2	1	N	PB	0.3	6.50	6.57	62.91	7.97	8.70	60.90	7.01	7.48	63.67	7.40	8.25
12/8/08	2	2	N	ddW	0	5.89	5.90	64.72	8.46	8.47	67.50	10.06	11.49	67.39	10.13	11.06
12/8/08	2	3	P	SP	0.2	5.84	5.87	67.03	11.30	12.11	67.10	10.28	11.08	67.82	9.91	10.41
12/8/08	2	4	P	SB	0.2	6.18	6.14	66.11	9.06	10.11	66.32	7.79	7.75	65.64	8.73	10.01
12/8/08	2	5	P	PC	0.2	6.47	6.06	62.32	8.10	8.53	62.27	7.70	8.08	65.39	7.57	8.52
12/8/08	2	6	N	Control	0	5.79	5.92	62.97	8.95	8.78	67.21	11.05	12.06	69.41	10.32	11.21
12/8/08	2	7	P	PB	0.1	6.01	5.82	63.69	9.45	9.57	68.25	10.12	11.15	67.61	8.98	10.46
12/8/08	2	8	N	PB	0.2	6.45	6.30	65.12	8.09	9.07	63.72	7.44	7.88	64.59	7.34	7.90
12/8/08	2	9	P	SP	0.1	5.81	5.83	68.39	10.64	11.97	67.84	10.21	11.03	67.12	9.22	9.85
12/8/08	2	10	N	SC	0.1	6.02	6.32	63.11	7.31	8.34	62.18	6.94	7.55	63.26	8.84	9.73
12/8/08	2	11	P	SC	0.1	6.21	6.15	66.66	9.24	10.44	64.58	10.33	10.87	66.54	9.29	10.23
12/8/08	2	12	N	PC	0.1	6.37	6.20	64.74	7.38	8.16	64.58	7.36	8.21	64.88	8.24	9.57
12/8/08	2	13	P	SP	0.3	5.90	5.87	67.11	10.05	10.85	59.80	7.81	6.78	64.64	10.62	10.21
12/8/08	2	14	N	SC	0.2	6.62	6.61	60.98	6.34	6.93	64.37	6.52	7.18	61.31	6.73	7.41
12/8/08	2	15	N	PB	0.1	6.11	6.07	67.43	8.50	10.37	65.66	8.30	9.70	65.33	9.14	10.31
12/8/08	2	16	P	PC	0.1	6.11	6.09	63.83	8.95	9.58	66.03	8.61	9.46	64.32	8.56	9.64
12/8/08	2	17	P	SB	0.1	5.96	5.97	68.97	10.28	11.66	69.13	10.71	11.93	68.09	10.22	11.49
12/8/08	2	18	N	SC	0.3	6.84	6.82	61.85	7.06	8.13	64.14	7.82	8.89	62.16	7.22	8.14
12/8/08	2	19	P	PC	0.3	6.55	6.76	64.38	7.99	8.77	58.89	7.69	6.54	63.76	7.03	7.71
12/8/08	2	20	P	SC	0.3	6.73	6.71	64.00	6.82	7.93	60.80	6.65	6.91	62.23	8.32	8.50
12/8/08	2	21	N	SP	0.3	6.04	5.99	65.55	8.71	9.95	64.77	8.15	8.80	65.12	8.86	10.02
12/8/08	2	22	N	SB	0.1	6.14	6.17	65.66	9.21	10.60	66.37	8.41	9.95	65.35	8.04	9.29
12/8/08	2	23	N	PC	0.3	6.94	6.80	60.25	5.15	6.12	59.98	6.23	6.36	69.84	5.10	7.22
12/8/08	2	24	P	SB	0.3	6.31	6.28	64.05	8.36	9.45	62.44	7.50	7.93	63.57	7.60	8.25
12/8/08	2	25	N	PC	0.2	6.59	6.63	62.45	7.03	8.10	60.97	6.04	6.66	61.53	7.01	8.10
12/8/08	2	26	N	SB	0.3	6.29	6.47	60.64	6.51	6.61	61.35	7.21	7.78	62.58	6.70	7.52
12/8/08	2	27	P	PB	0.2	6.19	6.07	66.63	8.93	10.04	63.57	8.81	9.52	66.56	9.31	10.50
12/8/08	2	28	N	SP	0.2	5.93	5.98	66.27	9.70	10.74	65.35	8.43	8.95	65.64	8.69	9.11
12/8/08	2	29	N	SP	0.1	5.84	5.87	66.86	9.86	11.44	68.06	9.71	11.62	66.30	9.47	10.68
12/8/08	2	30	P	PB	0.3	6.23	6.32	63.39	8.43	9.45	64.21	8.81	9.77	65.83	8.24	9.41
12/8/08	2	31	P	Control	0	5.80	5.78	68.43	11.13	11.62	69.08	11.81	13.33	67.40	11.30	12.04
12/8/08	2	32	N	SB	0.2	6.12	5.93	63.92	8.36	9.77	64.19	7.88	8.66	61.84	7.52	8.51
12/8/08	2	33	P	ddW	0	5.81	5.74	70.69	10.36	12.09	70.16	10.36	11.98	69.66	10.05	11.49

12/8/08	2	34	P	SC	0.2	5.95	6.45	65.27	9.73	10.87	63.33	7.12	7.84	65.51	9.88	11.44
1/12/09	3	1	P	SP	0.3	5.68	5.69	65.96	9.80	10.53	65.78	9.04	9.35	64.55	9.71	10.50
1/12/09	3	2	P	ddW	0	5.44	5.18	69.05	9.96	11.40	65.31	9.76	10.06	69.44	10.19	11.61
1/12/09	3	3	N	ddW	0	5.61	5.50	68.31	9.75	10.90	67.45	8.79	9.46	71.15	8.99	10.49
1/12/09	3	4	N	PC	0.3	6.80	6.57	61.29	7.68	8.23	63.14	6.75	7.44	64.47	6.61	7.09
1/12/09	3	5	P	Control	0	5.54	5.50	67.31	10.62	11.43	65.85	9.51	10.03	68.99	10.59	11.95
1/12/09	3	6	N	SP	0.2	5.77	5.79	66.72	9.02	9.80	66.68	9.28	10.31	67.00	8.99	9.76
1/12/09	3	7	P	PB	0.3	6.04	6.17	66.60	9.50	10.35	66.26	9.68	10.84	65.35	9.11	10.09
1/12/09	3	8	N	SP	0.3	5.80	5.81	67.02	8.74	10.15	65.67	8.94	9.70	65.27	9.38	10.23
1/12/09	3	9	N	PC	0.1	6.14	6.14	66.43	8.24	9.27	64.69	8.55	9.56	68.31	8.68	10.14
1/12/09	3	10	N	SC	0.2	6.23	6.42	64.15	8.31	8.67	66.30	8.41	10.14	65.67	8.72	10.23
1/12/09	3	11	P	SP	0.1	5.59	5.58	69.45	10.00	11.54	69.08	9.64	10.95	70.46	9.41	10.84
1/12/09	3	12	P	PC	0.2	6.30	5.92	65.97	9.25	10.57	61.75	8.30	8.49	64.28	8.02	8.39
1/12/09	3	13	P	SB	0.1	5.71	5.73	67.46	9.46	10.52	66.92	9.44	10.68	66.23	8.81	9.12
1/12/09	3	14	P	PB	0.2	5.92	5.80	65.72	7.95	8.19	66.75	9.03	9.89	66.30	8.00	8.66
1/12/09	3	15	N	PB	0.3	6.31	6.27	65.59	8.26	9.34	65.80	9.26	10.70	63.93	8.06	8.99
1/12/09	3	16	N	SB	0.1	5.86	5.91	67.35	8.77	10.12	66.79	8.80	10.16	68.38	8.75	10.30
1/12/09	3	17	N	SC	0.1	6.28	6.08	63.60	8.46	9.01	66.25	9.02	10.37	67.06	8.89	10.26
1/12/09	3	18	P	SC	0.2	6.28	6.27	67.33	8.53	10.02	62.01	9.16	9.52	66.80	8.29	9.10
1/12/09	3	19	N	Control	0	5.69	5.67	68.28	9.62	10.80	66.50	8.36	9.27	65.80	8.38	8.18
1/12/09	3	20	P	SP	0.2	5.59	5.59	66.18	8.98	10.10	67.65	9.24	10.67	66.67	9.55	10.73
1/12/09	3	21	P	SC	0.3	6.45	6.55	64.03	7.90	8.31	62.75	8.67	9.28	62.20	8.59	9.45
1/12/09	3	22	N	SP	0.1	5.65	5.68	66.79	7.79	8.17	67.42	9.18	10.44	69.01	8.27	10.38
1/12/09	3	23	N	PC	0.2	6.06	6.38	65.23	9.09	10.39	64.69	8.39	9.97	65.45	8.57	10.02
1/12/09	3	24	N	SC	0.3	6.63	6.55	66.30	7.67	8.88	64.02	8.73	10.09	64.52	8.24	9.41
1/12/09	3	25	P	PC	0.1	5.91	5.92	65.86	8.80	9.70	66.34	8.85	10.06	66.66	9.39	10.20
1/12/09	3	26	N	SB	0.2	6.04	6.09	61.59	7.91	8.62	65.29	9.44	10.86	66.80	8.53	10.25
1/12/09	3	27	P	SC	0.1	5.95	5.91	64.35	8.11	8.56	67.38	9.21	10.58	66.62	8.60	9.95
1/12/09	3	28	P	PC	0.3	6.41	6.49	62.38	6.79	7.26	62.56	7.96	9.17	61.60	5.98	5.86
1/12/09	3	29	P	SB	0.2	5.93	5.90	66.19	9.28	10.20	67.00	9.41	10.61	65.10	9.02	10.08
1/12/09	3	30	P	PB	0.1	5.67	5.68	68.17	9.62	10.94	67.99	9.52	10.77	66.54	9.15	10.27
1/12/09	3	31	N	SB	0.3	5.93	6.24	63.20	8.17	8.86	67.57	7.70	9.46	65.04	8.07	9.26
1/12/09	3	32	N	PB	0.1	5.80	5.89	67.30	8.57	10.05	68.65	8.66	10.23	67.70	8.03	9.63
1/12/09	3	33	P	SB	0.3	6.09	6.07	65.86	8.71	9.87	65.45	8.66	9.51	65.89	9.52	10.81
1/12/09	3	34	N	PB	0.2	6.10	6.06	67.55	8.02	9.32	66.61	8.72	10.07	66.24	8.71	9.87

Cooked pH & color

Date	Week	Sample	PSENorm	Trt	Level	CkpH1	CkpH2	CkL1	CkA1	CkB1	CkL2	CkA2	CkB2	CkL3	CkA3	CkB3
12/2/08	1	1	N	SP	0.3	6.27	6.24	76.89	7.79	9.06	77.89	7.40	8.79	79.35	7.71	9.37
12/2/08	1	2	P	SC	0.2	6.54	6.16	76.53	7.65	8.66	75.96	8.12	9.06	74.99	8.33	9.77
12/2/08	1	3	P	PB	0.2	6.17	6.14	80.72	6.80	9.30	80.19	7.17	10.35	79.20	7.64	10.22
12/2/08	1	4	P	SB	0.3	6.31	6.29	78.39	7.76	10.00	77.74	7.88	9.95	77.62	8.67	10.52
12/2/08	1	5	N	SB	0.1	6.27	6.26	80.14	7.85	9.56	79.26	7.91	9.84	80.64	8.04	9.69
12/2/08	1	6	N	SC	0.1	6.28	6.41	78.11	8.04	9.56	78.68	7.89	9.36	78.69	8.02	9.75
12/2/08	1	7	N	SC	0.2	6.58	6.76	75.01	7.68	8.27	75.15	7.96	8.62	75.51	7.57	8.20
12/2/08	1	8	N	PB	0.3	6.58	6.56	76.21	7.96	8.98	76.69	7.83	9.09	77.15	7.92	9.24
12/2/08	1	9	P	PB	0.3	6.31	6.30	78.97	7.44	9.51	78.63	7.98	10.43	79.30	7.91	10.50
12/2/08	1	10	P	SP	0.2	5.89	5.90	79.92	6.75	9.74	80.00	7.55	10.83	78.82	7.42	10.28
12/2/08	1	11	P	SB	0.1	6.10	6.04	80.13	7.64	9.98	79.23	7.83	10.35	81.08	7.59	10.19
12/2/08	1	12	N	PB	0.2	6.41	6.38	79.84	7.85	9.53	78.64	7.88	9.53	79.55	7.75	9.46
12/2/08	1	13	P	SB	0.2	6.14	6.15	80.12	7.80	10.49	79.71	8.15	11.34	81.35	7.13	9.86
12/2/08	1	14	N	SP	0.1	6.08	6.08	78.89	8.63	11.16	79.56	8.86	11.10	79.29	8.65	11.45
12/2/08	1	15	P	PC	0.1	6.16	6.16	80.36	6.85	9.65	79.48	7.46	9.84	79.99	7.47	10.36
12/2/08	1	16	N	PC	0.2	6.79	6.73	75.46	7.46	8.60	75.12	7.88	8.57	75.12	8.02	9.23
12/2/08	1	17	N	PB	0.1	6.24	6.23	79.81	7.77	9.71	79.80	7.63	9.36	80.30	7.68	9.93
12/2/08	1	18	P	ddW	0	5.87	5.89	81.73	6.75	9.88	81.17	7.26	9.59	80.73	7.73	10.10
12/2/08	1	19	P	SP	0.3	5.94	5.95	80.10	7.19	10.02	79.78	7.05	9.73	80.64	7.26	10.39
12/2/08	1	20	P	PC	0.2	6.48	6.46	76.57	7.53	9.55	76.58	7.80	9.82	77.38	8.00	10.12
12/2/08	1	21	N	SB	0.3	6.50	6.55	77.87	7.48	8.60	77.99	7.41	8.86	77.39	7.75	9.20
12/2/08	1	22	P	Control	0	5.91	5.92	79.95	7.64	9.83	81.47	7.28	9.45	79.76	7.21	8.84
12/2/08	1	23	N	SP	0.2	6.15	6.13	80.90	6.80	9.02	80.16	7.33	9.39	79.99	7.28	9.61
12/2/08	1	24	N	Control	0	5.42	6.11	79.69	7.89	9.65	79.03	8.98	11.11	78.79	7.91	10.46
12/2/08	1	25	N	SC	0.3	7.16	7.06	73.33	7.11	7.31	72.75	7.72	7.85	74.10	7.14	7.47
12/2/08	1	26	N	PC	0.3	7.05	7.06	75.07	7.54	7.94	73.88	7.37	7.75	73.87	7.35	7.44
12/2/08	1	27	N	PC	0.1	6.39	6.37	79.48	7.55	9.20	79.08	7.53	9.30	79.06	7.64	9.38
12/2/08	1	28	P	PB	0.1	6.09	6.09	81.26	7.37	10.45	81.54	7.09	9.40	81.07	7.12	9.86
12/2/08	1	29	P	SP	0.1	5.81	5.84	81.87	7.07	9.78	81.80	7.43	10.17	81.09	7.58	10.53
12/2/08	1	30	N	SB	0.2	6.42	6.41	80.85	6.55	10.13	82.60	5.92	9.24	82.60	6.34	10.01
12/2/08	1	31	N	ddW	0	6.09	6.11	80.26	8.10	11.20	80.16	7.58	10.03	81.19	7.90	10.65
12/2/08	1	32	P	PC	0.3	6.79	6.79	76.26	7.37	8.08	75.18	7.36	8.08	75.29	7.33	7.94

12/2/08	1	33	P	SC	0.1	6.14	6.14	80.44	6.82	9.58	80.40	7.09	10.35	80.12	6.74	9.86
12/2/08	1	34	P	SC	0.3	6.76	6.75	74.54	6.88	7.45	73.72	6.90	7.61	74.66	6.87	7.14
12/8/08	2	1	N	PB	0.3	6.45	6.42	78.43	7.87	9.06	79.03	8.13	9.56	78.41	8.40	10.26
12/8/08	2	2	N	ddW	0	5.95	5.96	81.65	7.45	10.30	79.73	9.04	12.13	80.58	7.94	11.49
12/8/08	2	3	P	SP	0.2	5.79	5.78	79.41	7.23	9.74	77.91	8.06	10.38	79.72	7.33	9.96
12/8/08	2	4	P	SB	0.2	6.03	5.99	80.21	7.57	10.12	80.00	7.90	10.20	79.38	7.97	10.29
12/8/08	2	5	P	PC	0.2	6.37	6.38	75.96	8.55	9.84	77.06	8.73	10.00	76.50	8.49	9.82
12/8/08	2	6	N	Control	0	5.95	5.95	77.43	8.13	10.48	79.75	8.03	9.36	79.28	8.31	9.60
12/8/08	2	7	P	PB	0.1	6.00	6.01	80.74	7.70	9.35	79.79	8.43	10.26	80.15	8.10	10.26
12/8/08	2	8	N	PB	0.2	6.24	6.24	79.88	7.88	9.88	80.54	7.33	9.45	79.68	7.75	10.18
12/8/08	2	9	P	SP	0.1	5.72	5.73	78.35	6.71	9.87	79.56	8.05	10.47	81.23	7.94	10.85
12/8/08	2	10	N	SC	0.1	6.15	6.23	80.58	6.68	9.01	79.37	7.04	8.99	79.67	7.52	10.48
12/8/08	2	11	P	SC	0.1	6.00	6.00	78.82	7.40	9.84	80.08	7.47	10.19	79.73	7.58	10.41
12/8/08	2	12	N	PC	0.1	6.21	6.24	79.89	7.11	8.94	79.66	7.25	9.27	78.49	7.83	10.49
12/8/08	2	13	P	SP	0.3	5.86	5.85	78.07	6.59	10.32	78.82	7.22	9.68	79.80	6.74	9.04
12/8/08	2	14	N	SC	0.2	6.61	6.61	75.85	8.48	10.12	76.22	8.23	9.32	75.64	8.35	9.65
12/8/08	2	15	N	PB	0.1	6.11	6.11	80.60	8.23	10.95	78.71	8.81	12.38	79.81	9.25	12.00
12/8/08	2	16	P	PC	0.1	6.03	6.02	81.52	6.33	8.93	80.10	7.16	10.01	79.82	7.71	10.12
12/8/08	2	17	P	SB	0.1	6.11	6.07	79.40	7.87	9.48	80.62	8.05	9.39	81.04	7.55	8.78
12/8/08	2	18	N	SC	0.3	6.95	6.98	73.69	7.22	6.17	74.75	7.14	6.60	73.23	7.35	6.60
12/8/08	2	19	P	PC	0.3	6.72	6.78	74.48	7.90	7.00	74.51	8.06	7.42	74.87	8.06	7.81
12/8/08	2	20	P	SC	0.3	6.67	6.56	74.93	7.77	7.11	74.88	7.90	7.66	74.81	7.63	7.25
12/8/08	2	21	N	SP	0.3	6.08	6.08	79.65	6.97	9.01	78.99	8.29	10.19	79.88	7.21	9.36
12/8/08	2	22	N	SB	0.1	6.33	6.30	80.20	6.94	8.57	79.79	7.85	9.56	79.12	7.64	9.26
12/8/08	2	23	N	PC	0.3	7.03	7.01	73.44	7.59	6.84	74.71	7.04	6.62	74.31	7.57	6.81
12/8/08	2	24	P	SB	0.3	6.27	6.26	79.33	8.03	9.92	79.62	7.60	9.44	79.42	7.57	9.18
12/8/08	2	25	N	PC	0.2	6.68	6.70	77.12	7.77	8.02	77.18	7.63	8.34	76.16	7.83	8.21
12/8/08	2	26	N	SB	0.3	6.46	6.47	78.56	7.73	8.84	79.05	7.69	8.76	78.92	7.72	8.45
12/8/08	2	27	P	PB	0.2	6.10	6.10	79.42	6.97	9.04	80.00	7.50	9.59	80.59	7.25	9.30
12/8/08	2	28	N	SP	0.2	6.00	6.03	80.44	6.74	8.82	80.71	7.28	9.27	80.55	7.26	9.36
12/8/08	2	29	N	SP	0.1	5.94	5.98	81.28	6.66	8.97	81.23	6.99	9.80	81.25	6.88	9.20
12/8/08	2	30	P	PB	0.3	6.24	6.27	78.04	7.80	9.71	78.89	7.85	9.91	77.87	8.26	10.90
12/8/08	2	31	P	Control	0	5.85	5.87	78.61	7.35	9.41	78.95	7.66	8.99	79.80	7.59	8.83
12/8/08	2	32	N	SB	0.2	6.27	6.28	79.68	7.06	8.75	79.50	7.25	9.02	80.77	6.94	8.69
12/8/08	2	33	P	ddW	0	5.89	5.88	81.58	6.96	9.18	81.26	7.02	9.43	81.83	6.40	9.11

12/8/08	2	34	P	SC	0.2	6.48	6.45	77.58	7.53	8.86	76.96	7.61	8.90	75.68	8.45	9.49
1/12/09	3	1	P	SP	0.3	5.73	5.75	78.54	7.83	9.21	77.25	8.73	10.45	76.18	7.06	9.68
1/12/09	3	2	P	ddW	0	5.68	5.68	81.02	6.49	8.84	81.29	6.34	8.74	80.04	7.50	9.56
1/12/09	3	3	N	ddW	0	5.89	5.86	81.40	7.50	9.09	82.14	7.43	9.19	78.99	9.78	12.00
1/12/09	3	4	N	PC	0.3	6.48	6.81	74.34	7.17	7.39	74.90	7.16	7.23	74.21	7.64	7.91
1/12/09	3	5	P	Control	0	5.68	5.68	79.13	6.69	8.71	77.35	8.39	10.30	78.42	8.68	9.90
1/12/09	3	6	N	SP	0.2	5.85	5.85	77.77	7.40	9.87	80.70	6.58	9.21	81.53	6.98	9.53
1/12/09	3	7	P	PB	0.3	6.04	6.03	79.24	6.40	8.74	78.06	8.36	10.42	76.95	8.48	10.78
1/12/09	3	8	N	SP	0.3	5.91	5.89	79.51	6.83	9.50	78.98	7.46	9.49	78.87	8.00	10.52
1/12/09	3	9	N	PC	0.1	6.05	6.11	80.08	7.77	9.99	79.67	7.90	9.83	78.85	7.78	10.31
1/12/09	3	10	N	SC	0.2	6.38	6.40	76.80	7.82	8.90	77.28	7.81	8.72	78.38	7.56	8.63
1/12/09	3	11	P	SP	0.1	5.63	5.59	80.20	6.76	8.62	80.98	6.98	9.99	79.96	8.19	10.50
1/12/09	3	12	P	PC	0.2	6.19	6.19	77.88	7.83	9.11	78.13	7.60	9.29	79.03	7.61	9.82
1/12/09	3	13	P	SB	0.1	5.88	5.86	80.05	8.09	9.67	80.02	8.33	9.75	79.96	8.09	9.62
1/12/09	3	14	P	PB	0.2	5.99	5.98	79.62	7.61	9.31	78.07	8.02	10.17	78.35	8.71	11.19
1/12/09	3	15	N	PB	0.3	6.25	6.28	78.81	7.52	9.18	79.21	7.27	8.60	79.65	7.03	8.71
1/12/09	3	16	N	SB	0.1	6.02	6.03	73.93	4.10	6.77	76.82	9.50	11.62	79.93	8.08	10.46
1/12/09	3	17	N	SC	0.1	6.10	6.09	80.34	6.56	8.43	80.33	7.46	8.96	79.09	8.66	10.49
1/12/09	3	18	P	SC	0.2	6.18	6.19	75.96	9.57	10.93	76.24	8.54	10.32	77.23	8.15	10.08
1/12/09	3	19	N	Control	0	5.86	5.87	79.74	9.14	10.69	80.32	6.51	8.61	79.42	8.49	9.97
1/12/09	3	20	P	SP	0.2	5.68	5.66	80.11	6.58	9.11	78.96	6.69	10.06	80.11	7.34	9.89
1/12/09	3	21	P	SC	0.3	6.48	6.46	74.67	7.97	8.81	74.71	7.38	7.83	75.53	7.94	8.38
1/12/09	3	22	N	SP	0.1	5.79	5.78	80.12	7.64	10.68	81.02	7.98	10.71	79.74	8.12	11.23
1/12/09	3	23	N	PC	0.2	6.45	6.44	76.83	7.43	8.25	77.25	7.70	8.63	76.24	7.61	8.69
1/12/09	3	24	N	SC	0.3	6.63	6.69	74.58	7.07	7.02	75.13	6.98	6.99	75.01	7.15	7.64
1/12/09	3	25	P	PC	0.1	5.93	5.94	79.04	7.98	10.38	78.44	7.29	9.85	79.64	8.40	10.73
1/12/09	3	26	N	SB	0.2	6.15	6.12	79.78	7.29	8.90	79.37	8.03	10.18	81.04	7.40	9.18
1/12/09	3	27	P	SC	0.1	5.95	5.95	79.50	6.99	8.68	79.39	5.29	7.76	80.58	7.17	9.01
1/12/09	3	28	P	PC	0.3	6.47	6.52	75.01	7.27	7.20	74.79	7.53	8.13	75.10	7.16	7.38
1/12/09	3	29	P	SB	0.2	5.96	5.98	79.26	7.61	9.49	79.45	7.29	9.77	79.06	7.28	9.18
1/12/09	3	30	P	PB	0.1	5.90	5.90	79.72	6.88	8.87	79.11	8.02	10.30	78.37	9.03	11.19
1/12/09	3	31	N	SB	0.3	6.19	6.27	78.94	6.97	8.56	78.63	7.72	10.35	78.86	7.46	9.46
1/12/09	3	32	N	PB	0.1	6.02	6.04	81.56	6.83	8.82	79.05	8.46	10.86	80.63	7.66	10.07
1/12/09	3	33	P	SB	0.3	6.04	5.99	78.64	6.58	8.49	77.46	7.61	10.01	78.26	7.43	9.80
1/12/09	3	34	N	PB	0.2	6.12	6.18	79.20	6.59	9.09	79.15	7.81	10.37	78.53	7.84	11.60

Carver press method for WHC

Date	Week	Sample	PSENorm	Trt	Level	CarWt1	CarWt2	CarWt3	MCarWt	1Meat1	1Meat2	1Meat3	1Meat4
12/2/08	1	1	N	SP	0.3	0.4977	0.5007	0.4985	0.4990	4.5	4.3	4.4	4.4
12/2/08	1	2	P	SC	0.2	0.4996	0.4967	0.4989	0.4984	4.4	4.7	5.0	5.0
12/2/08	1	3	P	PB	0.2	0.5002	0.5013	0.4990	0.5002	4.3	4.3	4.1	4.1
12/2/08	1	4	P	SB	0.3	0.4990	0.4962	0.5039	0.4997	4.6	4.7	4.6	4.8
12/2/08	1	5	N	SB	0.1	0.4961	0.5026	0.4982	0.4990	4.6	4.7	5.0	4.8
12/2/08	1	6	N	SC	0.1	0.4983	0.4985	0.5012	0.4993	5.0	5.0	5.0	5.1
12/2/08	1	7	N	SC	0.2	0.4996	0.5002	0.4991	0.4996	5.0	5.0	4.8	5.0
12/2/08	1	8	N	PB	0.3	0.5044	0.4991	0.5026	0.5020	4.6	4.6	4.6	4.7
12/2/08	1	9	P	PB	0.3	0.4973	0.4984	0.4998	0.4985	4.2	4.4	4.5	4.6
12/2/08	1	10	P	SP	0.2	0.4967	0.5003	0.4994	0.4988	4.0	4.0	4.2	4.2
12/2/08	1	11	P	SB	0.1	0.5034	0.5029	0.4990	0.5018	4.5	4.4	4.2	4.4
12/2/08	1	12	N	PB	0.2	0.4973	0.5014	0.4976	0.4988	4.6	4.6	4.6	4.7
12/2/08	1	13	P	SB	0.2	0.5007	0.5010	0.4970	0.4996	4.3	4.3	4.4	4.4
12/2/08	1	14	N	SP	0.1	0.5011	0.5014	0.4992	0.5006	4.3	4.3	4.5	4.6
12/2/08	1	15	P	PC	0.1	0.4997	0.4984	0.5040	0.5007	4.7	4.7	4.6	4.6
12/2/08	1	16	N	PC	0.2	0.5033	0.4979	0.5028	0.5013	5.8	5.6	5.2	5.0
12/2/08	1	17	N	PB	0.1	0.4965	0.4999	0.5001	0.4988	4.7	4.6	4.6	4.9
12/2/08	1	18	P	ddW	0	0.4951	0.5025	0.4983	0.4986	4.4	4.3	4.4	4.7
12/2/08	1	19	P	SP	0.3	0.4971	0.5034	0.5025	0.5010	4.5	4.7	4.7	4.4
12/2/08	1	20	P	PC	0.2	0.4975	0.5043	0.4966	0.4995	4.8	4.7	4.6	4.3
12/2/08	1	21	N	SB	0.3	0.5012	0.4960	0.5015	0.4996	4.6	4.6	4.8	4.7
12/2/08	1	22	P	Control	0	0.4993	0.5029	0.4995	0.5006	3.9	4.0	4.2	4.2
12/2/08	1	23	N	SP	0.2	0.5035	0.4976	0.4986	0.4999	4.5	4.8	4.4	4.5
12/2/08	1	24	N	Control	0	0.5009	0.4969	0.4971	0.4983	4.7	4.5	4.8	4.5
12/2/08	1	25	N	SC	0.3	0.4973	0.5001	0.5021	0.4998	5.0	5.2	5.2	5.0
12/2/08	1	26	N	PC	0.3	0.5032	0.4977	0.4965	0.4991	5.3	5.2	5.4	5.5
12/2/08	1	27	N	PC	0.1	0.5023	0.5034	0.5040	0.5032	4.7	4.6	4.9	5.0
12/2/08	1	28	P	PB	0.1	0.5027	0.4996	0.4994	0.5006	4.5	4.5	4.7	4.5
12/2/08	1	29	P	SP	0.1	0.5024	0.5019	0.5018	0.5020	4.2	4.2	4.4	4.3
12/2/08	1	30	N	SB	0.2	0.4994	0.4956	0.5050	0.5000	4.7	4.9	4.8	5.0
12/2/08	1	31	N	ddW	0	0.5044	0.5023	0.4953	0.5007	4.6	4.9	4.6	4.7
12/2/08	1	32	P	PC	0.3	0.5048	0.4994	0.4994	0.5012	5.3	5.1	5.3	5.3

12/2/08	1	33	P	SC	0.1	0.4989	0.5038	0.5022	0.5016	4.7	4.7	4.7	4.6
12/2/08	1	34	P	SC	0.3	0.5041	0.4988	0.4982	0.5004	4.9	5.1	5.2	5.2
12/8/08	2	1	N	PB	0.3	0.4973	0.5000	0.4999	0.4991	4.9	5.0	4.9	5.0
12/8/08	2	2	N	ddW	0	0.5007	0.4970	0.4985	0.4987	4.8	4.8	4.6	4.7
12/8/08	2	3	P	SP	0.2	0.4996	0.5043	0.5031	0.5023	4.5	4.5	5.0	4.3
12/8/08	2	4	P	SB	0.2	0.5009	0.4986	0.5019	0.5005	4.9	4.9	4.9	4.9
12/8/08	2	5	P	PC	0.2	0.5008	0.5018	0.5015	0.5014	4.3	4.4	4.1	4.5
12/8/08	2	6	N	Control	0	0.5050	0.4962	0.5034	0.5015	4.4	4.4	4.3	4.5
12/8/08	2	7	P	PB	0.1	0.4991	0.4986	0.5005	0.4994	4.4	4.3	4.4	4.4
12/8/08	2	8	N	PB	0.2	0.4985	0.5017	0.5015	0.5006	4.9	4.8	4.9	4.7
12/8/08	2	9	P	SP	0.1	0.4982	0.5030	0.4955	0.4989	4.1	4.1	4.1	4.2
12/8/08	2	10	N	SC	0.1	0.5029	0.5008	0.5012	0.5016	4.6	4.5	5.0	4.7
12/8/08	2	11	P	SC	0.1	0.5008	0.5018	0.5037	0.5021	4.3	4.1	4.3	4.4
12/8/08	2	12	N	PC	0.1	0.5007	0.5001	0.5046	0.5018	4.8	4.3	4.6	4.3
12/8/08	2	13	P	SP	0.3	0.5049	0.5025	0.4998	0.5024	4.3	4.4	4.5	4.6
12/8/08	2	14	N	SC	0.2	0.4972	0.5039	0.5035	0.5015	5.0	5.1	5.0	5.0
12/8/08	2	15	N	PB	0.1	0.5040	0.5039	0.4973	0.5017	4.4	4.2	4.3	4.0
12/8/08	2	16	P	PC	0.1	0.4968	0.5031	0.5045	0.5015	4.1	4.1	4.4	4.4
12/8/08	2	17	P	SB	0.1	0.5033	0.5008	0.4984	0.5008	4.3	4.2	4.3	4.1
12/8/08	2	18	N	SC	0.3	0.5028	0.4963	0.5026	0.5006	5.3	5.3	5.3	5.4
12/8/08	2	19	P	PC	0.3	0.5004	0.4981	0.5088	0.5024	4.6	4.6	4.7	4.7
12/8/08	2	20	P	SC	0.3	0.5010	0.5026	0.5039	0.5025	4.6	4.8	4.5	4.5
12/8/08	2	21	N	SP	0.3	0.4994	0.4969	0.5070	0.5011	3.8	4.1	4.2	4.2
12/8/08	2	22	N	SB	0.1	0.5077	0.5037	0.5070	0.5061	3.9	4.0	4.0	4.1
12/8/08	2	23	N	PC	0.3	0.4995	0.4969	0.4964	0.4976	5.1	5.2	5.1	4.9
12/8/08	2	24	P	SB	0.3	0.4945	0.4929	0.5058	0.4977	4.3	4.2	4.2	4.1
12/8/08	2	25	N	PC	0.2	0.4920	0.5090	0.4999	0.5003	4.4	4.7	4.9	5.0
12/8/08	2	26	N	SB	0.3	0.5089	0.4955	0.4972	0.5005	4.6	4.5	4.8	4.7
12/8/08	2	27	P	PB	0.2	0.5094	0.4958	0.4927	0.4993	4.2	4.4	4.3	4.2
12/8/08	2	28	N	SP	0.2	0.5094	0.5035	0.4954	0.5028	3.9	3.9	3.9	3.9
12/8/08	2	29	N	SP	0.1	0.5045	0.4998	0.4999	0.5014	4.1	4.3	4.1	4.1
12/8/08	2	30	P	PB	0.3	0.5094	0.4945	0.5007	0.5015	4.1	4.3	4.5	4.5
12/8/08	2	31	P	Control	0	0.5060	0.5034	0.4907	0.5000	3.7	3.6	3.6	3.9
12/8/08	2	32	N	SB	0.2	0.5019	0.4997	0.5082	0.5033	4.3	4.3	4.3	4.4
12/8/08	2	33	P	ddW	0	0.5045	0.5093	0.5064	0.5067	4.0	4.0	4.0	4.0

12/8/08	2	34	P	SC	0.2	0.5048	0.5036	0.4959	0.5014	4.3	4.1	4.2	4.3
1/12/09	3	1	P	SP	0.3	0.5047	0.4969	0.4961	0.4992	4.0	4.1	4.1	4.1
1/12/09	3	2	P	ddW	0	0.5024	0.5042	0.5022	0.5029	3.8	3.6	3.8	3.8
1/12/09	3	3	N	ddW	0	0.4967	0.4999	0.4997	0.4988	4.0	3.9	3.9	4.0
1/12/09	3	4	N	PC	0.3	0.5041	0.4972	0.5041	0.5018	4.8	4.9	5.0	5.0
1/12/09	3	5	P	Control	0	0.4986	0.5005	0.4952	0.4981	4.0	4.0	4.1	4.1
1/12/09	3	6	N	SP	0.2	0.4980	0.5020	0.4978	0.4993	3.9	4.1	4.4	4.3
1/12/09	3	7	P	PB	0.3	0.5003	0.5016	0.5048	0.5022	4.5	4.6	4.5	4.3
1/12/09	3	8	N	SP	0.3	0.5008	0.5031	0.4975	0.5005	4.0	4.0	4.3	4.4
1/12/09	3	9	N	PC	0.1	0.4973	0.4976	0.5048	0.4999	4.4	4.4	4.4	4.5
1/12/09	3	10	N	SC	0.2	0.5002	0.5008	0.5042	0.5017	4.3	4.2	4.5	4.6
1/12/09	3	11	P	SP	0.1	0.5012	0.5030	0.5042	0.5028	3.9	3.8	3.9	3.8
1/12/09	3	12	P	PC	0.2	0.5040	0.5002	0.4980	0.5007	4.3	4.4	4.3	4.3
1/12/09	3	13	P	SB	0.1	0.4980	0.4972	0.5023	0.4992	3.9	3.8	4.0	4.0
1/12/09	3	14	P	PB	0.2	0.5036	0.5044	0.5018	0.5033	4.3	4.4	4.5	4.2
1/12/09	3	15	N	PB	0.3	0.5005	0.4959	0.5048	0.5004	4.3	4.4	4.6	4.4
1/12/09	3	16	N	SB	0.1	0.5019	0.5017	0.5024	0.5020	3.9	3.8	4.0	4.1
1/12/09	3	17	N	SC	0.1	0.5040	0.5021	0.5046	0.5036	4.3	4.3	4.5	4.6
1/12/09	3	18	P	SC	0.2	0.4998	0.5015	0.4972	0.4995	4.4	4.7	4.6	4.5
1/12/09	3	19	N	Control	0	0.5012	0.5045	0.5046	0.5034	3.9	3.9	4.0	4.1
1/12/09	3	20	P	SP	0.2	0.4983	0.4974	0.5012	0.4990	3.8	3.9	3.9	3.8
1/12/09	3	21	P	SC	0.3	0.4960	0.5008	0.5027	0.4998	4.7	4.8	4.7	4.6
1/12/09	3	22	N	SP	0.1	0.4979	0.4958	0.4974	0.4970	3.7	3.8	3.7	3.7
1/12/09	3	23	N	PC	0.2	0.5042	0.5011	0.5004	0.5019	5.5	5.4	5.5	5.3
1/12/09	3	24	N	SC	0.3	0.5024	0.5031	0.4984	0.5013	4.7	4.7	4.8	5.0
1/12/09	3	25	P	PC	0.1	0.5016	0.4959	0.5008	0.4994	4.0	4.2	5.0	5.0
1/12/09	3	26	N	SB	0.2	0.4951	0.4991	0.4958	0.4967	4.1	4.3	4.6	4.4
1/12/09	3	27	P	SC	0.1	0.4984	0.4954	0.5032	0.4990	4.1	4.2	4.6	4.6
1/12/09	3	28	P	PC	0.3	0.4951	0.4966	0.5046	0.4988	4.7	4.6	4.5	4.7
1/12/09	3	29	P	SB	0.2	0.4959	0.4977	0.4982	0.4973	4.3	4.3	4.3	4.3
1/12/09	3	30	P	PB	0.1	0.5048	0.4999	0.5047	0.5031	3.7	4.0	4.0	3.8
1/12/09	3	31	N	SB	0.3	0.4950	0.5003	0.5032	0.4995	4.7	4.4	4.6	4.5
1/12/09	3	32	N	PB	0.1	0.4987	0.5010	0.5041	0.5013	4.4	4.2	4.1	4.4
1/12/09	3	33	P	SB	0.3	0.5030	0.5014	0.4967	0.5004	4.4	4.2	4.4	4.2
1/12/09	3	34	N	PB	0.2	0.5015	0.5010	0.4982	0.5002	4.4	4.3	4.3	4.3

Date	Week	Sample	PSENorm	Trt	Level	1Meat5	1Meat6	1Meat7	1Meat8	1Ring1	1Ring2	1Ring3	1Ring4	1Ring5
12/2/08	1	1	N	SP	0.3	4.5	4.4	4.5	4.5	6.3	6.0	5.9	5.8	5.9
12/2/08	1	2	P	SC	0.2	4.7	4.8	4.6	4.5	6.0	6.1	6.5	6.6	6.5
12/2/08	1	3	P	PB	0.2	4.2	4.3	4.4	4.5	6.2	6.0	5.9	5.8	5.9
12/2/08	1	4	P	SB	0.3	4.9	4.7	4.5	4.6	6.0	6.1	6.1	6.2	6.2
12/2/08	1	5	N	SB	0.1	4.8	4.8	4.6	4.7	5.8	6.0	6.3	6.5	6.5
12/2/08	1	6	N	SC	0.1	5.1	4.9	4.8	5.0	6.2	6.3	6.4	6.5	6.4
12/2/08	1	7	N	SC	0.2	5.2	5.3	5.3	5.2	6.1	6.0	6.0	6.1	6.5
12/2/08	1	8	N	PB	0.3	4.9	5.0	4.9	4.6	5.7	5.7	5.8	5.8	6.0
12/2/08	1	9	P	PB	0.3	4.6	4.5	4.4	4.3	6.0	6.0	6.3	6.2	6.3
12/2/08	1	10	P	SP	0.2	4.3	4.1	4.1	4.0	5.9	6.1	6.1	6.5	6.3
12/2/08	1	11	P	SB	0.1	4.5	4.7	4.9	4.6	6.2	6.1	6.2	6.2	6.3
12/2/08	1	12	N	PB	0.2	4.8	4.6	5.0	5.0	6.1	6.1	6.1	6.1	6.1
12/2/08	1	13	P	SB	0.2	4.5	4.5	4.5	4.5	6.1	5.9	5.9	5.8	5.8
12/2/08	1	14	N	SP	0.1	4.6	4.7	4.5	4.3	6.3	6.1	6.1	6.5	6.3
12/2/08	1	15	P	PC	0.1	4.5	4.5	4.5	4.5	6.0	6.0	6.0	6.0	6.0
12/2/08	1	16	N	PC	0.2	5.3	5.3	5.4	5.5	6.7	6.7	6.5	6.2	6.1
12/2/08	1	17	N	PB	0.1	4.8	4.6	4.7	4.8	5.8	5.7	6.1	6.1	6.2
12/2/08	1	18	P	ddW	0	4.4	4.4	4.5	4.2	6.3	6.2	6.1	6.1	5.9
12/2/08	1	19	P	SP	0.3	4.4	4.5	4.6	4.5	6.0	6.2	6.1	6.1	6.1
12/2/08	1	20	P	PC	0.2	4.5	4.6	4.7	4.7	6.0	6.0	5.8	6.0	6.1
12/2/08	1	21	N	SB	0.3	4.8	4.8	4.8	4.9	6.0	6.0	6.0	6.0	5.9
12/2/08	1	22	P	Control	0	3.9	4.0	4.0	4.0	5.9	5.9	6.1	6.1	5.8
12/2/08	1	23	N	SP	0.2	4.8	4.8	4.9	4.8	6.4	6.1	6.0	5.9	6.3
12/2/08	1	24	N	Control	0	4.6	4.5	4.5	4.7	5.9	5.9	6.0	5.8	5.7
12/2/08	1	25	N	SC	0.3	5.5	5.3	5.4	5.3	5.9	5.7	5.9	5.9	6.2
12/2/08	1	26	N	PC	0.3	5.4	5.4	5.5	5.2	6.1	6.0	6.2	6.2	6.2
12/2/08	1	27	N	PC	0.1	5.0	5.0	5.1	4.8	6.1	6.1	6.2	6.4	6.4
12/2/08	1	28	P	PB	0.1	4.6	4.3	4.5	4.4	6.4	6.4	6.5	6.2	6.0
12/2/08	1	29	P	SP	0.1	4.4	4.2	4.1	4.0	6.0	6.1	6.2	6.2	6.0
12/2/08	1	30	N	SB	0.2	4.6	4.7	4.6	5.0	6.1	6.0	5.9	5.9	6.0
12/2/08	1	31	N	ddW	0	4.8	4.8	4.6	4.5	6.2	6.1	6.0	6.2	6.4
12/2/08	1	32	P	PC	0.3	5.2	5.3	5.2	5.1	6.2	6.3	6.3	6.1	6.1
12/2/08	1	33	P	SC	0.1	4.4	4.6	4.4	4.5	6.4	6.5	6.1	5.8	5.8
12/2/08	1	34	P	SC	0.3	5.1	5.1	5.0	5.0	5.7	5.7	5.9	6.1	6.1

12/8/08	2	1	N	PB	0.3	4.9	4.9	4.8	4.9	6.3	6.3	5.6	6.4	6.2
12/8/08	2	2	N	ddW	0	4.6	4.5	4.8	4.7	6.6	6.5	6.8	6.8	6.6
12/8/08	2	3	P	SP	0.2	4.1	4.2	4.5	4.3	6.2	6.1	5.7	5.7	5.8
12/8/08	2	4	P	SB	0.2	4.9	4.8	4.7	4.7	6.5	6.3	6.4	6.2	6.3
12/8/08	2	5	P	PC	0.2	4.5	4.5	4.5	4.3	6.3	6.3	6.1	6.3	6.0
12/8/08	2	6	N	Control	0	4.2	4.3	4.1	4.3	5.9	6.1	5.9	5.9	5.9
12/8/08	2	7	P	PB	0.1	4.4	4.5	4.3	4.3	5.7	5.8	6.2	6.3	6.2
12/8/08	2	8	N	PB	0.2	5.1	4.7	4.8	4.8	6.2	6.2	6.1	6.9	6.8
12/8/08	2	9	P	SP	0.1	4.3	4.3	4.2	4.2	6.1	6.2	6.0	5.9	6.0
12/8/08	2	10	N	SC	0.1	4.8	4.5	4.5	4.4	6.3	6.5	6.4	6.6	6.9
12/8/08	2	11	P	SC	0.1	4.7	4.6	4.6	4.4	5.9	5.8	5.8	6.1	6.3
12/8/08	2	12	N	PC	0.1	4.4	4.3	4.3	4.3	6.2	6.1	6.3	6.1	6.0
12/8/08	2	13	P	SP	0.3	4.4	4.4	4.4	4.4	6.0	6.0	6.1	6.1	6.0
12/8/08	2	14	N	SC	0.2	5.0	5.1	5.1	5.0	6.3	6.3	6.3	6.2	6.2
12/8/08	2	15	N	PB	0.1	4.1	4.5	4.4	4.3	6.3	6.2	6.2	5.9	6.0
12/8/08	2	16	P	PC	0.1	4.4	4.3	4.3	4.3	6.6	6.5	6.4	6.3	6.1
12/8/08	2	17	P	SB	0.1	4.1	4.1	4.0	4.0	6.2	6.3	6.2	6.3	6.4
12/8/08	2	18	N	SC	0.3	5.5	5.4	5.4	5.4	6.5	6.6	6.6	6.5	6.5
12/8/08	2	19	P	PC	0.3	4.8	4.8	4.8	4.8	6.0	6.1	6.9	6.2	6.2
12/8/08	2	20	P	SC	0.3	5.0	4.6	4.7	4.8	6.1	6.5	6.7	6.4	6.5
12/8/08	2	21	N	SP	0.3	4.0	3.9	3.9	3.9	6.1	6.1	6.3	6.2	6.4
12/8/08	2	22	N	SB	0.1	4.2	4.1	4.0	4.0	5.9	6.0	6.1	6.1	6.4
12/8/08	2	23	N	PC	0.3	5.0	5.1	5.2	5.2	6.1	6.2	6.1	6.1	6.1
12/8/08	2	24	P	SB	0.3	4.2	4.3	4.3	4.3	6.1	6.2	6.2	6.3	6.4
12/8/08	2	25	N	PC	0.2	5.1	5.0	4.9	4.6	5.7	5.9	6.2	6.2	6.5
12/8/08	2	26	N	SB	0.3	4.6	4.7	4.9	4.5	6.2	6.0	6.2	6.3	6.3
12/8/08	2	27	P	PB	0.2	4.2	4.0	4.1	4.2	6.2	6.4	6.3	6.3	6.1
12/8/08	2	28	N	SP	0.2	4.0	4.1	4.0	4.0	6.4	5.8	5.9	6.1	6.2
12/8/08	2	29	N	SP	0.1	4.2	4.2	4.3	4.2	6.3	6.1	6.1	6.2	6.6
12/8/08	2	30	P	PB	0.3	4.3	4.1	4.4	4.2	6.2	6.3	6.4	6.3	6.1
12/8/08	2	31	P	Control	0	3.6	3.9	3.9	3.8	5.6	5.3	5.6	5.7	6.0
12/8/08	2	32	N	SB	0.2	4.5	4.2	4.3	4.4	6.1	6.3	6.3	6.4	6.4
12/8/08	2	33	P	ddW	0	4.2	4.3	4.4	4.2	6.3	6.3	6.4	6.4	6.4
12/8/08	2	34	P	SC	0.2	4.1	4.1	4.3	4.3	5.9	6.0	6.0	6.2	5.8
1/12/09	3	1	P	SP	0.3	4.1	4.0	4.0	4.1	5.9	6.1	6.3	6.4	6.6

1/12/09	3	2	P	ddW	0	3.9	3.7	3.8	3.7	5.9	5.6	5.6	5.9	6.2
1/12/09	3	3	N	ddW	0	4.0	4.1	4.1	4.1	5.8	5.8	5.9	6.2	6.3
1/12/09	3	4	N	PC	0.3	5.3	4.9	5.0	4.8	6.9	6.4	6.5	6.6	6.5
1/12/09	3	5	P	Control	0	4.2	4.1	4.2	4.0	5.8	5.7	5.5	5.6	5.8
1/12/09	3	6	N	SP	0.2	4.1	4.1	4.1	4.0	6.5	6.6	6.4	6.1	5.8
1/12/09	3	7	P	PB	0.3	4.2	4.3	4.8	4.3	6.0	6.2	6.1	6.0	5.6
1/12/09	3	8	N	SP	0.3	4.3	4.0	4.0	4.1	5.8	5.8	5.9	6.1	6.2
1/12/09	3	9	N	PC	0.1	4.4	4.4	4.4	4.3	5.7	6.0	6.1	6.3	6.2
1/12/09	3	10	N	SC	0.2	4.5	4.6	4.6	4.7	5.5	5.6	5.6	5.9	5.9
1/12/09	3	11	P	SP	0.1	4.0	4.0	4.0	3.9	6.3	5.9	6.0	5.9	6.2
1/12/09	3	12	P	PC	0.2	4.4	4.5	4.5	4.4	5.7	5.8	5.9	6.1	6.3
1/12/09	3	13	P	SB	0.1	4.0	4.0	4.1	4.1	5.7	5.9	6.0	6.1	6.3
1/12/09	3	14	P	PB	0.2	4.0	3.7	3.8	4.1	6.4	6.6	6.4	6.5	6.3
1/12/09	3	15	N	PB	0.3	4.4	4.4	4.5	4.6	5.9	6.0	6.4	6.3	6.3
1/12/09	3	16	N	SB	0.1	4.3	4.3	4.3	4.0	5.8	5.8	5.7	5.8	6.4
1/12/09	3	17	N	SC	0.1	4.4	4.4	4.5	4.4	6.1	5.8	5.8	5.9	5.9
1/12/09	3	18	P	SC	0.2	4.4	4.3	4.3	4.5	6.1	6.3	6.3	6.0	5.9
1/12/09	3	19	N	Control	0	4.0	3.9	3.9	3.9	5.7	6.0	5.9	5.9	5.5
1/12/09	3	20	P	SP	0.2	3.6	3.6	3.5	3.6	6.3	6.5	6.4	6.3	5.8
1/12/09	3	21	P	SC	0.3	4.6	4.7	4.8	4.8	6.0	5.8	5.9	5.9	6.0
1/12/09	3	22	N	SP	0.1	3.6	3.7	3.7	3.7	6.0	5.8	5.6	5.8	5.9
1/12/09	3	23	N	PC	0.2	5.3	5.2	5.4	5.5	6.4	6.3	6.4	6.1	5.9
1/12/09	3	24	N	SC	0.3	4.8	4.8	5.0	4.8	5.7	5.7	5.8	6.0	6.4
1/12/09	3	25	P	PC	0.1	4.6	4.1	4.0	4.0	5.9	6.1	6.6	6.8	6.6
1/12/09	3	26	N	SB	0.2	4.5	4.4	4.4	4.3	5.9	5.9	6.0	6.1	6.1
1/12/09	3	27	P	SC	0.1	4.3	4.3	4.1	4.3	6.3	6.5	6.6	6.5	6.4
1/12/09	3	28	P	PC	0.3	4.5	4.7	4.8	5.0	5.9	5.9	5.8	6.1	6.0
1/12/09	3	29	P	SB	0.2	4.1	4.0	4.0	4.3	6.1	6.3	6.4	6.4	6.0
1/12/09	3	30	P	PB	0.1	3.8	3.6	3.8	3.9	6.3	6.1	6.1	6.0	6.1
1/12/09	3	31	N	SB	0.3	4.3	4.3	4.5	4.8	5.9	5.8	6.0	6.0	6.1
1/12/09	3	32	N	PB	0.1	4.0	4.3	4.3	4.3	6.4	6.1	6.0	5.9	6.0
1/12/09	3	33	P	SB	0.3	4.4	4.4	4.2	4.3	5.7	5.7	5.8	5.8	6.3
1/12/09	3	34	N	PB	0.2	4.4	4.5	4.6	4.4	6.0	5.8	5.8	5.9	6.0

Date	Week	Sample	PSENorm	Trt	Level	1Ring6	1Ring7	1Ring8	2Meat1	2Meat2	2Meat3	2Meat4	2Meat5	2Meat6
12/2/08	1	1	N	SP	0.3	6.1	6.3	6.3	4.3	4.2	4.3	4.4	4.4	4.3
12/2/08	1	2	P	SC	0.2	6.2	6.2	6.0	4.7	4.7	4.6	4.6	4.7	4.8
12/2/08	1	3	P	PB	0.2	5.9	6.0	6.3	4.2	4.4	4.2	4.0	4.1	4.1
12/2/08	1	4	P	SB	0.3	6.0	5.9	5.9	4.7	4.7	4.7	4.6	4.6	4.7
12/2/08	1	5	N	SB	0.1	6.2	5.9	5.8	4.8	4.8	4.5	5.0	4.7	4.8
12/2/08	1	6	N	SC	0.1	6.4	6.2	6.2	5.0	4.9	4.7	4.8	4.9	4.8
12/2/08	1	7	N	SC	0.2	6.6	6.5	6.5	5.0	5.0	5.1	5.2	5.0	5.2
12/2/08	1	8	N	PB	0.3	5.9	6.1	5.9	4.6	4.7	4.6	4.8	4.7	4.9
12/2/08	1	9	P	PB	0.3	6.1	6.0	5.8	4.6	4.5	4.5	4.5	5.0	4.6
12/2/08	1	10	P	SP	0.2	6.0	6.1	6.0	4.1	4.0	4.2	4.2	4.4	4.7
12/2/08	1	11	P	SB	0.1	6.1	6.4	6.3	4.4	4.5	4.4	4.4	4.5	4.3
12/2/08	1	12	N	PB	0.2	6.4	6.4	6.3	4.9	4.9	4.8	5.0	5.0	5.0
12/2/08	1	13	P	SB	0.2	6.0	6.1	6.1	4.5	4.2	4.3	4.3	4.2	4.1
12/2/08	1	14	N	SP	0.1	6.2	6.2	6.3	4.6	4.4	4.5	4.7	4.6	4.8
12/2/08	1	15	P	PC	0.1	6.2	6.3	6.4	4.9	5.0	4.5	4.3	4.3	4.3
12/2/08	1	16	N	PC	0.2	6.2	6.2	6.4	5.7	5.4	5.3	5.5	5.3	5.3
12/2/08	1	17	N	PB	0.1	6.2	6.1	5.9	4.9	4.6	4.9	5.0	4.5	4.8
12/2/08	1	18	P	ddW	0	5.9	5.8	6.0	4.6	4.7	4.5	4.4	4.4	4.6
12/2/08	1	19	P	SP	0.3	6.0	6.0	6.2	4.2	4.5	4.6	4.5	4.4	4.3
12/2/08	1	20	P	PC	0.2	6.2	6.1	6.0	4.8	4.9	4.6	4.6	4.7	4.6
12/2/08	1	21	N	SB	0.3	5.9	6.0	6.1	4.8	4.7	4.9	5.0	5.4	5.1
12/2/08	1	22	P	Control	0	5.7	5.6	5.7	4.0	4.0	4.2	4.4	4.4	4.4
12/2/08	1	23	N	SP	0.2	6.1	6.3	6.4	4.3	4.3	4.3	4.4	4.2	4.3
12/2/08	1	24	N	Control	0	5.8	5.8	5.8	4.3	4.3	4.0	4.4	4.5	4.4
12/2/08	1	25	N	SC	0.3	6.3	6.2	6.0	5.4	5.4	5.4	5.5	5.5	5.5
12/2/08	1	26	N	PC	0.3	6.2	6.1	6.1	5.1	5.4	5.4	5.5	5.5	5.5
12/2/08	1	27	N	PC	0.1	6.4	6.3	6.2	5.0	4.9	4.9	4.9	5.0	4.9
12/2/08	1	28	P	PB	0.1	6.0	5.9	6.0	4.4	4.3	4.9	4.6	4.4	4.4
12/2/08	1	29	P	SP	0.1	5.9	5.8	6.0	3.8	3.8	3.7	3.7	3.5	3.5
12/2/08	1	30	N	SB	0.2	6.0	6.0	6.1	4.8	4.8	4.6	4.7	4.8	4.9
12/2/08	1	31	N	ddW	0	6.4	6.4	6.2	4.5	4.3	4.4	4.3	4.2	4.4
12/2/08	1	32	P	PC	0.3	6.1	6.1	6.0	5.0	5.1	5.0	4.9	5.3	5.2
12/2/08	1	33	P	SC	0.1	5.9	6.0	6.2	4.4	4.5	4.5	4.6	4.5	4.4
12/2/08	1	34	P	SC	0.3	6.1	5.9	5.9	5.1	5.0	5.0	5.0	5.0	5.2

12/8/08	2	1	N	PB	0.3	6.1	6.3	6.4	5.4	5.2	5.0	4.8	4.7	5.0
12/8/08	2	2	N	ddW	0	6.5	6.5	6.7	4.6	4.7	4.6	4.6	4.6	4.5
12/8/08	2	3	P	SP	0.2	6.2	6.3	6.0	4.1	4.0	3.8	3.8	4.0	4.2
12/8/08	2	4	P	SB	0.2	6.3	6.3	6.2	4.9	4.6	4.7	4.7	4.7	4.7
12/8/08	2	5	P	PC	0.2	6.0	5.9	6.0	4.6	4.7	4.7	4.8	5.0	5.0
12/8/08	2	6	N	Control	0	5.5	5.5	5.7	4.1	4.0	4.3	4.4	4.6	4.5
12/8/08	2	7	P	PB	0.1	6.3	6.2	5.9	4.5	4.3	4.3	4.2	4.4	4.4
12/8/08	2	8	N	PB	0.2	6.6	6.5	6.4	4.6	4.4	4.5	4.5	4.4	4.7
12/8/08	2	9	P	SP	0.1	6.5	6.4	6.3	4.4	4.2	4.6	4.5	4.2	4.1
12/8/08	2	10	N	SC	0.1	6.4	6.3	6.3	4.5	4.8	4.5	4.6	4.6	4.5
12/8/08	2	11	P	SC	0.1	6.4	6.6	6.3	4.1	4.1	4.4	4.4	4.3	4.3
12/8/08	2	12	N	PC	0.1	6.0	6.0	6.0	4.5	4.4	4.5	4.3	4.3	4.5
12/8/08	2	13	P	SP	0.3	6.2	6.3	6.1	4.6	4.5	4.5	4.5	4.6	4.6
12/8/08	2	14	N	SC	0.2	6.1	6.3	6.4	5.0	4.9	4.8	5.0	5.0	4.9
12/8/08	2	15	N	PB	0.1	6.7	6.4	6.3	4.3	4.5	4.5	4.5	4.5	4.5
12/8/08	2	16	P	PC	0.1	6.0	6.3	6.3	3.8	3.8	4.3	4.3	4.3	4.0
12/8/08	2	17	P	SB	0.1	6.0	5.8	6.1	4.4	4.2	4.3	4.3	4.5	4.4
12/8/08	2	18	N	SC	0.3	6.4	6.4	6.4	5.7	5.4	5.4	5.4	5.3	5.1
12/8/08	2	19	P	PC	0.3	5.9	6.1	6.0	4.8	4.8	4.8	4.9	4.6	4.8
12/8/08	2	20	P	SC	0.3	6.5	6.3	6.3	4.5	5.1	5.2	4.8	4.7	4.6
12/8/08	2	21	N	SP	0.3	6.5	6.6	6.0	3.9	3.8	3.9	4.1	4.5	4.3
12/8/08	2	22	N	SB	0.1	6.3	6.3	6.4	4.0	4.1	4.3	4.2	4.3	4.3
12/8/08	2	23	N	PC	0.3	6.2	6.2	6.2	5.2	5.2	5.1	5.1	5.0	5.2
12/8/08	2	24	P	SB	0.3	6.4	6.2	6.1	4.6	4.6	4.4	4.3	4.5	4.6
12/8/08	2	25	N	PC	0.2	6.6	6.5	6.1	4.4	4.6	4.8	4.8	4.8	4.8
12/8/08	2	26	N	SB	0.3	6.6	6.8	6.7	4.7	4.5	4.8	4.8	4.9	4.5
12/8/08	2	27	P	PB	0.2	6.4	6.3	6.6	4.3	4.1	4.1	4.3	4.3	4.3
12/8/08	2	28	N	SP	0.2	6.6	6.9	6.6	3.7	3.7	3.9	4.0	4.0	3.9
12/8/08	2	29	N	SP	0.1	6.8	6.6	6.6	4.1	4.0	4.0	4.0	3.9	3.9
12/8/08	2	30	P	PB	0.3	6.3	6.2	6.1	4.4	4.2	4.1	4.1	4.2	4.3
12/8/08	2	31	P	Control	0	6.0	6.2	5.9	3.7	3.7	3.8	3.9	3.8	3.8
12/8/08	2	32	N	SB	0.2	6.2	6.1	6.2	4.2	4.1	4.1	4.0	4.3	4.2
12/8/08	2	33	P	ddW	0	6.3	6.6	6.7	3.7	3.7	3.7	3.6	3.7	3.9
12/8/08	2	34	P	SC	0.2	6.0	6.2	6.1	4.4	4.4	4.3	4.4	4.5	4.5
1/12/09	3	1	P	SP	0.3	6.5	6.4	6.0	3.8	3.9	4.0	4.1	4.2	4.1

1/12/09	3	2	P	ddW	0	6.0	6.0	6.1	3.6	3.5	3.5	3.6	3.7	3.6
1/12/09	3	3	N	ddW	0	6.2	6.5	6.0	4.2	4.2	4.1	4.0	3.9	3.9
1/12/09	3	4	N	PC	0.3	6.3	6.2	6.4	4.8	4.8	4.9	5.0	4.8	4.8
1/12/09	3	5	P	Control	0	6.0	6.0	5.8	4.0	3.9	3.7	3.9	4.1	4.0
1/12/09	3	6	N	SP	0.2	5.8	6.2	6.4	3.9	4.2	4.1	4.1	4.2	4.0
1/12/09	3	7	P	PB	0.3	5.7	6.0	6.5	4.5	4.6	4.3	4.4	4.3	4.2
1/12/09	3	8	N	SP	0.3	6.1	6.0	6.1	4.1	4.2	4.4	4.5	4.3	4.2
1/12/09	3	9	N	PC	0.1	6.1	5.8	5.6	4.2	4.2	4.3	4.2	4.5	4.7
1/12/09	3	10	N	SC	0.2	6.1	6.1	5.9	4.7	4.7	4.5	4.5	4.5	4.5
1/12/09	3	11	P	SP	0.1	6.3	6.5	6.5	3.9	3.9	3.8	3.8	3.9	4.0
1/12/09	3	12	P	PC	0.2	6.2	6.0	5.8	4.3	4.4	4.4	4.5	4.3	4.3
1/12/09	3	13	P	SB	0.1	6.3	6.2	6.1	3.8	3.8	3.8	3.9	3.9	4.0
1/12/09	3	14	P	PB	0.2	6.0	6.1	6.1	4.1	4.0	4.0	4.0	4.2	4.2
1/12/09	3	15	N	PB	0.3	6.2	5.8	5.9	4.4	4.6	4.3	4.1	4.3	4.1
1/12/09	3	16	N	SB	0.1	6.4	6.5	6.1	4.1	4.1	4.0	4.1	4.1	4.1
1/12/09	3	17	N	SC	0.1	5.9	5.9	6.1	4.3	4.5	4.4	4.2	4.5	4.4
1/12/09	3	18	P	SC	0.2	5.7	5.5	5.9	4.7	4.9	5.0	4.6	4.6	5.0
1/12/09	3	19	N	Control	0	5.5	5.4	5.5	4.1	4.0	4.0	3.9	3.9	4.3
1/12/09	3	20	P	SP	0.2	5.6	5.7	5.9	3.7	3.6	3.8	3.8	4.1	3.9
1/12/09	3	21	P	SC	0.3	6.3	6.2	6.1	4.6	4.6	4.6	4.5	4.6	4.7
1/12/09	3	22	N	SP	0.1	6.1	6.1	6.4	3.8	3.8	3.7	3.6	3.7	3.9
1/12/09	3	23	N	PC	0.2	6.0	6.0	6.3	4.5	4.6	4.5	4.5	4.4	4.7
1/12/09	3	24	N	SC	0.3	6.1	6.1	5.9	4.9	5.1	5.2	5.3	5.3	5.0
1/12/09	3	25	P	PC	0.1	6.3	6.1	5.8	4.8	4.9	4.8	5.0	5.0	4.9
1/12/09	3	26	N	SB	0.2	6.3	6.4	6.2	4.2	4.1	3.9	4.1	4.6	4.5
1/12/09	3	27	P	SC	0.1	6.2	6.3	6.0	4.4	4.4	4.4	4.1	4.2	4.1
1/12/09	3	28	P	PC	0.3	6.1	6.5	6.4	4.4	4.6	4.5	4.5	4.5	4.5
1/12/09	3	29	P	SB	0.2	5.9	5.9	6.3	4.3	4.1	4.3	4.3	4.2	4.2
1/12/09	3	30	P	PB	0.1	6.0	6.4	6.5	3.9	3.9	3.9	4.2	4.2	3.9
1/12/09	3	31	N	SB	0.3	6.1	6.1	6.1	4.3	4.5	4.8	4.6	4.3	4.4
1/12/09	3	32	N	PB	0.1	6.1	6.4	6.4	4.4	4.5	4.4	4.2	4.0	4.1
1/12/09	3	33	P	SB	0.3	6.3	6.3	6.2	4.3	4.3	4.3	4.5	4.3	4.3
1/12/09	3	34	N	PB	0.2	6.2	6.4	6.3	4.3	4.3	4.5	4.5	4.7	4.9

Date	Week	Sample	PSENorm	Trt	Level	2Meat7	2Meat8	2Ring1	2Ring2	2Ring3	2Ring4	2Ring5	2Ring6	2Ring7
12/2/08	1	1	N	SP	0.3	4.2	4.3	5.8	5.9	5.9	6.0	6.1	6.0	5.8
12/2/08	1	2	P	SC	0.2	4.9	4.7	6.1	6.3	6.3	6.5	6.5	6.3	6.0
12/2/08	1	3	P	PB	0.2	4.3	4.0	5.8	5.9	6.1	6.0	6.1	6.1	6.2
12/2/08	1	4	P	SB	0.3	4.8	4.6	6.0	6.1	6.1	6.0	5.8	5.8	5.9
12/2/08	1	5	N	SB	0.1	4.7	4.6	6.0	5.5	6.1	6.7	6.5	6.5	6.8
12/2/08	1	6	N	SC	0.1	4.8	4.9	6.1	6.2	6.3	6.1	6.1	6.0	6.0
12/2/08	1	7	N	SC	0.2	5.2	5.3	6.5	6.3	6.6	6.6	6.4	6.5	6.4
12/2/08	1	8	N	PB	0.3	4.7	4.8	5.8	5.9	5.8	5.8	6.0	6.3	6.1
12/2/08	1	9	P	PB	0.3	4.7	4.7	5.9	5.7	6.0	6.1	6.5	6.3	6.2
12/2/08	1	10	P	SP	0.2	4.7	4.1	5.8	5.8	5.9	6.0	6.5	6.3	6.2
12/2/08	1	11	P	SB	0.1	4.0	4.1	6.2	6.2	6.1	6.3	6.2	6.2	6.2
12/2/08	1	12	N	PB	0.2	4.9	4.6	6.0	6.2	6.2	6.5	6.4	6.4	6.1
12/2/08	1	13	P	SB	0.2	4.2	4.3	5.8	6.1	6.1	5.9	5.9	5.6	5.7
12/2/08	1	14	N	SP	0.1	4.6	4.7	6.1	6.2	6.3	6.6	6.5	6.3	5.9
12/2/08	1	15	P	PC	0.1	4.6	4.8	6.4	6.4	6.2	5.7	5.7	5.5	5.7
12/2/08	1	16	N	PC	0.2	5.3	5.5	6.4	6.5	6.6	6.5	6.4	6.1	6.3
12/2/08	1	17	N	PB	0.1	4.6	4.9	6.0	6.3	6.2	6.5	6.2	6.2	6.0
12/2/08	1	18	P	ddW	0	4.5	4.6	6.4	6.1	6.3	6.1	6.2	6.1	6.1
12/2/08	1	19	P	SP	0.3	4.2	4.2	6.3	6.1	6.2	6.0	5.9	5.9	5.8
12/2/08	1	20	P	PC	0.2	4.5	4.8	6.2	6.2	6.0	5.8	5.6	5.6	5.7
12/2/08	1	21	N	SB	0.3	5.0	5.0	6.0	6.0	6.0	6.3	6.4	6.4	6.3
12/2/08	1	22	P	Control	0	4.1	4.0	5.7	5.8	5.8	5.9	5.9	6.0	5.7
12/2/08	1	23	N	SP	0.2	4.3	4.1	6.3	6.1	6.0	6.0	5.8	6.3	6.2
12/2/08	1	24	N	Control	0	4.6	4.4	5.7	5.7	5.7	5.5	5.7	5.8	5.8
12/2/08	1	25	N	SC	0.3	5.6	5.5	6.4	6.3	6.3	6.2	6.2	6.3	6.3
12/2/08	1	26	N	PC	0.3	5.4	5.2	5.8	6.0	6.1	6.1	6.3	6.1	6.0
12/2/08	1	27	N	PC	0.1	5.1	4.8	6.4	6.5	6.1	6.1	6.2	6.4	6.5
12/2/08	1	28	P	PB	0.1	4.5	4.4	5.9	5.9	5.9	6.0	6.0	6.0	6.1
12/2/08	1	29	P	SP	0.1	3.6	3.7	6.1	5.8	6.3	5.9	5.7	5.5	5.7
12/2/08	1	30	N	SB	0.2	4.9	4.8	6.3	6.1	5.8	5.8	5.9	6.2	6.4
12/2/08	1	31	N	ddW	0	4.2	4.9	6.3	6.0	5.9	5.7	5.8	6.1	6.5
12/2/08	1	32	P	PC	0.3	5.0	5.0	5.9	5.8	5.9	6.0	6.0	6.0	5.9
12/2/08	1	33	P	SC	0.1	4.8	4.8	6.1	6.0	5.8	5.9	5.9	5.9	6.1
12/2/08	1	34	P	SC	0.3	5.3	5.4	6.0	6.0	6.0	6.0	6.1	6.3	6.3

12/8/08	2	1	N	PB	0.3	5.0	5.1	6.7	6.5	6.4	6.2	6.2	6.5	6.6
12/8/08	2	2	N	ddW	0	4.7	4.8	6.6	6.6	7.0	6.6	6.4	6.1	6.4
12/8/08	2	3	P	SP	0.2	4.2	4.0	6.1	6.4	6.2	6.2	6.2	6.5	6.3
12/8/08	2	4	P	SB	0.2	4.8	4.6	6.7	6.5	6.6	6.2	6.1	6.3	6.4
12/8/08	2	5	P	PC	0.2	4.7	4.6	6.1	6.3	6.3	6.2	6.1	6.3	6.2
12/8/08	2	6	N	Control	0	4.3	4.2	5.7	5.8	5.7	6.4	6.3	6.2	5.8
12/8/08	2	7	P	PB	0.1	4.5	4.4	6.4	6.3	6.3	6.3	6.4	6.5	6.6
12/8/08	2	8	N	PB	0.2	4.7	4.7	6.3	6.2	6.1	6.3	6.4	6.7	6.1
12/8/08	2	9	P	SP	0.1	4.2	4.3	6.4	6.9	6.5	6.3	5.9	5.6	5.9
12/8/08	2	10	N	SC	0.1	4.4	4.6	6.5	6.6	6.6	6.5	6.3	6.2	6.2
12/8/08	2	11	P	SC	0.1	4.1	4.1	6.1	6.0	6.2	6.1	6.2	6.5	6.4
12/8/08	2	12	N	PC	0.1	4.3	4.5	6.4	6.2	6.1	6.4	5.7	5.9	5.9
12/8/08	2	13	P	SP	0.3	4.5	4.3	6.3	6.3	6.4	6.5	6.3	6.3	6.3
12/8/08	2	14	N	SC	0.2	5.2	5.0	6.4	6.2	5.9	6.1	6.1	6.0	6.3
12/8/08	2	15	N	PB	0.1	4.3	4.4	6.5	6.5	6.5	6.1	6.5	6.3	6.3
12/8/08	2	16	P	PC	0.1	4.1	3.9	5.8	6.3	6.5	6.2	6.3	6.1	6.0
12/8/08	2	17	P	SB	0.1	4.3	4.1	6.2	6.5	6.4	6.3	6.1	6.0	6.0
12/8/08	2	18	N	SC	0.3	5.2	5.4	6.3	6.6	6.5	6.4	6.5	6.5	6.9
12/8/08	2	19	P	PC	0.3	4.7	4.6	5.8	6.1	6.2	6.2	6.1	6.0	6.0
12/8/08	2	20	P	SC	0.3	4.5	4.4	6.2	6.4	6.3	6.5	6.8	6.6	6.7
12/8/08	2	21	N	SP	0.3	4.1	4.3	6.0	5.9	5.9	6.3	6.4	6.6	6.4
12/8/08	2	22	N	SB	0.1	4.2	4.0	5.9	6.3	6.6	6.4	6.5	6.1	6.2
12/8/08	2	23	N	PC	0.3	5.2	5.2	6.2	6.2	6.3	6.4	6.3	6.6	6.3
12/8/08	2	24	P	SB	0.3	4.9	4.5	6.3	6.1	6.3	6.6	6.5	6.7	6.8
12/8/08	2	25	N	PC	0.2	4.7	4.8	6.4	6.4	6.3	6.1	6.1	5.8	5.9
12/8/08	2	26	N	SB	0.3	4.5	4.7	6.3	6.6	6.6	6.9	6.5	6.3	6.0
12/8/08	2	27	P	PB	0.2	4.3	4.1	6.2	6.1	6.0	6.2	6.4	6.4	6.4
12/8/08	2	28	N	SP	0.2	3.8	3.7	5.7	6.0	6.4	6.0	6.4	6.3	6.3
12/8/08	2	29	N	SP	0.1	3.9	3.8	6.2	6.1	6.3	6.2	6.0	5.9	6.0
12/8/08	2	30	P	PB	0.3	4.1	4.5	6.1	5.8	6.0	6.2	6.5	6.1	5.9
12/8/08	2	31	P	Control	0	3.9	3.7	6.2	6.1	6.2	6.0	5.7	5.6	5.6
12/8/08	2	32	N	SB	0.2	4.1	4.3	6.3	6.0	6.1	6.0	6.0	5.8	6.3
12/8/08	2	33	P	ddW	0	3.9	3.6	5.9	5.8	6.1	6.6	6.5	6.4	6.3
12/8/08	2	34	P	SC	0.2	4.7	4.4	6.0	6.1	6.1	6.1	6.2	6.4	6.5
1/12/09	3	1	P	SP	0.3	4.0	3.9	6.1	5.8	5.9	5.8	5.8	6.3	6.0

1/12/09	3	2	P	ddW	0	3.7	3.5	5.8	5.6	5.7	6.0	6.4	6.3	6.6
1/12/09	3	3	N	ddW	0	3.9	4.0	6.4	6.6	6.4	6.3	6.3	5.8	6.2
1/12/09	3	4	N	PC	0.3	4.6	4.5	5.7	5.9	5.9	6.1	6.1	5.8	5.6
1/12/09	3	5	P	Control	0	4.1	4.1	5.7	5.8	6.1	6.2	6.1	6.1	6.1
1/12/09	3	6	N	SP	0.2	4.1	3.9	5.8	6.0	6.0	6.2	6.0	6.0	5.6
1/12/09	3	7	P	PB	0.3	4.4	4.5	6.5	6.2	6.1	6.2	5.8	5.7	5.8
1/12/09	3	8	N	SP	0.3	4.2	4.0	6.0	5.8	5.8	5.8	6.0	6.3	6.5
1/12/09	3	9	N	PC	0.1	4.3	4.2	6.0	5.7	5.7	5.7	6.1	6.2	6.1
1/12/09	3	10	N	SC	0.2	4.7	4.7	6.0	5.8	5.7	5.7	5.7	6.1	6.1
1/12/09	3	11	P	SP	0.1	3.9	3.9	6.0	6.2	6.3	6.4	6.5	6.4	6.2
1/12/09	3	12	P	PC	0.2	4.4	4.4	6.0	6.3	6.3	6.3	6.1	5.7	5.9
1/12/09	3	13	P	SB	0.1	3.9	3.9	5.7	5.9	6.1	6.1	6.3	6.2	6.1
1/12/09	3	14	P	PB	0.2	4.3	4.1	6.0	6.1	5.9	5.8	5.8	5.9	6.2
1/12/09	3	15	N	PB	0.3	4.2	4.4	6.4	6.7	6.5	6.7	6.8	6.1	5.9
1/12/09	3	16	N	SB	0.1	4.1	4.2	6.3	6.3	5.9	5.8	6.0	6.4	6.3
1/12/09	3	17	N	SC	0.1	4.5	4.4	6.5	6.1	6.0	6.1	6.3	6.5	6.5
1/12/09	3	18	P	SC	0.2	5.0	5.1	5.5	5.7	5.7	5.9	6.1	5.8	5.9
1/12/09	3	19	N	Control	0	4.3	4.1	5.8	5.8	5.4	5.9	5.5	5.7	5.9
1/12/09	3	20	P	SP	0.2	4.0	3.7	5.9	5.8	5.8	6.1	6.3	6.5	6.5
1/12/09	3	21	P	SC	0.3	4.8	4.8	5.8	5.8	6.2	6.3	6.3	6.1	6.0
1/12/09	3	22	N	SP	0.1	3.8	3.9	5.8	5.8	5.7	5.8	6.3	6.3	6.3
1/12/09	3	23	N	PC	0.2	4.8	4.5	6.1	6.1	6.3	6.1	6.3	6.5	6.6
1/12/09	3	24	N	SC	0.3	4.8	4.6	6.1	6.4	6.5	6.3	6.4	6.4	6.0
1/12/09	3	25	P	PC	0.1	4.8	4.5	6.5	6.5	6.4	6.2	6.4	6.4	6.4
1/12/09	3	26	N	SB	0.2	4.2	4.1	6.1	6.3	6.4	6.3	6.3	6.1	5.9
1/12/09	3	27	P	SC	0.1	4.1	4.6	6.3	6.2	6.2	5.8	5.8	6.2	6.5
1/12/09	3	28	P	PC	0.3	4.5	4.4	6.0	5.8	5.8	6.0	6.0	6.4	6.3
1/12/09	3	29	P	SB	0.2	4.1	4.1	6.1	6.2	6.1	6.2	6.1	5.9	5.8
1/12/09	3	30	P	PB	0.1	3.9	3.8	6.1	6.4	6.6	6.3	6.1	5.8	5.7
1/12/09	3	31	N	SB	0.3	4.7	4.5	5.6	6.1	6.1	6.3	6.3	6.4	6.3
1/12/09	3	32	N	PB	0.1	4.3	4.4	6.3	6.3	5.9	6.0	6.0	6.2	6.5
1/12/09	3	33	P	SB	0.3	4.5	4.3	5.8	5.9	6.0	6.1	6.2	6.3	6.0
1/12/09	3	34	N	PB	0.2	4.9	4.3	5.7	5.9	6.4	6.4	6.5	6.4	6.0

Date	Week	Sample	PSENorm	Trt	Level	2Ring1	2Ring2	2Ring3	2Ring4	2Ring5	2Ring6	2Ring7	2Ring8
12/2/08	1	1	N	SP	0.3	5.8	5.9	5.9	6	6.1	6	5.8	6
12/2/08	1	2	P	SC	0.2	6.1	6.3	6.3	6.5	6.5	6.3	6	6
12/2/08	1	3	P	PB	0.2	5.8	5.9	6.1	6	6.1	6.1	6.2	6
12/2/08	1	4	P	SB	0.3	6	6.1	6.1	6	5.8	5.8	5.9	5.9
12/2/08	1	5	N	SB	0.1	6	5.5	6.1	6.7	6.5	6.5	6.8	6.5
12/2/08	1	6	N	SC	0.1	6.1	6.2	6.3	6.1	6.1	6	6	6
12/2/08	1	7	N	SC	0.2	6.5	6.3	6.6	6.6	6.4	6.5	6.4	6.4
12/2/08	1	8	N	PB	0.3	5.8	5.9	5.8	5.8	6	6.3	6.1	6
12/2/08	1	9	P	PB	0.3	5.9	5.7	6	6.1	6.5	6.3	6.2	6.2
12/2/08	1	10	P	SP	0.2	5.8	5.8	5.9	6	6.5	6.3	6.2	6.2
12/2/08	1	11	P	SB	0.1	6.2	6.2	6.1	6.3	6.2	6.2	6.2	6.2
12/2/08	1	12	N	PB	0.2	6	6.2	6.2	6.5	6.4	6.4	6.1	5.9
12/2/08	1	13	P	SB	0.2	5.8	6.1	6.1	5.9	5.9	5.6	5.7	5.9
12/2/08	1	14	N	SP	0.1	6.1	6.2	6.3	6.6	6.5	6.3	5.9	6.1
12/2/08	1	15	P	PC	0.1	6.4	6.4	6.2	5.7	5.7	5.5	5.7	6.2
12/2/08	1	16	N	PC	0.2	6.4	6.5	6.6	6.5	6.4	6.1	6.3	6.3
12/2/08	1	17	N	PB	0.1	6	6.3	6.2	6.5	6.2	6.2	6	6.1
12/2/08	1	18	P	ddW	0	6.4	6.1	6.3	6.1	6.2	6.1	6.1	6.4
12/2/08	1	19	P	SP	0.3	6.3	6.1	6.2	6	5.9	5.9	5.8	5.9
12/2/08	1	20	P	PC	0.2	6.2	6.2	6	5.8	5.6	5.6	5.7	6
12/2/08	1	21	N	SB	0.3	6	6	6	6.3	6.4	6.4	6.3	6
12/2/08	1	22	P	Control	0	5.7	5.8	5.8	5.9	5.9	6	5.7	5.4
12/2/08	1	23	N	SP	0.2	6.3	6.1	6	6	5.8	6.3	6.2	6.3
12/2/08	1	24	N	Control	0	5.7	5.7	5.7	5.5	5.7	5.8	5.8	5.8
12/2/08	1	25	N	SC	0.3	6.4	6.3	6.3	6.2	6.2	6.3	6.3	6.5
12/2/08	1	26	N	PC	0.3	5.8	6	6.1	6.1	6.3	6.1	6	5.8
12/2/08	1	27	N	PC	0.1	6.4	6.5	6.1	6.1	6.2	6.4	6.5	6.4
12/2/08	1	28	P	PB	0.1	5.9	5.9	5.9	6	6	6	6.1	5.8
12/2/08	1	29	P	SP	0.1	6.1	5.8	6.3	5.9	5.7	5.5	5.7	5.6
12/2/08	1	30	N	SB	0.2	6.3	6.1	5.8	5.8	5.9	6.2	6.4	6.4
12/2/08	1	31	N	ddW	0	6.3	6	5.9	5.7	5.8	6.1	6.5	6.5
12/2/08	1	32	P	PC	0.3	5.9	5.8	5.9	6	6	6	5.9	5.7
12/2/08	1	33	P	SC	0.1	6.1	6	5.8	5.9	5.9	5.9	6.1	6.1
12/2/08	1	34	P	SC	0.3	6	6	6	6	6.1	6.3	6.3	6.1

12/8/08	2	1	N	PB	0.3	6.7	6.5	6.4	6.2	6.2	6.5	6.6	6.8
12/8/08	2	2	N	ddW	0	6.6	6.6	7	6.6	6.4	6.1	6.4	6.3
12/8/08	2	3	P	SP	0.2	6.1	6.4	6.2	6.2	6.2	6.5	6.3	6.3
12/8/08	2	4	P	SB	0.2	6.7	6.5	6.6	6.2	6.1	6.3	6.4	6.2
12/8/08	2	5	P	PC	0.2	6.1	6.3	6.3	6.2	6.1	6.3	6.2	6.1
12/8/08	2	6	N	Control	0	5.7	5.8	5.7	6.4	6.3	6.2	5.8	5.7
12/8/08	2	7	P	PB	0.1	6.4	6.3	6.3	6.3	6.4	6.5	6.6	6.3
12/8/08	2	8	N	PB	0.2	6.3	6.2	6.1	6.3	6.4	6.7	6.1	6.3
12/8/08	2	9	P	SP	0.1	6.4	6.9	6.5	6.3	5.9	5.6	5.9	6.1
12/8/08	2	10	N	SC	0.1	6.5	6.6	6.6	6.5	6.3	6.2	6.2	6.2
12/8/08	2	11	P	SC	0.1	6.1	6	6.2	6.1	6.2	6.5	6.4	6.3
12/8/08	2	12	N	PC	0.1	6.4	6.2	6.1	6.4	5.7	5.9	5.9	6
12/8/08	2	13	P	SP	0.3	6.3	6.3	6.4	6.5	6.3	6.3	6.3	6.4
12/8/08	2	14	N	SC	0.2	6.4	6.2	5.9	6.1	6.1	6	6.3	6.3
12/8/08	2	15	N	PB	0.1	6.5	6.5	6.5	6.1	6.5	6.3	6.3	6.5
12/8/08	2	16	P	PC	0.1	5.8	6.3	6.5	6.2	6.3	6.1	6	5.8
12/8/08	2	17	P	SB	0.1	6.2	6.5	6.4	6.3	6.1	6	6	6.1
12/8/08	2	18	N	SC	0.3	6.3	6.6	6.5	6.4	6.5	6.5	6.9	6.9
12/8/08	2	19	P	PC	0.3	5.8	6.1	6.2	6.2	6.1	6	6	6
12/8/08	2	20	P	SC	0.3	6.2	6.4	6.3	6.5	6.8	6.6	6.7	6.1
12/8/08	2	21	N	SP	0.3	6	5.9	5.9	6.3	6.4	6.6	6.4	6.4
12/8/08	2	22	N	SB	0.1	5.9	6.3	6.6	6.4	6.5	6.1	6.2	6
12/8/08	2	23	N	PC	0.3	6.2	6.2	6.3	6.4	6.3	6.6	6.3	6.3
12/8/08	2	24	P	SB	0.3	6.3	6.1	6.3	6.6	6.5	6.7	6.8	6.5
12/8/08	2	25	N	PC	0.2	6.4	6.4	6.3	6.1	6.1	5.8	5.9	6.3
12/8/08	2	26	N	SB	0.3	6.3	6.6	6.6	6.9	6.5	6.3	6	6.2
12/8/08	2	27	P	PB	0.2	6.2	6.1	6	6.2	6.4	6.4	6.4	6.3
12/8/08	2	28	N	SP	0.2	5.7	6	6.4	6	6.4	6.3	6.3	6
12/8/08	2	29	N	SP	0.1	6.2	6.1	6.3	6.2	6	5.9	6	6.3
12/8/08	2	30	P	PB	0.3	6.1	5.8	6	6.2	6.5	6.1	5.9	6.3
12/8/08	2	31	P	Control	0	6.2	6.1	6.2	6	5.7	5.6	5.6	5.8
12/8/08	2	32	N	SB	0.2	6.3	6	6.1	6	6	5.8	6.3	6.1
12/8/08	2	33	P	ddW	0	5.9	5.8	6.1	6.6	6.5	6.4	6.3	6.3
12/8/08	2	34	P	SC	0.2	6	6.1	6.1	6.1	6.2	6.4	6.5	6.3
1/12/09	3	1	P	SP	0.3	6.1	5.8	5.9	5.8	5.8	6.3	6	6.1

1/12/09	3	2	P	ddW	0	5.8	5.6	5.7	6	6.4	6.3	6.6	6
1/12/09	3	3	N	ddW	0	6.4	6.6	6.4	6.3	6.3	5.8	6.2	6.4
1/12/09	3	4	N	PC	0.3	5.7	5.9	5.9	6.1	6.1	5.8	5.6	5.5
1/12/09	3	5	P	Control	0	5.7	5.8	6.1	6.2	6.1	6.1	6.1	5.9
1/12/09	3	6	N	SP	0.2	5.8	6	6	6.2	6	6	5.6	5.5
1/12/09	3	7	P	PB	0.3	6.5	6.2	6.1	6.2	5.8	5.7	5.8	6.1
1/12/09	3	8	N	SP	0.3	6	5.8	5.8	5.8	6	6.3	6.5	6.3
1/12/09	3	9	N	PC	0.1	6	5.7	5.7	5.7	6.1	6.2	6.1	6.1
1/12/09	3	10	N	SC	0.2	6	5.8	5.7	5.7	5.7	6.1	6.1	6
1/12/09	3	11	P	SP	0.1	6	6.2	6.3	6.4	6.5	6.4	6.2	5.9
1/12/09	3	12	P	PC	0.2	6	6.3	6.3	6.3	6.1	5.7	5.9	6
1/12/09	3	13	P	SB	0.1	5.7	5.9	6.1	6.1	6.3	6.2	6.1	5.8
1/12/09	3	14	P	PB	0.2	6	6.1	5.9	5.8	5.8	5.9	6.2	5.8
1/12/09	3	15	N	PB	0.3	6.4	6.7	6.5	6.7	6.8	6.1	5.9	6.1
1/12/09	3	16	N	SB	0.1	6.3	6.3	5.9	5.8	6	6.4	6.3	6.3
1/12/09	3	17	N	SC	0.1	6.5	6.1	6	6.1	6.3	6.5	6.5	6.5
1/12/09	3	18	P	SC	0.2	5.5	5.7	5.7	5.9	6.1	5.8	5.9	5.6
1/12/09	3	19	N	Control	0	5.8	5.8	5.4	5.9	5.5	5.7	5.9	5.7
1/12/09	3	20	P	SP	0.2	5.9	5.8	5.8	6.1	6.3	6.5	6.5	6.2
1/12/09	3	21	P	SC	0.3	5.8	5.8	6.2	6.3	6.3	6.1	6	6
1/12/09	3	22	N	SP	0.1	5.8	5.8	5.7	5.8	6.3	6.3	6.3	6.4
1/12/09	3	23	N	PC	0.2	6.1	6.1	6.3	6.1	6.3	6.5	6.6	6.2
1/12/09	3	24	N	SC	0.3	6.1	6.4	6.5	6.3	6.4	6.4	6	6
1/12/09	3	25	P	PC	0.1	6.5	6.5	6.4	6.2	6.4	6.4	6.4	6.3
1/12/09	3	26	N	SB	0.2	6.1	6.3	6.4	6.3	6.3	6.1	5.9	5.7
1/12/09	3	27	P	SC	0.1	6.3	6.2	6.2	5.8	5.8	6.2	6.5	6.3
1/12/09	3	28	P	PC	0.3	6	5.8	5.8	6	6	6.4	6.3	6.1
1/12/09	3	29	P	SB	0.2	6.1	6.2	6.1	6.2	6.1	5.9	5.8	5.9
1/12/09	3	30	P	PB	0.1	6.1	6.4	6.6	6.3	6.1	5.8	5.7	5.8
1/12/09	3	31	N	SB	0.3	5.6	6.1	6.1	6.3	6.3	6.4	6.3	5.8
1/12/09	3	32	N	PB	0.1	6.3	6.3	5.9	6	6	6.2	6.5	6.5
1/12/09	3	33	P	SB	0.3	5.8	5.9	6	6.1	6.2	6.3	6	5.8
1/12/09	3	34	N	PB	0.2	5.7	5.9	6.4	6.4	6.5	6.4	6	6

Date	Week	Sample	PSENorm	Trt	Level	3Meat1	3Meat2	3Meat3	3Meat4	3Meat5	3Meat6	3Meat7	3Meat8
12/2/08	1	1	N	SP	0.3	4.5	4.5	4.4	4.3	4.4	4.4	4.5	4.4
12/2/08	1	2	P	SC	0.2	4.9	5	4.7	4.9	4.7	4.7	4.8	4.9
12/2/08	1	3	P	PB	0.2	4.3	4.4	4.3	4	3.9	3.9	4	4.1
12/2/08	1	4	P	SB	0.3	4.7	4.7	4.9	4.7	4.7	4.8	4.8	4.8
12/2/08	1	5	N	SB	0.1	4.5	4.6	4.7	4.7	4.6	5	4.6	4.6
12/2/08	1	6	N	SC	0.1	4.8	4.8	4.8	5.2	5	5	5.1	5
12/2/08	1	7	N	SC	0.2	5	5.3	5.3	5.2	5.1	5	5.1	5.1
12/2/08	1	8	N	PB	0.3	5	4.7	5	5.1	5	5	4.8	5
12/2/08	1	9	P	PB	0.3	4.5	4.5	4.5	4.6	4.4	4.5	4.4	4.5
12/2/08	1	10	P	SP	0.2	4.7	4.4	4.1	4.4	4.5	4.4	4.1	4.1
12/2/08	1	11	P	SB	0.1	4.5	4.7	4.3	4.3	4.3	4.5	4.1	4.4
12/2/08	1	12	N	PB	0.2	4.3	4.3	4.4	4.6	4.6	4.5	4.5	4.4
12/2/08	1	13	P	SB	0.2	4.1	4.1	4.1	4.2	4.3	4.1	4.1	4.2
12/2/08	1	14	N	SP	0.1	4.6	4.4	4.5	4.5	4.6	4.6	4.7	4.6
12/2/08	1	15	P	PC	0.1	4.6	4.5	4.5	4.6	4.6	4.8	4.7	4.7
12/2/08	1	16	N	PC	0.2	5.1	5	5.1	5.1	5.2	5.2	5	5.2
12/2/08	1	17	N	PB	0.1	4.6	4.6	4.5	4.6	4.6	4.9	4.5	4.7
12/2/08	1	18	P	ddW	0	4	4.3	4.4	4.5	4.5	4.4	4.5	4.4
12/2/08	1	19	P	SP	0.3	4.6	4.3	4.8	4.7	4.6	4.3	4.2	4.4
12/2/08	1	20	P	PC	0.2	4.9	5	4.9	4.6	4.6	4.4	4.6	4.7
12/2/08	1	21	N	SB	0.3	5.1	5.1	4.9	4.8	4.5	4.8	4.8	4.9
12/2/08	1	22	P	Control	0	4.1	4.2	4.3	4.2	4.2	4.2	4.1	4.1
12/2/08	1	23	N	SP	0.2	4.7	4.5	4.6	4.6	4.9	4.8	5	4.7
12/2/08	1	24	N	Control	0	4.5	4.3	4.5	4.4	4.4	4.4	4.5	4.5
12/2/08	1	25	N	SC	0.3	4.9	5.1	5.5	5.3	5.3	5.4	5.2	5
12/2/08	1	26	N	PC	0.3	5.1	5	5.1	5.4	5.5	5.4	5.5	5.3
12/2/08	1	27	N	PC	0.1	5	5	5	4.8	4.8	4.6	5	4.9
12/2/08	1	28	P	PB	0.1	4.1	4.1	4.2	4.3	4.4	4.5	4.4	4.6
12/2/08	1	29	P	SP	0.1	4.3	4.5	4.5	4.4	4.3	4.1	4	4.2
12/2/08	1	30	N	SB	0.2	4.5	4.5	4.6	4.6	4.7	4.7	4.8	4.8
12/2/08	1	31	N	ddW	0	4.1	4	4	4.3	4.2	4.3	4.4	4.3
12/2/08	1	32	P	PC	0.3	4.9	4.7	4.8	4.8	5	5	5	4.8
12/2/08	1	33	P	SC	0.1	4.5	4.6	4.7	4.5	4.4	4.4	4.4	4.3
12/2/08	1	34	P	SC	0.3	5.1	5.2	5.1	5.2	5.1	5.1	5.1	5.1

12/8/08	2	1	N	PB	0.3	5.1	5	5.2	5.4	5.2	4.9	4.7	4.9
12/8/08	2	2	N	ddW	0	4.6	4.9	4.5	4.6	4.5	4.7	4.7	4.5
12/8/08	2	3	P	SP	0.2	4.4	4.1	4.3	4.2	4.3	4.4	4.5	4.4
12/8/08	2	4	P	SB	0.2	4.4	4.3	4.4	4.5	4.5	4.2	4.5	4.9
12/8/08	2	5	P	PC	0.2	4.9	5	4.6	5	4.7	4.7	4.7	4.7
12/8/08	2	6	N	Control	0	4.6	4.6	4.5	4.6	4.8	4.9	4.4	4.4
12/8/08	2	7	P	PB	0.1	4.4	4.4	4.6	4.4	4.5	4.9	4.9	4.7
12/8/08	2	8	N	PB	0.2	4.8	4.8	4.9	4.6	4.8	4.6	4.7	4.7
12/8/08	2	9	P	SP	0.1	3.5	3.5	3.8	4.2	4.2	4.1	3.8	3.7
12/8/08	2	10	N	SC	0.1	5	4.8	4.7	4.5	4.7	4.6	4.4	5
12/8/08	2	11	P	SC	0.1	4.2	4	4.1	4.2	4	4.1	4.6	4.2
12/8/08	2	12	N	PC	0.1	4.4	4.3	4.3	4.3	4.5	4.5	4.3	4.4
12/8/08	2	13	P	SP	0.3	4.5	4.3	4.2	4.3	4.3	4.6	4.6	4.8
12/8/08	2	14	N	SC	0.2	5	4.9	4.9	4.9	4.8	4.9	5	4.9
12/8/08	2	15	N	PB	0.1	4.3	4.3	4.3	4.2	4.2	4.2	4.2	4.2
12/8/08	2	16	P	PC	0.1	3.7	4	3.8	3.9	3.8	3.8	3.7	3.6
12/8/08	2	17	P	SB	0.1	4.1	4.1	4.3	4.2	4.4	4.3	4.3	4
12/8/08	2	18	N	SC	0.3	5	5.1	5.3	5.2	5.2	5.4	5.3	5.2
12/8/08	2	19	P	PC	0.3	4.6	4.8	4.7	4.7	5	4.8	4.9	4.7
12/8/08	2	20	P	SC	0.3	4.3	4.3	4.1	4.2	4.6	4.5	4.6	4.5
12/8/08	2	21	N	SP	0.3	3.7	4	4	3.8	3.8	3.9	3.7	3.6
12/8/08	2	22	N	SB	0.1	4.1	4.3	4.3	3.8	3.8	3.6	3.8	4.1
12/8/08	2	23	N	PC	0.3	5.2	5.1	5	5.1	5.2	5.1	5.4	5.4
12/8/08	2	24	P	SB	0.3	4.5	4.2	4.3	4.2	4.3	4.4	4.6	4.6
12/8/08	2	25	N	PC	0.2	4.7	5.2	5	4.8	4.9	4.8	4.8	4.7
12/8/08	2	26	N	SB	0.3	4.6	4.5	4.3	4.9	4.9	4.8	4.5	4.5
12/8/08	2	27	P	PB	0.2	3.9	4	4.2	4.3	4.1	3.9	3.8	3.8
12/8/08	2	28	N	SP	0.2	3.9	3.7	3.8	3.7	3.6	3.9	4	4
12/8/08	2	29	N	SP	0.1	3.6	3.6	3.7	3.8	4.1	4.1	4.1	3.9
12/8/08	2	30	P	PB	0.3	4.1	4.2	4.3	4.2	4.5	4.3	4.4	4.2
12/8/08	2	31	P	Control	0	3.4	3.4	3.5	3.6	3.6	3.7	3.5	3.5
12/8/08	2	32	N	SB	0.2	4.3	4.3	4.5	4.5	4.5	4.6	4.5	4.3
12/8/08	2	33	P	ddW	0	3.7	3.6	3.7	3.7	3.8	4	4	3.8
12/8/08	2	34	P	SC	0.2	4.2	4.3	4.1	4.3	4.3	4.3	4.2	4.1
1/12/09	3	1	P	SP	0.3	3.5	3.7	3.9	3.9	4.1	3.9	3.8	3.6

1/12/09	3	2	P	ddW	0	3.6	3.8	4	3.9	4.1	3.9	3.8	3.5
1/12/09	3	3	N	ddW	0	4	3.9	4.1	4	3.9	3.9	4.2	4.3
1/12/09	3	4	N	PC	0.3	4.9	4.7	4.5	4.7	4.7	4.6	4.7	4.9
1/12/09	3	5	P	Control	0	3.9	3.9	3.8	3.7	3.6	3.8	3.8	3.9
1/12/09	3	6	N	SP	0.2	4	4	3.8	4	3.9	3.9	4.2	4.2
1/12/09	3	7	P	PB	0.3	4.4	4.6	4.6	4.5	4.5	4.5	4.4	4.4
1/12/09	3	8	N	SP	0.3	4.2	3.9	4	3.9	4.3	4.4	4.5	4.2
1/12/09	3	9	N	PC	0.1	4	4.5	4.6	4.5	4.5	4.6	4.5	4.4
1/12/09	3	10	N	SC	0.2	4.2	4.3	4.6	4.4	4.3	4.2	4.4	4.3
1/12/09	3	11	P	SP	0.1	3.7	3.8	3.8	3.8	3.8	3.9	3.9	3.8
1/12/09	3	12	P	PC	0.2	4.5	4.4	4.5	4.4	4.5	4.5	4.6	4.6
1/12/09	3	13	P	SB	0.1	3.9	4	4	4	4	3.9	3.9	3.8
1/12/09	3	14	P	PB	0.2	4.3	4.3	4.3	4.4	4.3	4.2	4.2	4.3
1/12/09	3	15	N	PB	0.3	4.3	4.1	4.2	4.4	4.5	4.5	4.5	4.4
1/12/09	3	16	N	SB	0.1	4.3	4	4	4.2	4.3	4.4	4.1	4.3
1/12/09	3	17	N	SC	0.1	4.3	4.3	4.3	4.3	4.3	4.1	4	4
1/12/09	3	18	P	SC	0.2	4.6	4.7	4.6	4.9	4.2	4.7	4.8	4.8
1/12/09	3	19	N	Control	0	4.1	4	4.2	4	4	3.9	3.9	4
1/12/09	3	20	P	SP	0.2	3.7	3.7	3.7	3.7	3.8	3.7	3.9	3.7
1/12/09	3	21	P	SC	0.3	4.8	4.6	4.4	4.4	4.4	4.4	4.7	4.8
1/12/09	3	22	N	SP	0.1	4.6	4.4	4.4	4	4.5	4.4	4.3	4.7
1/12/09	3	23	N	PC	0.2	4.5	4.5	4.4	4.6	4.5	4.6	4.6	4.7
1/12/09	3	24	N	SC	0.3	4.7	4.8	5.1	4.9	4.9	4.9	4.8	4.9
1/12/09	3	25	P	PC	0.1	4.4	4.3	4.5	4.5	4	4	4.4	4.5
1/12/09	3	26	N	SB	0.2	4.3	4.3	4.3	4.4	4.4	4.3	4.4	4.2
1/12/09	3	27	P	SC	0.1	4	4	4.1	4.2	4	4.1	4.2	3.9
1/12/09	3	28	P	PC	0.3	4.7	4.8	4.6	4.6	4.6	4.6	4.5	4.9
1/12/09	3	29	P	SB	0.2	4.2	4.1	4.2	4.3	4.2	4.4	4.3	4.4
1/12/09	3	30	P	PB	0.1	3.8	3.9	3.9	3.9	3.9	4.1	4	3.8
1/12/09	3	31	N	SB	0.3	4.5	4.4	4.3	4.3	4.3	4.5	4.7	4.5
1/12/09	3	32	N	PB	0.1	4.4	4.3	4.1	4.1	4.3	4.3	4.2	4.3
1/12/09	3	33	P	SB	0.3	4.4	4.4	4.2	4.2	4.3	4.1	4.4	4.5
1/12/09	3	34	N	PB	0.2	4.3	4.1	4.1	4.3	4.4	4.3	4.4	4.3

Date	Week	Sample	PSENorm	Trt	Level	3Ring1	3Ring2	3Ring3	3Ring4	3Ring5	3Ring6	3Ring7	3Ring8
12/2/08	1	1	N	SP	0.3	5.9	6	6.1	6.3	6.3	6.1	6.1	6.1
12/2/08	1	2	P	SC	0.2	6.5	6.3	6.5	6.2	6.2	6.3	6.5	6.5
12/2/08	1	3	P	PB	0.2	6.4	6.3	6	6	5.7	5.8	5.9	6.1
12/2/08	1	4	P	SB	0.3	6	5.9	6	5.9	6	6.1	6.3	6.1
12/2/08	1	5	N	SB	0.1	5.9	5.9	6.3	6.4	6.5	6.2	6	5.9
12/2/08	1	6	N	SC	0.1	6	6.1	6.2	6.3	6.4	6.4	6.1	6.1
12/2/08	1	7	N	SC	0.2	6.2	6.4	6.5	6.4	6	5.8	5.7	6
12/2/08	1	8	N	PB	0.3	5.8	5.7	6	6.1	6.1	6.1	6	5.9
12/2/08	1	9	P	PB	0.3	5.8	5.8	6.1	6.3	6.3	6.2	6.3	5.9
12/2/08	1	10	P	SP	0.2	5.9	6.1	6.2	6.5	6.3	6.2	5.8	5.9
12/2/08	1	11	P	SB	0.1	6.3	6.3	6.1	6.1	6.1	6	6.3	6.3
12/2/08	1	12	N	PB	0.2	5.5	5.5	5.6	5.8	6.1	5.9	5.5	5.4
12/2/08	1	13	P	SB	0.2	5.7	5.7	5.8	5.9	6	5.6	5.7	5.7
12/2/08	1	14	N	SP	0.1	6.4	6.3	6.5	6.4	6.5	6.2	6.1	6.4
12/2/08	1	15	P	PC	0.1	6	6.1	5.7	5.9	6.1	6.2	6.2	6.2
12/2/08	1	16	N	PC	0.2	5.8	5.7	5.7	5.8	5.9	6	6.1	6
12/2/08	1	17	N	PB	0.1	6.1	6.2	6.2	6.2	6.2	6.4	6.5	6.3
12/2/08	1	18	P	ddW	0	5.9	5.7	5.9	6.3	6.4	6.3	6.3	6.5
12/2/08	1	19	P	SP	0.3	6.4	6.5	6.5	6	5.9	5.8	5.9	6.1
12/2/08	1	20	P	PC	0.2	6.1	5.9	6.4	6.2	6	5.8	5.9	5.9
12/2/08	1	21	N	SB	0.3	6.5	6.5	6.4	6.3	5.9	5.8	5.9	6.4
12/2/08	1	22	P	Control	0	5.9	6	6.1	6	5.7	5.6	5.7	5.7
12/2/08	1	23	N	SP	0.2	6	6.3	6.5	6.3	6.3	6.1	6.1	6.1
12/2/08	1	24	N	Control	0	5.6	5.7	5.8	5.9	5.9	5.9	5.8	5.9
12/2/08	1	25	N	SC	0.3	5.6	5.8	6.1	6.1	5.7	5.7	5.7	5.6
12/2/08	1	26	N	PC	0.3	5.9	5.7	5.8	6	6.2	6.3	6.2	6
12/2/08	1	27	N	PC	0.1	6.5	6.3	6.1	5.9	5.9	5.9	6	6.3
12/2/08	1	28	P	PB	0.1	5.6	5.7	5.6	5.9	6	5.9	5.9	5.9
12/2/08	1	29	P	SP	0.1	6	6.4	6.7	6.6	6.2	5.8	5.8	6.1
12/2/08	1	30	N	SB	0.2	5.9	6.2	6.1	6	5.8	5.9	6	6
12/2/08	1	31	N	ddW	0	5.8	5.9	6.1	6.1	6.1	6	6	6
12/2/08	1	32	P	PC	0.3	5.9	5.7	5.8	5.8	5.8	6	6	5.9
12/2/08	1	33	P	SC	0.1	5.7	5.7	5.7	6	5.9	5.9	6	5.7
12/2/08	1	34	P	SC	0.3	6.3	6.1	6	6	5.8	5.8	5.8	6

12/8/08	2	1	N	PB	0.3	6.3	6.3	6.6	6.6	6.7	6.4	6.4	6.2
12/8/08	2	2	N	ddW	0	6.3	6.6	6.7	6.7	6.4	6.3	6.3	6.3
12/8/08	2	3	P	SP	0.2	6.1	6	6.3	6.4	6.3	6.9	6.5	6.4
12/8/08	2	4	P	SB	0.2	6.4	6.3	6.2	6.2	5.9	5.9	5.8	6.1
12/8/08	2	5	P	PC	0.2	6.4	6.5	6.4	6.1	6.3	6.1	6	6.2
12/8/08	2	6	N	Control	0	5.8	6.3	6.2	6	5.9	5.7	5.6	5.8
12/8/08	2	7	P	PB	0.1	6.4	6.4	6.2	6	6.1	6.2	6.3	6.4
12/8/08	2	8	N	PB	0.2	6.2	6.3	6.3	6.4	6.4	6.3	6.1	6.2
12/8/08	2	9	P	SP	0.1	5.8	5.9	6.3	6.5	6.3	6.1	5.9	5.9
12/8/08	2	10	N	SC	0.1	6.3	6.3	6.1	6.3	6.3	6.5	6.3	6.3
12/8/08	2	11	P	SC	0.1	6.1	6.2	6.4	6.3	6.2	6.3	6.4	6
12/8/08	2	12	N	PC	0.1	6.3	6.3	6.1	6.3	6.6	6.4	6.7	6.7
12/8/08	2	13	P	SP	0.3	6.5	6.2	6	6.3	6.1	6.3	6.1	6.9
12/8/08	2	14	N	SC	0.2	6	5.9	5.9	5.9	5.8	5.9	6	6.1
12/8/08	2	15	N	PB	0.1	6	6.1	6.4	6.4	6.5	6.1	6	5.9
12/8/08	2	16	P	PC	0.1	5.6	6.2	6.9	6.4	6.3	6.3	5.7	5.6
12/8/08	2	17	P	SB	0.1	6.2	6.5	6.3	6.6	6.3	6.3	6.3	6
12/8/08	2	18	N	SC	0.3	6.3	6.3	6.4	6.5	6.5	6.4	6.4	6.4
12/8/08	2	19	P	PC	0.3	5.9	5.8	6.3	6.1	6.4	6.2	6.2	6.2
12/8/08	2	20	P	SC	0.3	5.7	5.6	5.9	5.9	6.3	6.1	6.1	6
12/8/08	2	21	N	SP	0.3	6	6.4	6.4	6.3	6.3	6.3	6.1	6.1
12/8/08	2	22	N	SB	0.1	6.4	6.6	6.8	6.6	6.1	6.1	6.1	6.1
12/8/08	2	23	N	PC	0.3	6.2	6.1	6.2	6.2	6.4	6.6	6.7	6.5
12/8/08	2	24	P	SB	0.3	6.2	6.1	6	5.9	6.1	6.5	6.8	6.7
12/8/08	2	25	N	PC	0.2	6.6	6.8	6.6	6.3	6.2	6.1	6.1	6.2
12/8/08	2	26	N	SB	0.3	6	6.3	6.4	6.3	6.4	6.2	6.3	6.2
12/8/08	2	27	P	PB	0.2	5.9	5.8	6.5	6.8	6.1	5.9	5.7	5.9
12/8/08	2	28	N	SP	0.2	6.1	6.3	5.9	5.7	5.9	6.3	6.4	6.6
12/8/08	2	29	N	SP	0.1	5.5	5.8	5.9	5.9	6.2	6.5	6.5	6.1
12/8/08	2	30	P	PB	0.3	6.2	6.2	6.4	6.3	6.1	6.1	6.1	6
12/8/08	2	31	P	Control	0	5.6	5.3	5.2	5.3	5.5	5.9	6	6.2
12/8/08	2	32	N	SB	0.2	6.2	6.4	6.6	6.5	6.5	6.3	6.4	6.2
12/8/08	2	33	P	ddW	0	5.9	5.8	5.9	6.4	6.7	6.8	6.9	6.4
12/8/08	2	34	P	SC	0.2	5.8	5.8	6	5.9	6	6.1	5.9	5.8
1/12/09	3	1	P	SP	0.3	5.5	5.7	6.2	6.3	6.5	5.9	5.6	5.5

1/12/09	3	2	P	ddW	0	5.6	5.8	5.8	6.6	6.5	6.3	6.3	6.8
1/12/09	3	3	N	ddW	0	6.1	6.1	5.9	5.9	6.1	6.3	6.2	6.2
1/12/09	3	4	N	PC	0.3	5.9	5.7	5.5	5.6	5.7	5.8	5.9	6
1/12/09	3	5	P	Control	0	6.2	5.8	5.9	5.6	5.6	5.7	6.1	6.3
1/12/09	3	6	N	SP	0.2	6.2	6.1	6.2	6	5.6	6	6.1	6.2
1/12/09	3	7	P	PB	0.3	6.2	6.3	6.5	6.2	6	5.9	6	6
1/12/09	3	8	N	SP	0.3	5.8	5.5	5.7	5.8	6	6.3	6.1	5.8
1/12/09	3	9	N	PC	0.1	5.2	6	6.1	6.3	6.6	6.4	6	5.8
1/12/09	3	10	N	SC	0.2	5.6	5.7	5.9	6	5.6	5.5	5.4	5.4
1/12/09	3	11	P	SP	0.1	6.1	5.8	5.7	5.8	6	6.4	6.6	6.4
1/12/09	3	12	P	PC	0.2	5.8	5.8	6	6.1	6.5	6.2	6	5.9
1/12/09	3	13	P	SB	0.1	6.2	6.3	6.4	6.5	6.3	5.9	6.4	6.1
1/12/09	3	14	P	PB	0.2	6.3	6.3	6.4	6.4	6.2	6.1	6.1	6.2
1/12/09	3	15	N	PB	0.3	5.7	5.5	5.5	5.8	6.1	6.2	6.6	6.3
1/12/09	3	16	N	SB	0.1	5.9	5.9	5.8	5.8	6	6	6	6.3
1/12/09	3	17	N	SC	0.1	6	6	5.9	6.1	6	5.6	5.7	5.8
1/12/09	3	18	P	SC	0.2	6	5.8	5.9	5.8	5.9	6	6.3	6.3
1/12/09	3	19	N	Control	0	5.9	6.2	6.2	6.1	5.6	5.5	5.5	5.4
1/12/09	3	20	P	SP	0.2	5.6	5.5	5.6	6.2	6.5	6.2	6.1	5.6
1/12/09	3	21	P	SC	0.3	5.8	5.8	5.7	5.9	6	5.9	6.1	5.9
1/12/09	3	22	N	SP	0.1	5.7	5.8	5.9	.	.	.	6.3	6.5
1/12/09	3	23	N	PC	0.2	6.2	6.3	6.5	6.7	6.4	6.5	6.6	6.5
1/12/09	3	24	N	SC	0.3	5.8	5.9	6.1	6.1	6.1	6	5.8	5.7
1/12/09	3	25	P	PC	0.1	6.5	6.6	6.4	6.2	6	5.7	5.9	6.1
1/12/09	3	26	N	SB	0.2	6	6	6	6	6.6	6.4	6.4	6.3
1/12/09	3	27	P	SC	0.1	5.6	5.5	5.7	5.8	5.8	6	6	5.8
1/12/09	3	28	P	PC	0.3	6.3	6.3	6.4	6.1	6.1	6	6	6.1
1/12/09	3	29	P	SB	0.2	5.7	5.9	5.9	6	6.3	6.4	6.1	6
1/12/09	3	30	P	PB	0.1	5.6	5.6	5.5	5.6	5.9	6.3	6.4	5.9
1/12/09	3	31	N	SB	0.3	6	6.1	5.9	5.9	5.8	5.8	5.8	6.1
1/12/09	3	32	N	PB	0.1	6.4	6.1	5.9	6	6.3	6.6	6.7	6.6
1/12/09	3	33	P	SB	0.3	6.5	6.1	5.8	6	6.2	6.4	6.4	6.7
1/12/09	3	34	N	PB	0.2	5.8	6	6.1	6.4	6.3	6.4	6.3	5.9

Date	Week	Sample	PSENorm	Trt	Level	MmeatA	MmeatB	MmeatC	Mmeat	MeatArea	MringA	MringB	MringC
12/2/08	1	1	N	SP	0.3	4.44	4.30	4.43	1.73	2.34	6.08	5.94	6.11
12/2/08	1	2	P	SC	0.2	4.71	4.71	4.83	1.87	2.75	6.26	6.25	6.38
12/2/08	1	3	P	PB	0.2	4.28	4.16	4.11	1.65	2.13	6.00	6.03	6.03
12/2/08	1	4	P	SB	0.3	4.68	4.68	4.76	1.85	2.69	6.05	5.95	6.04
12/2/08	1	5	N	SB	0.1	4.75	4.74	4.66	1.86	2.71	6.13	6.33	6.14
12/2/08	1	6	N	SC	0.1	4.99	4.85	4.96	1.94	2.96	6.33	6.10	6.20
12/2/08	1	7	N	SC	0.2	5.10	5.13	5.14	2.02	3.19	6.29	6.46	6.13
12/2/08	1	8	N	PB	0.3	4.74	4.73	4.95	1.89	2.81	5.86	5.96	5.96
12/2/08	1	9	P	PB	0.3	4.44	4.64	4.49	1.78	2.49	6.09	6.11	6.09
12/2/08	1	10	P	SP	0.2	4.11	4.30	4.34	1.67	2.20	6.13	6.09	6.11
12/2/08	1	11	P	SB	0.1	4.53	4.33	4.39	1.74	2.37	6.23	6.20	6.19
12/2/08	1	12	N	PB	0.2	4.74	4.89	4.45	1.85	2.68	6.20	6.21	5.66
12/2/08	1	13	P	SB	0.2	4.43	4.26	4.15	1.68	2.23	5.96	5.88	5.76
12/2/08	1	14	N	SP	0.1	4.48	4.61	4.56	1.79	2.52	6.25	6.25	6.35
12/2/08	1	15	P	PC	0.1	4.58	4.59	4.63	1.81	2.57	6.11	5.98	6.05
12/2/08	1	16	N	PC	0.2	5.39	5.41	5.11	2.09	3.42	6.38	6.39	5.88
12/2/08	1	17	N	PB	0.1	4.71	4.78	4.63	1.85	2.69	6.01	6.19	6.26
12/2/08	1	18	P	ddW	0	4.41	4.54	4.38	1.75	2.40	6.04	6.21	6.16
12/2/08	1	19	P	SP	0.3	4.54	4.36	4.49	1.76	2.42	6.09	6.01	6.14
12/2/08	1	20	P	PC	0.2	4.61	4.69	4.71	1.84	2.66	6.03	5.89	6.03
12/2/08	1	21	N	SB	0.3	4.75	4.99	4.86	1.92	2.88	5.99	6.18	6.21
12/2/08	1	22	P	Control	0	4.03	4.19	4.18	1.63	2.08	5.85	5.78	5.84
12/2/08	1	23	N	SP	0.2	4.69	4.28	4.73	1.80	2.53	6.19	6.13	6.21
12/2/08	1	24	N	Control	0	4.60	4.36	4.44	1.76	2.43	5.84	5.71	5.81
12/2/08	1	25	N	SC	0.3	5.24	5.48	5.21	2.09	3.43	6.01	6.31	5.79
12/2/08	1	26	N	PC	0.3	5.36	5.38	5.29	2.10	3.47	6.14	6.03	6.01
12/2/08	1	27	N	PC	0.1	4.89	4.94	4.89	1.93	2.93	6.26	6.33	6.11
12/2/08	1	28	P	PB	0.1	4.50	4.49	4.33	1.75	2.40	6.18	5.95	5.81
12/2/08	1	29	P	SP	0.1	4.23	3.66	4.29	1.60	2.01	6.03	5.83	6.20
12/2/08	1	30	N	SB	0.2	4.79	4.79	4.65	1.87	2.74	6.00	6.11	5.99
12/2/08	1	31	N	ddW	0	4.69	4.40	4.20	1.74	2.39	6.24	6.10	6.00
12/2/08	1	32	P	PC	0.3	5.23	5.06	4.88	1.99	3.11	6.15	5.90	5.86
12/2/08	1	33	P	SC	0.1	4.58	4.56	4.48	1.79	2.51	6.09	5.98	5.83
12/2/08	1	34	P	SC	0.3	5.08	5.13	5.13	2.01	3.18	5.93	6.10	5.98

12/8/08	2	1	N	PB	0.3	4.91	5.03	5.05	1.97	3.04	6.20	6.49	6.44
12/8/08	2	2	N	ddW	0	4.69	4.64	4.63	1.83	2.63	6.63	6.50	6.45
12/8/08	2	3	P	SP	0.2	4.43	4.01	4.33	1.67	2.20	6.00	6.28	6.36
12/8/08	2	4	P	SB	0.2	4.84	4.71	4.46	1.84	2.66	6.31	6.38	6.10
12/8/08	2	5	P	PC	0.2	4.39	4.76	4.79	1.83	2.63	6.11	6.20	6.25
12/8/08	2	6	N	Control	0	4.31	4.30	4.60	1.73	2.36	5.80	5.95	5.91
12/8/08	2	7	P	PB	0.1	4.38	4.38	4.60	1.75	2.41	6.08	6.39	6.25
12/8/08	2	8	N	PB	0.2	4.84	4.56	4.74	1.86	2.70	6.46	6.30	6.28
12/8/08	2	9	P	SP	0.1	4.19	4.31	3.85	1.62	2.06	6.18	6.20	6.09
12/8/08	2	10	N	SC	0.1	4.63	4.56	4.71	1.82	2.61	6.46	6.39	6.30
12/8/08	2	11	P	SC	0.1	4.43	4.23	4.18	1.68	2.22	6.15	6.23	6.24
12/8/08	2	12	N	PC	0.1	4.41	4.41	4.38	1.73	2.36	6.09	6.08	6.43
12/8/08	2	13	P	SP	0.3	4.43	4.51	4.45	1.76	2.42	6.10	6.35	6.30
12/8/08	2	14	N	SC	0.2	5.04	4.98	4.91	1.96	3.01	6.26	6.16	5.94
12/8/08	2	15	N	PB	0.1	4.28	4.44	4.24	1.70	2.27	6.25	6.40	6.18
12/8/08	2	16	P	PC	0.1	4.29	4.06	3.79	1.59	1.99	6.31	6.13	6.13
12/8/08	2	17	P	SB	0.1	4.14	4.31	4.21	1.66	2.17	6.16	6.20	6.31
12/8/08	2	18	N	SC	0.3	5.38	5.36	5.21	2.09	3.44	6.49	6.58	6.40
12/8/08	2	19	P	PC	0.3	4.73	4.75	4.78	1.87	2.75	6.18	6.05	6.14
12/8/08	2	20	P	SC	0.3	4.69	4.73	4.39	1.81	2.58	6.41	6.45	5.95
12/8/08	2	21	N	SP	0.3	4.00	4.11	3.81	1.56	1.92	6.28	6.24	6.24
12/8/08	2	22	N	SB	0.1	4.04	4.18	3.98	1.60	2.01	6.19	6.25	6.35
12/8/08	2	23	N	PC	0.3	5.10	5.15	5.19	2.03	3.22	6.15	6.33	6.36
12/8/08	2	24	P	SB	0.3	4.24	4.55	4.39	1.73	2.35	6.24	6.48	6.29
12/8/08	2	25	N	PC	0.2	4.83	4.71	4.86	1.89	2.80	6.21	6.16	6.36
12/8/08	2	26	N	SB	0.3	4.66	4.68	4.63	1.83	2.64	6.39	6.43	6.26
12/8/08	2	27	P	PB	0.2	4.20	4.23	4.00	1.63	2.09	6.33	6.25	6.08
12/8/08	2	28	N	SP	0.2	3.96	3.84	3.83	1.53	1.83	6.31	6.14	6.15
12/8/08	2	29	N	SP	0.1	4.19	3.95	3.86	1.57	1.95	6.41	6.13	6.05
12/8/08	2	30	P	PB	0.3	4.30	4.24	4.28	1.68	2.22	6.24	6.11	6.18
12/8/08	2	31	P	Control	0	3.75	3.79	3.53	1.45	1.66	5.79	5.90	5.63
12/8/08	2	32	N	SB	0.2	4.34	4.16	4.44	1.70	2.26	6.25	6.08	6.39
12/8/08	2	33	P	ddW	0	4.14	3.73	3.79	1.53	1.84	6.43	6.24	6.35
12/8/08	2	34	P	SC	0.2	4.21	4.45	4.23	1.69	2.25	6.03	6.21	5.91
1/12/09	3	1	P	SP	0.3	4.06	4.00	3.80	1.56	1.90	6.28	5.98	5.90

1/12/09	3	2	P	ddW	0	3.76	3.59	3.83	1.47	1.69	5.91	6.05	6.21
1/12/09	3	3	N	ddW	0	4.01	4.03	4.04	1.58	1.97	6.09	6.30	6.10
1/12/09	3	4	N	PC	0.3	4.96	4.78	4.71	1.90	2.82	6.48	5.83	5.76
1/12/09	3	5	P	Control	0	4.09	3.98	3.80	1.56	1.90	5.78	6.00	5.90
1/12/09	3	6	N	SP	0.2	4.13	4.06	4.00	1.60	2.01	6.23	5.89	6.05
1/12/09	3	7	P	PB	0.3	4.44	4.40	4.49	1.75	2.40	6.01	6.05	6.14
1/12/09	3	8	N	SP	0.3	4.14	4.24	4.18	1.65	2.13	6.00	6.06	5.88
1/12/09	3	9	N	PC	0.1	4.40	4.33	4.45	1.73	2.35	5.98	5.95	6.05
1/12/09	3	10	N	SC	0.2	4.50	4.60	4.34	1.76	2.44	5.83	5.89	5.64
1/12/09	3	11	P	SP	0.1	3.91	3.89	3.81	1.52	1.82	6.20	6.24	6.10
1/12/09	3	12	P	PC	0.2	4.39	4.38	4.50	1.74	2.38	5.98	6.08	6.04
1/12/09	3	13	P	SB	0.1	3.99	3.88	3.94	1.55	1.88	6.08	6.03	6.26
1/12/09	3	14	P	PB	0.2	4.13	4.11	4.29	1.64	2.12	6.30	5.94	6.25
1/12/09	3	15	N	PB	0.3	4.45	4.30	4.36	1.72	2.33	6.10	6.40	5.96
1/12/09	3	16	N	SB	0.1	4.09	4.10	4.20	1.63	2.08	6.06	6.16	5.96
1/12/09	3	17	N	SC	0.1	4.43	4.40	4.20	1.71	2.29	5.93	6.31	5.89
1/12/09	3	18	P	SC	0.2	4.46	4.86	4.66	1.84	2.65	5.96	5.78	6.00
1/12/09	3	19	N	Control	0	3.95	4.08	4.01	1.58	1.96	5.68	5.71	5.80
1/12/09	3	20	P	SP	0.2	3.71	3.83	3.74	1.48	1.72	6.06	6.14	5.91
1/12/09	3	21	P	SC	0.3	4.71	4.65	4.56	1.83	2.62	6.03	6.06	5.89
1/12/09	3	22	N	SP	0.1	3.70	3.78	4.41	1.56	1.91	5.96	6.05	6.04
1/12/09	3	23	N	PC	0.2	5.39	4.56	4.55	1.90	2.84	6.18	6.28	6.46
1/12/09	3	24	N	SC	0.3	4.83	5.03	4.88	1.93	2.93	5.96	6.26	5.94
1/12/09	3	25	P	PC	0.1	4.36	4.84	4.33	1.77	2.47	6.28	6.39	6.18
1/12/09	3	26	N	SB	0.2	4.38	4.21	4.33	1.69	2.26	6.11	6.14	6.21
1/12/09	3	27	P	SC	0.1	4.31	4.29	4.06	1.66	2.17	6.35	6.16	5.78
1/12/09	3	28	P	PC	0.3	4.69	4.49	4.66	1.82	2.59	6.09	6.05	6.16
1/12/09	3	29	P	SB	0.2	4.20	4.20	4.26	1.66	2.17	6.16	6.04	6.04
1/12/09	3	30	P	PB	0.1	3.83	3.96	3.91	1.54	1.85	6.19	6.10	5.85
1/12/09	3	31	N	SB	0.3	4.51	4.51	4.44	1.77	2.45	6.01	6.11	5.93
1/12/09	3	32	N	PB	0.1	4.25	4.29	4.25	1.68	2.21	6.16	6.21	6.33
1/12/09	3	33	P	SB	0.3	4.31	4.35	4.31	1.70	2.28	6.01	6.01	6.26
1/12/09	3	34	N	PB	0.2	4.40	4.55	4.28	1.74	2.37	6.05	6.16	6.15

Date	Week	Sample	PSENorm	Trt	Level	Mring	RingArea	%moisture	TMoisture	FreeWater	BoundWater
12/2/08	1	1	N	SP	0.3	2.38	4.44	77.40	386.21	33.23	66.77
12/2/08	1	2	P	SC	0.2	2.48	4.83	77.68	387.16	32.80	67.20
12/2/08	1	3	P	PB	0.2	2.37	4.41	78.17	390.99	35.57	64.43
12/2/08	1	4	P	SB	0.3	2.37	4.40	77.45	387.01	26.95	73.05
12/2/08	1	5	N	SB	0.1	2.44	4.67	77.74	387.91	30.95	69.05
12/2/08	1	6	N	SC	0.1	2.44	4.69	76.95	384.22	27.52	72.48
12/2/08	1	7	N	SC	0.2	2.48	4.82	77.52	387.31	25.66	74.34
12/2/08	1	8	N	PB	0.3	2.33	4.28	77.61	389.64	23.05	76.95
12/2/08	1	9	P	PB	0.3	2.40	4.52	77.40	385.86	32.23	67.77
12/2/08	1	10	P	SP	0.2	2.40	4.54	77.08	384.48	37.23	62.77
12/2/08	1	11	P	SB	0.1	2.44	4.69	77.99	391.31	36.16	63.84
12/2/08	1	12	N	PB	0.2	2.37	4.42	78.28	390.43	27.22	72.78
12/2/08	1	13	P	SB	0.2	2.31	4.19	78.34	391.38	30.61	69.39
12/2/08	1	14	N	SP	0.1	2.47	4.81	77.45	387.67	36.03	63.97
12/2/08	1	15	P	PC	0.1	2.38	4.45	77.70	389.06	29.50	70.50
12/2/08	1	16	N	PC	0.2	2.45	4.70	77.61	389.07	20.00	80.00
12/2/08	1	17	N	PB	0.1	2.42	4.61	77.74	387.79	30.20	69.80
12/2/08	1	18	P	ddW	0	2.42	4.59	77.75	387.71	34.42	65.58
12/2/08	1	19	P	SP	0.3	2.39	4.50	77.38	387.66	32.70	67.30
12/2/08	1	20	P	PC	0.2	2.35	4.35	77.59	387.52	26.74	73.26
12/2/08	1	21	N	SB	0.3	2.41	4.57	77.29	386.10	26.65	73.35
12/2/08	1	22	P	Control	0	2.29	4.12	75.03	375.55	33.34	66.66
12/2/08	1	23	N	SP	0.2	2.43	4.64	77.07	385.26	33.43	66.57
12/2/08	1	24	N	Control	0	2.28	4.08	75.14	374.44	26.90	73.10
12/2/08	1	25	N	SC	0.3	2.38	4.44	77.65	388.11	15.86	84.14
12/2/08	1	26	N	PC	0.3	2.39	4.47	77.72	387.93	15.66	84.34
12/2/08	1	27	N	PC	0.1	2.45	4.73	77.41	389.53	28.27	71.73
12/2/08	1	28	P	PB	0.1	2.35	4.35	77.16	386.25	30.93	69.07
12/2/08	1	29	P	SP	0.1	2.37	4.41	77.30	388.06	37.82	62.18
12/2/08	1	30	N	SB	0.2	2.38	4.43	77.60	388.00	26.68	73.32
12/2/08	1	31	N	ddW	0	2.41	4.55	77.80	389.50	33.89	66.11
12/2/08	1	32	P	PC	0.3	2.35	4.34	77.76	389.72	19.29	80.71
12/2/08	1	33	P	SC	0.1	2.35	4.33	77.33	387.90	28.69	71.31
12/2/08	1	34	P	SC	0.3	2.36	4.38	76.49	382.76	19.25	80.75

12/8/08	2	1	N	PB	0.3	2.51	4.95	77.76	388.07	30.06	69.94
12/8/08	2	2	N	ddW	0	2.57	5.18	77.27	385.35	40.44	59.56
12/8/08	2	3	P	SP	0.2	2.45	4.70	76.58	384.70	39.63	60.37
12/8/08	2	4	P	SB	0.2	2.47	4.77	77.11	385.91	33.54	66.46
12/8/08	2	5	P	PC	0.2	2.44	4.66	76.97	385.91	32.19	67.81
12/8/08	2	6	N	Control	0	2.32	4.22	75.34	377.85	30.05	69.95
12/8/08	2	7	P	PB	0.1	2.46	4.74	77.00	384.56	36.95	63.05
12/8/08	2	8	N	PB	0.2	2.50	4.90	76.99	385.40	34.86	65.14
12/8/08	2	9	P	SP	0.1	2.42	4.61	76.94	383.84	40.55	59.45
12/8/08	2	10	N	SC	0.1	2.51	4.96	77.55	389.03	36.86	63.14
12/8/08	2	11	P	SC	0.1	2.44	4.69	77.54	389.35	38.62	61.38
12/8/08	2	12	N	PC	0.1	2.44	4.67	77.49	388.87	36.40	63.60
12/8/08	2	13	P	SP	0.3	2.46	4.76	76.94	386.52	36.85	63.15
12/8/08	2	14	N	SC	0.2	2.41	4.56	77.11	386.74	24.45	75.55
12/8/08	2	15	N	PB	0.1	2.47	4.79	77.14	387.03	39.86	60.14
12/8/08	2	16	P	PC	0.1	2.44	4.66	77.13	386.77	42.15	57.85
12/8/08	2	17	P	SB	0.1	2.45	4.72	77.43	387.78	40.16	59.84
12/8/08	2	18	N	SC	0.3	2.55	5.12	77.38	387.32	26.54	73.46
12/8/08	2	19	P	PC	0.3	2.41	4.56	76.24	383.07	28.94	71.06
12/8/08	2	20	P	SC	0.3	2.47	4.79	76.59	384.86	35.10	64.90
12/8/08	2	21	N	SP	0.3	2.46	4.76	77.23	386.99	44.71	55.29
12/8/08	2	22	N	SB	0.1	2.47	4.77	77.51	392.28	43.07	56.93
12/8/08	2	23	N	PC	0.3	2.47	4.80	76.91	382.68	25.17	74.83
12/8/08	2	24	P	SB	0.3	2.49	4.88	77.21	384.29	40.31	59.69
12/8/08	2	25	N	PC	0.2	2.46	4.75	76.52	382.84	31.03	68.97
12/8/08	2	26	N	SB	0.3	2.50	4.92	76.93	385.04	36.25	63.75
12/8/08	2	27	P	PB	0.2	2.45	4.70	77.16	385.28	41.49	58.51
12/8/08	2	28	N	SP	0.2	2.44	4.68	77.49	389.60	44.72	55.28
12/8/08	2	29	N	SP	0.1	2.44	4.67	77.13	386.72	43.06	56.94
12/8/08	2	30	P	PB	0.3	2.43	4.64	77.16	386.97	38.23	61.77
12/8/08	2	31	P	Control	0	2.27	4.05	74.52	372.64	39.33	60.67
12/8/08	2	32	N	SB	0.2	2.46	4.74	76.76	386.28	39.11	60.89
12/8/08	2	33	P	ddW	0	2.50	4.89	77.26	391.51	47.65	52.35
12/8/08	2	34	P	SC	0.2	2.38	4.46	76.59	384.04	35.15	64.85
1/12/09	3	1	P	SP	0.3	2.38	4.46	77.77	388.26	40.17	59.83

1/12/09	3	2	P	ddW	0	2.39	4.47	78.02	392.39	43.27	56.73
1/12/09	3	3	N	ddW	0	2.43	4.62	77.34	385.72	41.99	58.01
1/12/09	3	4	N	PC	0.3	2.37	4.41	77.01	386.44	25.12	74.88
1/12/09	3	5	P	Control	0	2.32	4.23	75.28	374.96	37.84	62.16
1/12/09	3	6	N	SP	0.2	2.38	4.46	77.24	385.61	38.87	61.13
1/12/09	3	7	P	PB	0.3	2.39	4.48	77.34	388.42	32.70	67.30
1/12/09	3	8	N	SP	0.3	2.35	4.35	76.83	384.49	35.31	64.69
1/12/09	3	9	N	PC	0.1	2.36	4.37	77.20	385.93	32.02	67.98
1/12/09	3	10	N	SC	0.2	2.28	4.07	76.80	385.35	25.83	74.17
1/12/09	3	11	P	SP	0.1	2.43	4.65	77.28	388.58	44.41	55.59
1/12/09	3	12	P	PC	0.2	2.37	4.43	77.62	388.65	32.17	67.83
1/12/09	3	13	P	SB	0.1	2.41	4.56	77.89	388.78	42.08	57.92
1/12/09	3	14	P	PB	0.2	2.43	4.62	78.10	393.05	38.88	61.12
1/12/09	3	15	N	PB	0.3	2.42	4.61	76.73	383.97	36.36	63.64
1/12/09	3	16	N	SB	0.1	2.39	4.47	77.77	390.43	37.54	62.46
1/12/09	3	17	N	SC	0.1	2.38	4.44	77.02	387.86	33.85	66.15
1/12/09	3	18	P	SC	0.2	2.33	4.26	78.01	389.64	25.23	74.77
1/12/09	3	19	N	Control	0	2.26	4.00	74.57	375.41	33.13	66.87
1/12/09	3	20	P	SP	0.2	2.38	4.44	77.35	385.96	43.03	56.97
1/12/09	3	21	P	SC	0.3	2.36	4.37	77.78	388.75	27.47	72.53
1/12/09	3	22	N	SP	0.1	2.37	4.41	76.96	382.49	39.88	60.12
1/12/09	3	23	N	PC	0.2	2.48	4.84	77.29	387.93	31.41	68.59
1/12/09	3	24	N	SC	0.3	2.38	4.46	76.71	384.53	24.30	75.70
1/12/09	3	25	P	PC	0.1	2.47	4.80	77.62	387.65	36.65	63.35
1/12/09	3	26	N	SB	0.2	2.42	4.61	77.76	386.21	37.26	62.74
1/12/09	3	27	P	SC	0.1	2.40	4.52	77.25	385.47	37.33	62.67
1/12/09	3	28	P	PC	0.3	2.40	4.53	76.76	382.87	30.96	69.04
1/12/09	3	29	P	SB	0.2	2.39	4.50	77.91	387.42	36.75	63.25
1/12/09	3	30	P	PB	0.1	2.38	4.45	77.86	391.73	40.52	59.48
1/12/09	3	31	N	SB	0.3	2.37	4.41	76.84	383.81	31.13	68.87
1/12/09	3	32	N	PB	0.1	2.45	4.73	77.46	388.27	39.63	60.37
1/12/09	3	33	P	SB	0.3	2.40	4.52	77.67	388.64	35.32	64.68
1/12/09	3	34	N	PB	0.2	2.41	4.56	76.92	384.78	34.86	65.14

Cook Yield (%)

Date	Week	Sample	PSENorm	Trt	Level	15RWtA	15RWtB	15RWtC	15RWtD	15RWtE	15CkWtA	15CkWtB	15CkWtC
12/2/08	1	1	N	SP	0.3	14.99	14.98	15.02	15.01	14.99	13.27	13.24	13.28
12/2/08	1	2	P	SC	0.2	15.05	15.04	15.02	14.97	14.95	14.42	14.35	14.30
12/2/08	1	3	P	PB	0.2	14.97	14.98	14.99	14.99	15.05	12.64	12.92	12.58
12/2/08	1	4	P	SB	0.3	15.04	14.98	15.02	15.05	15.04	13.74	13.70	13.57
12/2/08	1	5	N	SB	0.1	15.02	14.96	14.98	15.02	14.96	13.26	13.07	13.11
12/2/08	1	6	N	SC	0.1	15.01	15.01	14.98	14.99	15.01	14.11	14.12	14.20
12/2/08	1	7	N	SC	0.2	14.98	15.04	15.02	15.05	14.97	14.51	14.58	14.52
12/2/08	1	8	N	PB	0.3	15.03	15.01	15.03	15.02	15.02	14.38	14.26	14.26
12/2/08	1	9	P	PB	0.3	15.03	15.04	15.05	15.00	14.96	13.36	13.15	13.40
12/2/08	1	10	P	SP	0.2	15.03	14.96	14.97	14.95	14.95	12.16	11.95	11.88
12/2/08	1	11	P	SB	0.1	15.00	15.05	15.02	14.96	14.98	12.44	12.41	12.50
12/2/08	1	12	N	PB	0.2	15.00	15.05	15.05	14.98	15.03	13.74	13.74	13.62
12/2/08	1	13	P	SB	0.2	15.02	14.96	15.04	15.03	14.97	13.05	13.06	12.94
12/2/08	1	14	N	SP	0.1	15.04	14.96	15.03	15.00	14.99	13.24	13.28	13.15
12/2/08	1	15	P	PC	0.1	14.95	15.02	15.04	15.04	14.95	12.65	12.95	12.86
12/2/08	1	16	N	PC	0.2	14.96	14.04	15.05	15.01	15.04	14.68	14.72	14.72
12/2/08	1	17	N	PB	0.1	15.05	14.98	15.00	15.01	15.01	13.24	13.20	13.36
12/2/08	1	18	P	ddW	0	15.05	15.02	15.02	15.00	15.04	12.68	12.41	12.48
12/2/08	1	19	P	SP	0.3	14.98	15.02	15.00	15.04	15.00	12.74	12.70	12.62
12/2/08	1	20	P	PC	0.2	14.97	14.99	15.00	15.04	15.04	14.15	14.09	14.22
12/2/08	1	21	N	SB	0.3	15.01	14.96	15.02	14.96	15.01	14.74	14.49	14.65
12/2/08	1	22	P	Control	0	15.00	15.04	15.00	15.00	.	12.90	12.75	12.53
12/2/08	1	23	N	SP	0.2	15.03	14.96	15.03	15.01	15.00	13.38	13.18	13.48
12/2/08	1	24	N	Control	0	14.96	15.05	15.04	15.00	14.99	14.21	14.37	13.69
12/2/08	1	25	N	SC	0.3	15.00	15.04	14.97	15.03	15.02	14.71	14.82	14.77
12/2/08	1	26	N	PC	0.3	15.04	15.00	14.97	15.05	14.95	14.82	14.72	14.74
12/2/08	1	27	N	PC	0.1	15.03	15.05	14.99	15.03	15.02	14.33	14.21	14.04
12/2/08	1	28	P	PB	0.1	15.01	14.97	15.02	15.03	15.05	12.82	12.65	12.55
12/2/08	1	29	P	SP	0.1	15.04	15.00	15.04	15.02	15.03	12.23	12.49	12.50
12/2/08	1	30	N	SB	0.2	15.05	14.99	15.04	15.01	15.03	14.27	14.26	13.99
12/2/08	1	31	N	ddW	0	15.04	15.02	14.99	15.04	14.99	13.13	12.65	12.72
12/2/08	1	32	P	PC	0.3	15.01	15.00	14.97	14.96	14.96	14.71	14.57	14.50

12/2/08	1	33	P	SC	0.1	14.97	15.05	15.04	15.02	14.98	12.95	12.50	12.63
12/2/08	1	34	P	SC	0.3	14.96	15.04	14.96	14.97	14.99	14.79	14.83	14.76
12/8/08	2	1	N	PB	0.3	15.00	15.00	14.95	14.98	15.00	14.05	13.89	13.94
12/8/08	2	2	N	ddW	0	15.00	15.04	15.01	15.05	15.03	12.37	12.35	12.40
12/8/08	2	3	P	SP	0.2	14.95	14.99	15.04	15.04	14.99	12.33	12.18	12.16
12/8/08	2	4	P	SB	0.2	15.04	14.96	14.98	15.01	14.98	12.57	12.50	12.49
12/8/08	2	5	P	PC	0.2	14.98	14.97	15.02	14.96	15.00	13.83	13.65	13.64
12/8/08	2	6	N	Control	0	15.02	15.04	14.98	15.01	15.04	13.18	13.16	13.05
12/8/08	2	7	P	PB	0.1	15.04	15.04	15.04	15.04	15.01	12.52	12.49	12.43
12/8/08	2	8	N	PB	0.2	15.05	14.97	14.96	14.96	15.03	13.31	13.12	13.08
12/8/08	2	9	P	SP	0.1	15.05	14.96	14.99	15.01	14.97	12.19	12.21	12.12
12/8/08	2	10	N	SC	0.1	15.04	15.02	15.05	14.96	14.98	13.29	12.99	13.27
12/8/08	2	11	P	SC	0.1	14.97	14.99	14.97	15.00	14.99	12.49	12.44	12.55
12/8/08	2	12	N	PC	0.1	15.02	15.00	15.01	15.03	14.95	13.17	13.11	13.00
12/8/08	2	13	P	SP	0.3	14.96	14.97	15.04	15.03	15.01	12.36	12.20	12.30
12/8/08	2	14	N	SC	0.2	15.00	14.97	14.95	14.96	15.05	14.30	14.29	14.19
12/8/08	2	15	N	PB	0.1	14.99	14.97	14.95	15.04	15.05	12.73	12.44	12.42
12/8/08	2	16	P	PC	0.1	15.05	15.03	15.02	15.03	15.04	12.30	12.20	12.16
12/8/08	2	17	P	SB	0.1	14.99	14.98	15.02	15.00	15.02	12.55	12.50	12.38
12/8/08	2	18	N	SC	0.3	14.99	14.95	14.96	14.99	14.97	14.69	14.64	14.63
12/8/08	2	19	P	PC	0.3	14.98	15.05	15.05	15.00	14.96	14.48	14.50	14.46
12/8/08	2	20	P	SC	0.3	15.00	15.05	15.03	15.00	15.05	14.43	14.38	14.42
12/8/08	2	21	N	SP	0.3	15.04	15.03	15.00	15.05	15.02	12.39	12.49	12.39
12/8/08	2	22	N	SB	0.1	15.02	15.03	15.00	15.04	15.02	12.46	12.48	12.39
12/8/08	2	23	N	PC	0.3	15.00	15.01	15.05	15.04	14.98	14.63	14.62	14.65
12/8/08	2	24	P	SB	0.3	15.04	14.99	15.02	14.98	15.05	13.06	13.02	13.08
12/8/08	2	25	N	PC	0.2	14.97	15.05	14.95	14.97	14.97	14.30	14.53	14.30
12/8/08	2	26	N	SB	0.3	15.01	15.04	15.02	14.99	15.02	13.76	13.85	13.86
12/8/08	2	27	P	PB	0.2	14.95	15.02	15.03	15.03	14.96	12.31	12.11	12.33
12/8/08	2	28	N	SP	0.2	14.97	14.98	15.02	14.95	14.99	12.20	12.15	12.21
12/8/08	2	29	N	SP	0.1	14.99	14.97	14.99	15.05	15.00	12.17	12.17	12.08
12/8/08	2	30	P	PB	0.3	15.01	15.02	15.05	15.04	14.97	12.78	12.62	12.85
12/8/08	2	31	P	Control	0	15.03	14.98	15.03	14.96	14.96	12.42	12.28	12.40
12/8/08	2	32	N	SB	0.2	15.03	14.98	14.96	15.01	14.97	13.00	12.63	12.60
12/8/08	2	33	P	ddW	0	15.05	14.96	15.05	14.99	14.97	11.90	11.82	11.95

12/8/08	2	34	P	SC	0.2	14.97	15.01	15.03	15.00	14.97	13.72	13.64	13.67
1/12/09	3	1	P	SP	0.3	14.96	14.96	15.01	15.04	15.00	12.26	12.15	12.18
1/12/09	3	2	P	ddW	0	14.95	15.00	14.96	14.99	15.00	11.72	11.71	11.69
1/12/09	3	3	N	ddW	0	14.99	15.00	15.02	15.01	14.97	12.39	12.40	12.41
1/12/09	3	4	N	PC	0.3	15.00	14.96	15.00	15.03	14.99	14.64	14.58	14.60
1/12/09	3	5	P	Control	0	15.03	15.00	15.00	14.96	15.02	12.46	12.34	12.39
1/12/09	3	6	N	SP	0.2	14.99	15.03	15.01	14.97	14.99	12.40	12.39	12.22
1/12/09	3	7	P	PB	0.3	15.04	15.02	15.01	15.03	15.03	12.87	12.41	12.54
1/12/09	3	8	N	SP	0.3	15.05	15.03	15.04	15.02	14.99	12.85	12.67	12.67
1/12/09	3	9	N	PC	0.1	14.98	15.01	14.99	15.01	14.99	13.01	12.94	12.99
1/12/09	3	10	N	SC	0.2	15.01	15.04	15.03	15.01	14.99	14.37	14.27	14.35
1/12/09	3	11	P	SP	0.1	15.04	14.97	15.02	15.01	14.99	11.62	11.63	11.76
1/12/09	3	12	P	PC	0.2	15.01	15.02	15.02	14.96	14.99	13.09	13.08	13.10
1/12/09	3	13	P	SB	0.1	15.01	14.98	15.01	15.01	15.01	12.21	12.12	12.12
1/12/09	3	14	P	PB	0.2	15.00	15.03	15.02	15.04	15.03	12.33	11.80	12.23
1/12/09	3	15	N	PB	0.3	15.01	15.03	14.97	15.02	15.02	13.77	13.57	13.55
1/12/09	3	16	N	SB	0.1	14.99	15.05	15.02	15.03	15.04	12.85	12.74	12.60
1/12/09	3	17	N	SC	0.1	14.97	14.98	15.04	15.02	15.04	12.69	12.80	12.97
1/12/09	3	18	P	SC	0.2	14.97	15.01	15.03	15.01	15.02	13.49	13.25	13.15
1/12/09	3	19	N	Control	0	15.01	15.03	15.03	15.01	15.00	13.30	13.04	13.10
1/12/09	3	20	P	SP	0.2	15.02	15.00	14.96	15.00	15.03	11.77	11.83	11.51
1/12/09	3	21	P	SC	0.3	14.95	15.01	15.04	14.99	15.04	14.36	14.29	14.34
1/12/09	3	22	N	SP	0.1	15.01	15.00	15.00	15.02	15.01	12.37	12.34	12.29
1/12/09	3	23	N	PC	0.2	15.05	15.05	15.02	14.96	15.02	14.43	14.37	14.35
1/12/09	3	24	N	SC	0.3	14.99	15.00	14.99	15.00	15.02	14.60	14.63	14.61
1/12/09	3	25	P	PC	0.1	14.99	14.99	14.99	15.02	15.04	12.40	12.47	12.43
1/12/09	3	26	N	SB	0.2	15.04	15.01	15.01	15.02	14.95	13.32	13.04	12.98
1/12/09	3	27	P	SC	0.1	15.02	14.95	14.99	14.97	15.04	12.39	12.27	12.30
1/12/09	3	28	P	PC	0.3	14.98	15.03	14.98	15.00	15.03	14.21	14.37	14.20
1/12/09	3	29	P	SB	0.2	15.00	14.95	15.02	14.98	14.98	12.34	12.24	12.43
1/12/09	3	30	P	PB	0.1	14.99	15.04	14.99	15.03	14.97	12.16	12.12	12.13
1/12/09	3	31	N	SB	0.3	14.97	15.00	14.99	14.97	14.97	13.86	13.83	13.81
1/12/09	3	32	N	PB	0.1	15.01	14.96	14.98	14.99	14.96	12.80	12.75	12.77
1/12/09	3	33	P	SB	0.3	14.98	14.99	15.02	15.02	15.00	12.77	12.70	12.58
1/12/09	3	34	N	PB	0.2	15.02	14.95	15.01	14.98	14.96	13.21	13.12	13.14

Date	Week	Sample	PSENorm	Trt	Level	15CkWtD	15CkWtE	MrawWt	MCkWt	CkYield	CkLoss
12/2/08	1	1	N	SP	0.3	13.32	13.30	15.00	13.28	88.56	11.44
12/2/08	1	2	P	SC	0.2	14.27	14.25	15.01	14.32	95.42	4.58
12/2/08	1	3	P	PB	0.2	12.54	12.70	15.00	12.68	84.53	15.47
12/2/08	1	4	P	SB	0.3	13.77	13.70	15.03	13.70	91.15	8.85
12/2/08	1	5	N	SB	0.1	13.21	12.99	14.99	13.13	87.59	12.41
12/2/08	1	6	N	SC	0.1	14.12	13.86	15.00	14.08	93.88	6.12
12/2/08	1	7	N	SC	0.2	14.61	14.55	15.01	14.55	96.95	3.05
12/2/08	1	8	N	PB	0.3	14.30	14.39	15.02	14.32	95.31	4.69
12/2/08	1	9	P	PB	0.3	13.33	13.17	15.02	13.28	88.45	11.55
12/2/08	1	10	P	SP	0.2	11.92	11.96	14.97	11.97	79.98	20.02
12/2/08	1	11	P	SB	0.1	12.35	12.32	15.00	12.40	82.68	17.32
12/2/08	1	12	N	PB	0.2	13.84	13.84	15.02	13.76	91.57	8.43
12/2/08	1	13	P	SB	0.2	12.99	12.87	15.00	12.98	86.52	13.48
12/2/08	1	14	N	SP	0.1	12.98	13.44	15.00	13.22	88.10	11.90
12/2/08	1	15	P	PC	0.1	12.66	12.61	15.00	12.75	84.97	15.03
12/2/08	1	16	N	PC	0.2	14.64	15.04	14.82	14.76	99.60	0.40
12/2/08	1	17	N	PB	0.1	13.17	13.21	15.01	13.24	88.18	11.82
12/2/08	1	18	P	ddW	0	12.41	12.49	15.03	12.49	83.15	16.85
12/2/08	1	19	P	SP	0.3	12.84	12.52	15.01	12.68	84.51	15.49
12/2/08	1	20	P	PC	0.2	14.03	14.19	15.01	14.14	94.19	5.81
12/2/08	1	21	N	SB	0.3	14.81	14.77	14.99	14.69	98.00	2.00
12/2/08	1	22	P	Control	0	12.64	12.80	15.01	12.72	84.77	15.23
12/2/08	1	23	N	SP	0.2	13.02	13.17	15.01	13.25	88.27	11.73
12/2/08	1	24	N	Control	0	13.70	13.96	15.01	13.99	93.19	6.81
12/2/08	1	25	N	SC	0.3	14.79	14.82	15.01	14.78	98.47	1.53
12/2/08	1	26	N	PC	0.3	14.76	14.72	15.00	14.75	98.33	1.67
12/2/08	1	27	N	PC	0.1	14.07	14.02	15.02	14.13	94.08	5.92
12/2/08	1	28	P	PB	0.1	12.51	12.78	15.02	12.66	84.32	15.68
12/2/08	1	29	P	SP	0.1	12.25	12.27	15.03	12.35	82.18	17.82
12/2/08	1	30	N	SB	0.2	13.99	14.11	15.02	14.12	94.01	5.99
12/2/08	1	31	N	ddW	0	12.58	12.63	15.02	12.74	84.86	15.14
12/2/08	1	32	P	PC	0.3	14.56	14.66	14.98	14.60	97.46	2.54
12/2/08	1	33	P	SC	0.1	12.61	12.43	15.01	12.62	84.09	15.91
12/2/08	1	34	P	SC	0.3	14.76	14.74	14.98	14.78	98.61	1.39

12/8/08	2	1	N	PB	0.3	13.84	13.89	14.99	13.92	92.90	7.10
12/8/08	2	2	N	ddW	0	12.38	12.37	15.03	12.37	82.35	17.65
12/8/08	2	3	P	SP	0.2	12.22	12.12	15.00	12.20	81.34	18.66
12/8/08	2	4	P	SB	0.2	12.53	12.46	14.99	12.51	83.43	16.57
12/8/08	2	5	P	PC	0.2	13.71	13.80	14.99	13.73	91.59	8.41
12/8/08	2	6	N	Control	0	13.10	13.26	15.02	13.15	87.56	12.44
12/8/08	2	7	P	PB	0.1	12.50	12.31	15.03	12.45	82.81	17.19
12/8/08	2	8	N	PB	0.2	12.95	13.07	14.99	13.11	87.41	12.59
12/8/08	2	9	P	SP	0.1	12.08	11.97	15.00	12.11	80.78	19.22
12/8/08	2	10	N	SC	0.1	13.09	13.12	15.01	13.15	87.62	12.38
12/8/08	2	11	P	SC	0.1	12.54	12.58	14.98	12.52	83.56	16.44
12/8/08	2	12	N	PC	0.1	13.00	12.99	15.00	13.05	87.02	12.98
12/8/08	2	13	P	SP	0.3	12.38	12.24	15.00	12.30	81.96	18.04
12/8/08	2	14	N	SC	0.2	14.25	14.33	14.99	14.27	95.24	4.76
12/8/08	2	15	N	PB	0.1	12.38	12.48	15.00	12.49	83.27	16.73
12/8/08	2	16	P	PC	0.1	12.14	12.17	15.03	12.19	81.11	18.89
12/8/08	2	17	P	SB	0.1	12.44	12.36	15.00	12.45	82.96	17.04
12/8/08	2	18	N	SC	0.3	14.71	14.61	14.97	14.66	97.89	2.11
12/8/08	2	19	P	PC	0.3	14.39	14.40	15.01	14.45	96.26	3.74
12/8/08	2	20	P	SC	0.3	14.33	14.45	15.03	14.40	95.85	4.15
12/8/08	2	21	N	SP	0.3	12.35	12.47	15.03	12.42	82.63	17.37
12/8/08	2	22	N	SB	0.1	12.44	12.54	15.02	12.46	82.96	17.04
12/8/08	2	23	N	PC	0.3	14.67	14.59	15.02	14.63	97.44	2.56
12/8/08	2	24	P	SB	0.3	12.86	12.86	15.02	12.98	86.41	13.59
12/8/08	2	25	N	PC	0.2	14.41	14.42	14.98	14.39	96.06	3.94
12/8/08	2	26	N	SB	0.3	13.92	13.69	15.02	13.82	92.01	7.99
12/8/08	2	27	P	PB	0.2	12.16	12.28	15.00	12.24	81.60	18.40
12/8/08	2	28	N	SP	0.2	12.08	12.31	14.98	12.19	81.36	18.64
12/8/08	2	29	N	SP	0.1	12.21	12.13	15.00	12.15	81.01	18.99
12/8/08	2	30	P	PB	0.3	12.46	12.64	15.02	12.67	84.37	15.63
12/8/08	2	31	P	Control	0	12.31	12.21	14.99	12.32	82.20	17.80
12/8/08	2	32	N	SB	0.2	12.78	12.75	14.99	12.75	85.07	14.93
12/8/08	2	33	P	ddW	0	11.94	11.79	15.00	11.88	79.18	20.82
12/8/08	2	34	P	SC	0.2	13.63	13.65	15.00	13.66	91.10	8.90
1/12/09	3	1	P	SP	0.3	12.18	12.23	14.99	12.20	81.37	18.63

1/12/09	3	2	P	ddW	0	11.50	11.64	14.98	11.65	77.78	22.22
1/12/09	3	3	N	ddW	0	12.27	12.28	15.00	12.35	82.34	17.66
1/12/09	3	4	N	PC	0.3	14.62	14.66	15.00	14.62	97.49	2.51
1/12/09	3	5	P	Control	0	12.27	12.22	15.00	12.34	82.23	17.77
1/12/09	3	6	N	SP	0.2	12.07	12.18	15.00	12.25	81.69	18.31
1/12/09	3	7	P	PB	0.3	12.52	12.42	15.03	12.55	83.54	16.46
1/12/09	3	8	N	SP	0.3	12.64	12.65	15.03	12.70	84.49	15.51
1/12/09	3	9	N	PC	0.1	12.82	12.96	15.00	12.94	86.32	13.68
1/12/09	3	10	N	SC	0.2	14.18	14.28	15.02	14.29	95.17	4.83
1/12/09	3	11	P	SP	0.1	11.70	11.67	15.01	11.68	77.81	22.19
1/12/09	3	12	P	PC	0.2	13.00	13.05	15.00	13.06	87.09	12.91
1/12/09	3	13	P	SB	0.1	12.16	12.06	15.00	12.13	80.87	19.13
1/12/09	3	14	P	PB	0.2	12.36	12.13	15.02	12.17	81.00	19.00
1/12/09	3	15	N	PB	0.3	13.72	13.91	15.01	13.70	91.30	8.70
1/12/09	3	16	N	SB	0.1	12.66	12.60	15.03	12.69	84.45	15.55
1/12/09	3	17	N	SC	0.1	12.71	12.94	15.01	12.82	85.42	14.58
1/12/09	3	18	P	SC	0.2	13.12	13.12	15.01	13.23	88.13	11.87
1/12/09	3	19	N	Control	0	13.07	13.08	15.02	13.12	87.36	12.64
1/12/09	3	20	P	SP	0.2	11.45	11.62	15.00	11.64	77.56	22.44
1/12/09	3	21	P	SC	0.3	14.29	14.33	15.01	14.32	95.44	4.56
1/12/09	3	22	N	SP	0.1	12.22	12.31	15.01	12.31	82.00	18.00
1/12/09	3	23	N	PC	0.2	14.24	14.46	15.02	14.37	95.67	4.33
1/12/09	3	24	N	SC	0.3	14.59	14.57	15.00	14.60	97.33	2.67
1/12/09	3	25	P	PC	0.1	12.29	12.29	15.01	12.38	82.47	17.53
1/12/09	3	26	N	SB	0.2	13.07	13.06	15.01	13.09	87.26	12.74
1/12/09	3	27	P	SC	0.1	12.26	12.43	14.99	12.33	82.23	17.77
1/12/09	3	28	P	PC	0.3	14.31	14.37	15.00	14.29	95.25	4.75
1/12/09	3	29	P	SB	0.2	12.23	12.15	14.99	12.28	81.93	18.07
1/12/09	3	30	P	PB	0.1	12.09	12.10	15.00	12.12	80.78	19.22
1/12/09	3	31	N	SB	0.3	13.68	13.83	14.98	13.80	92.14	7.86
1/12/09	3	32	N	PB	0.1	12.74	12.60	14.98	12.73	84.99	15.01
1/12/09	3	33	P	SB	0.3	12.61	12.64	15.00	12.66	84.39	15.61
1/12/09	3	34	N	PB	0.2	13.09	12.97	14.98	13.11	87.47	12.53

Texture Profile Analysis

Date	Week	Sample	PSENorm	Trt	Level	Rep	TestID	Hardness1N	Hardness2N	Area12Nmm	Area45Nmm	Cohesiveness
12/3/08	1	1	N	SP	0.3	1	1001	46.12	36.18	152.96	49.61	0.3243
12/3/08	1	1	N	SP	0.3	2	1002	38.56	31.52	136.22	42.47	0.3118
12/3/08	1	1	N	SP	0.3	3	1003	46.07	36.89	149.88	48.69	0.3249
12/3/08	1	1	N	SP	0.3	4	1004	46.26	37.85	157.24	51.79	0.3294
12/3/08	1	1	N	SP	0.3	5	1005	49.05	39.25	170.43	52.93	0.3106
12/3/08	1	2	P	SC	0.2	1	2001	48.74	42.06	173.54	54.41	0.3135
12/3/08	1	2	P	SC	0.2	2	2002	48.29	41.18	172.06	53.42	0.3105
12/3/08	1	2	P	SC	0.2	3	2003	44.87	37.97	148.47	49.18	0.3312
12/3/08	1	2	P	SC	0.2	4	2004	45.33	37.02	178.05	49.84	0.2799
12/3/08	1	2	P	SC	0.2	5	2005	50.03	41.92	179.47	56.05	0.3123
12/3/08	1	3	P	PB	0.2	1	3001	59.96	47.75	201.96	69.35	0.3434
12/3/08	1	3	P	PB	0.2	2	3002	57.53	47.15	178.07	63.97	0.3592
12/3/08	1	3	P	PB	0.2	3	3003	59.76	50.00	190.14	67.43	0.3546
12/3/08	1	3	P	PB	0.2	4	3004	52.02	42.98	172.51	59.28	0.3436
12/3/08	1	3	P	PB	0.2	5	3005	55.93	47.03	175.00	62.29	0.3559
12/3/08	1	4	P	SB	0.3	1	4001	51.54	44.68	158.91	56.27	0.3541
12/3/08	1	4	P	SB	0.3	2	4002	48.04	41.86	155.61	51.75	0.3326
12/3/08	1	4	P	SB	0.3	3	4003	52.17	44.23	175.54	58.36	0.3325
12/3/08	1	4	P	SB	0.3	4	4004	50.99	43.02	178.01	59.69	0.3353
12/3/08	1	4	P	SB	0.3	5	4005	53.27	46.10	167.08	57.66	0.3451
12/3/08	1	5	N	SB	0.1	1	5001	57.25	47.15	188.12	65.07	0.3459
12/3/08	1	5	N	SB	0.1	2	5002	49.32	41.26	156.79	54.55	0.3479
12/3/08	1	5	N	SB	0.1	3	5003	49.36	39.40	166.18	51.88	0.3122
12/3/08	1	5	N	SB	0.1	4	5004	49.49	41.24	170.04	56.14	0.3302
12/3/08	1	5	N	SB	0.1	5	5005	48.73	40.30	157.81	51.78	0.3281
12/3/08	1	6	N	SC	0.1	1	6001	47.40	40.33	158.39	50.72	0.3202
12/3/08	1	6	N	SC	0.1	2	6002	44.71	38.63	146.70	47.24	0.3220
12/3/08	1	6	N	SC	0.1	3	6003	46.75	39.91	155.15	50.13	0.3231
12/3/08	1	6	N	SC	0.1	4	6004	42.12	36.01	144.85	47.88	0.3305
12/3/08	1	6	N	SC	0.1	5	6005	45.39	39.50	146.22	48.74	0.3333
12/3/08	1	7	N	SC	0.2	1	7001	41.90	35.75	157.20	46.89	0.2983

12/3/08	1	7	N	SC	0.2	2	7002	41.93	36.08	162.84	47.17	0.2897
12/3/08	1	7	N	SC	0.2	3	7003	43.54	36.66	159.70	47.40	0.2968
12/3/08	1	7	N	SC	0.2	4	7004	41.60	35.63	155.29	47.39	0.3052
12/3/08	1	7	N	SC	0.2	5	7005	43.05	36.42	146.12	47.35	0.3240
12/3/08	1	8	N	PB	0.3	1	8001	42.03	36.20	151.66	47.33	0.3121
12/3/08	1	8	N	PB	0.3	2	8002	42.16	37.17	150.73	49.56	0.3288
12/3/08	1	8	N	PB	0.3	3	8003	43.23	35.44	148.99	46.12	0.3096
12/3/08	1	8	N	PB	0.3	4	8004	44.75	38.86	145.44	48.86	0.3359
12/3/08	1	8	N	PB	0.3	5	8005	45.86	39.95	156.06	50.69	0.3248
12/3/08	1	9	P	PB	0.3	1	9001	50.52	41.02	164.89	55.48	0.3365
12/3/08	1	9	P	PB	0.3	2	9002	52.05	45.06	174.51	59.66	0.3419
12/3/08	1	9	P	PB	0.3	3	9003	48.85	41.16	169.89	55.51	0.3267
12/3/08	1	9	P	PB	0.3	4	9004	54.29	46.80	163.64	60.57	0.3701
12/3/08	1	9	P	PB	0.3	5	9005	52.02	44.28	167.89	60.05	0.3577
12/3/08	1	10	P	SP	0.2	1	10001	50.27	42.10	145.80	52.07	0.3571
12/3/08	1	10	P	SP	0.2	2	10002	56.24	43.67	176.79	58.17	0.3290
12/3/08	1	10	P	SP	0.2	3	10003	47.97	38.84	149.87	52.10	0.3476
12/3/08	1	10	P	SP	0.2	4	10004	56.17	46.18	153.81	57.62	0.3746
12/3/08	1	10	P	SP	0.2	5	10005	54.39	43.57	162.79	56.23	0.3454
12/3/08	1	11	P	SB	0.1	1	11001	49.29	41.43	155.78	54.86	0.3522
12/3/08	1	11	P	SB	0.1	2	11002	55.72	44.23	172.65	61.07	0.3537
12/3/08	1	11	P	SB	0.1	3	11003	52.36	41.39	172.17	56.61	0.3288
12/3/08	1	11	P	SB	0.1	4	11004	56.29	46.33	177.46	61.86	0.3486
12/3/08	1	11	P	SB	0.1	5	11005	49.91	40.34	170.79	55.57	0.3254
12/3/08	1	12	N	PB	0.2	1	12001	48.42	41.05	149.14	52.89	0.3546
12/3/08	1	12	N	PB	0.2	2	12002	47.12	39.51	159.96	49.74	0.3110
12/3/08	1	12	N	PB	0.2	3	12003	52.12	44.50	164.23	58.09	0.3537
12/3/08	1	12	N	PB	0.2	4	12004	45.82	38.11	152.20	50.96	0.3348
12/3/08	1	12	N	PB	0.2	5	12005	51.66	42.74	168.87	56.06	0.3320
12/3/08	1	13	P	SB	0.2	1	13001	53.19	44.74	159.41	56.62	0.3552
12/3/08	1	13	P	SB	0.2	2	13002	56.22	47.73	177.24	63.07	0.3558
12/3/08	1	13	P	SB	0.2	3	13003	47.85	42.01	149.23	54.05	0.3622
12/3/08	1	13	P	SB	0.2	4	13004	51.91	44.34	159.84	55.83	0.3493
12/3/08	1	13	P	SB	0.2	5	13005	53.98	45.04	161.99	57.84	0.3571
12/3/08	1	14	N	SP	0.1	1	14001	50.01	39.75	162.83	55.00	0.3378

12/3/08	1	14	N	SP	0.1	2	14002	42.86	35.41	121.58	42.11	0.3464
12/3/08	1	14	N	SP	0.1	3	14003	46.66	38.37	142.87	49.36	0.3455
12/3/08	1	14	N	SP	0.1	4	14004	49.95	42.47	151.20	54.31	0.3592
12/3/08	1	14	N	SP	0.1	5	14005	49.79	41.52	146.38	51.74	0.3535
12/3/08	1	15	P	PC	0.1	1	15001	57.87	48.86	177.73	64.82	0.3647
12/3/08	1	15	P	PC	0.1	2	15002	62.59	51.77	195.14	69.63	0.3568
12/3/08	1	15	P	PC	0.1	3	15003	61.39	52.02	182.64	68.75	0.3764
12/3/08	1	15	P	PC	0.1	4	15004	61.66	50.68	189.81	66.83	0.3521
12/3/08	1	15	P	PC	0.1	5	15005	53.18	44.85	165.49	58.82	0.3554
12/3/08	1	16	N	PC	0.2	1	16001	45.15	37.95	160.79	47.53	0.2956
12/3/08	1	16	N	PC	0.2	2	16002	43.64	36.73	148.94	49.10	0.3297
12/3/08	1	16	N	PC	0.2	3	16003	43.59	36.01	150.27	43.86	0.2919
12/3/08	1	16	N	PC	0.2	4	16004	43.91	37.26	152.60	50.12	0.3284
12/3/08	1	16	N	PC	0.2	5	16005	41.59	36.92	149.91	44.66	0.2979
12/3/08	1	17	N	PB	0.1	1	17001	54.90	45.31	173.13	60.71	0.3507
12/3/08	1	17	N	PB	0.1	2	17002	54.52	44.98	167.66	58.68	0.3500
12/3/08	1	17	N	PB	0.1	3	17003	48.91	43.16	156.16	54.87	0.3514
12/3/08	1	17	N	PB	0.1	4	17004	54.71	45.74	180.78	59.72	0.3303
12/3/08	1	17	N	PB	0.1	5	17005	52.80	44.54	163.30	54.87	0.3360
12/3/08	1	18	P	ddW	0	1	18001	52.90	43.91	163.78	56.86	0.3472
12/3/08	1	18	P	ddW	0	2	18002	49.74	40.93	155.04	53.21	0.3432
12/3/08	1	18	P	ddW	0	3	18003	53.03	43.50	164.19	54.45	0.3316
12/3/08	1	18	P	ddW	0	4	18004	48.98	40.46	146.78	51.02	0.3476
12/3/08	1	18	P	ddW	0	5	18005	49.88	40.39	145.98	50.63	0.3468
12/3/08	1	19	P	SP	0.3	1	19001	47.62	39.82	145.49	51.36	0.3530
12/3/08	1	19	P	SP	0.3	2	19002	49.51	37.45	146.71	48.19	0.3285
12/3/08	1	19	P	SP	0.3	3	19003	50.81	40.65	152.27	51.49	0.3381
12/3/08	1	19	P	SP	0.3	4	19004	50.87	42.52	141.92	52.28	0.3684
12/3/08	1	19	P	SP	0.3	5	19005	51.14	41.43	148.65	51.61	0.3472
12/3/08	1	20	P	PC	0.2	1	20001	46.45	40.18	138.03	49.78	0.3606
12/3/08	1	20	P	PC	0.2	2	20002	50.41	42.97	154.47	56.69	0.3670
12/3/08	1	20	P	PC	0.2	3	20003	49.06	41.20	146.92	51.67	0.3517
12/3/08	1	20	P	PC	0.2	4	20004	46.89	40.00	142.77	50.44	0.3533
12/3/08	1	20	P	PC	0.2	5	20005	44.75	37.50	138.74	46.95	0.3384
12/3/08	1	21	N	SB	0.3	1	21001	43.91	38.55	149.40	48.64	0.3256

12/3/08	1	21	N	SB	0.3	2	21002	42.14	35.95	143.41	45.04	0.3141
12/3/08	1	21	N	SB	0.3	3	21003	46.96	41.09	160.63	51.87	0.3229
12/3/08	1	21	N	SB	0.3	4	21004	41.63	33.88	136.13	43.27	0.3179
12/3/08	1	21	N	SB	0.3	5	21005	41.50	35.81	138.72	43.41	0.3129
12/3/08	1	22	P	Control	0	1	22001	63.21	50.95	193.83	72.80	0.3756
12/3/08	1	22	P	Control	0	2	22002	62.07	52.01	192.52	72.00	0.3740
12/3/08	1	22	P	Control	0	3	22003	61.23	51.14	196.40	69.41	0.3534
12/3/08	1	22	P	Control	0	4	22004	67.27	56.18	206.78	76.34	0.3692
12/3/08	1	22	P	Control	0	5	22005	66.88	54.73	217.56	76.30	0.3507
12/3/08	1	23	N	SP	0.2	1	23001	49.15	39.06	150.15	52.00	0.3463
12/3/08	1	23	N	SP	0.2	2	23002	41.44	33.55	126.51	41.85	0.3308
12/3/08	1	23	N	SP	0.2	3	23003	42.89	34.57	135.55	44.23	0.3263
12/3/08	1	23	N	SP	0.2	4	23004	44.80	36.67	140.06	47.80	0.3413
12/3/08	1	23	N	SP	0.2	5	23005	47.69	39.67	140.10	51.04	0.3643
12/3/08	1	24	N	Control	0	1	24001	63.39	53.20	212.26	71.90	0.3387
12/3/08	1	24	N	Control	0	2	24002	60.02	52.94	208.18	72.65	0.3490
12/3/08	1	24	N	Control	0	3	24003	64.58	53.19	212.65	72.81	0.3424
12/3/08	1	24	N	Control	0	4	24004	63.81	52.31	213.08	73.86	0.3466
12/3/08	1	24	N	Control	0	5	24005	67.28	55.71	212.97	78.54	0.3688
12/3/08	1	25	N	SC	0.3	1	25001	44.74	37.49	167.33	50.43	0.3014
12/3/08	1	25	N	SC	0.3	2	25002	51.28	43.27	175.96	61.40	0.3489
12/3/08	1	25	N	SC	0.3	3	25003	39.99	34.45	141.61	44.65	0.3153
12/3/08	1	25	N	SC	0.3	4	25004	43.87	36.82	159.14	49.63	0.3119
12/3/08	1	25	N	SC	0.3	5	25005	49.81	43.40	185.01	60.39	0.3264
12/3/08	1	26	N	PC	0.3	1	26001	44.45	37.09	171.34	47.11	0.2750
12/3/08	1	26	N	PC	0.3	2	26002	41.96	34.88	152.62	45.51	0.2982
12/3/08	1	26	N	PC	0.3	3	26003	43.84	36.04	163.74	48.09	0.2937
12/3/08	1	26	N	PC	0.3	4	26004	44.97	36.90	170.86	52.10	0.3049
12/3/08	1	26	N	PC	0.3	5	26005	47.35	39.34	174.31	51.98	0.2982
12/3/08	1	27	N	PC	0.1	1	27001	50.45	42.38	167.17	52.91	0.3165
12/3/08	1	27	N	PC	0.1	2	27002	46.39	40.03	152.74	51.36	0.3363
12/3/08	1	27	N	PC	0.1	3	27003	48.64	40.64	169.45	50.31	0.2969
12/3/08	1	27	N	PC	0.1	4	27004	48.19	41.09	150.44	49.82	0.3312
12/3/08	1	27	N	PC	0.1	5	27005	45.22	38.62	151.31	49.14	0.3248
12/3/08	1	28	P	PB	0.1	1	28001	56.08	43.07	176.58	59.73	0.3383

12/3/08	1	28	P	PB	0.1	2	28002	50.55	40.75	162.00	52.21	0.3223
12/3/08	1	28	P	PB	0.1	5	28003	52.24	43.05	161.27	57.60	0.3572
12/3/08	1	28	P	PB	0.1	3	28004	50.52	42.57	155.21	53.53	0.3449
12/3/08	1	28	P	PB	0.1	4	28005	53.90	43.10	170.12	58.38	0.3432
12/3/08	1	29	P	SP	0.1	1	29001	44.69	34.57	131.94	42.95	0.3255
12/3/08	1	29	P	SP	0.1	2	29002	51.55	41.69	151.78	55.09	0.3630
12/3/08	1	29	P	SP	0.1	3	29003	58.04	47.13	165.40	59.95	0.3625
12/3/08	1	29	P	SP	0.1	4	29004	45.24	35.94	131.89	42.45	0.3219
12/3/08	1	29	P	SP	0.1	5	29005	46.87	37.77	136.16	46.41	0.3408
12/3/08	1	30	N	SB	0.2	1	30001	48.50	40.44	154.99	53.47	0.3450
12/3/08	1	30	N	SB	0.2	2	30002	49.02	40.67	150.71	51.97	0.3448
12/3/08	1	30	N	SB	0.2	3	30003	51.00	42.06	175.20	59.09	0.3373
12/3/08	1	30	N	SB	0.2	4	30004	46.68	37.73	155.18	51.21	0.3300
12/3/08	1	30	N	SB	0.2	5	30005	43.31	35.76	141.22	46.00	0.3257
12/3/08	1	31	N	ddW	0	1	31001	54.57	45.23	172.75	58.38	0.3379
12/3/08	1	31	N	ddW	0	2	31002	53.07	45.92	166.12	59.81	0.3600
12/3/08	1	31	N	ddW	0	3	31003	50.90	43.59	172.18	57.08	0.3315
12/3/08	1	31	N	ddW	0	4	31004	52.00	43.98	172.19	60.19	0.3496
12/3/08	1	31	N	ddW	0	5	31005	49.49	41.88	163.73	55.88	0.3413
12/3/08	1	32	P	PC	0.3	1	32001	41.91	34.98	157.91	43.84	0.2776
12/3/08	1	32	P	PC	0.3	2	32002	37.82	31.28	136.61	41.80	0.3060
12/3/08	1	32	P	PC	0.3	3	32003	39.57	31.91	149.64	43.23	0.2889
12/3/08	1	32	P	PC	0.3	4	32004	44.20	36.79	150.98	47.18	0.3125
12/3/08	1	32	P	PC	0.3	5	32005	42.42	35.73	160.68	48.21	0.3000
12/3/08	1	33	P	SC	0.1	1	33001	55.07	44.27	177.19	63.42	0.3579
12/3/08	1	33	P	SC	0.1	2	33002	55.71	44.05	171.88	61.08	0.3554
12/3/08	1	33	P	SC	0.1	3	33003	52.29	42.81	153.56	57.11	0.3719
12/3/08	1	33	P	SC	0.1	4	33004	58.20	46.82	170.47	63.60	0.3731
12/3/08	1	33	P	SC	0.1	5	33005	62.80	51.32	190.05	68.15	0.3586
12/3/08	1	34	P	SC	0.3	1	34001	43.83	37.19	159.43	50.31	0.3156
12/3/08	1	34	P	SC	0.3	2	34002	40.00	34.81	160.67	47.82	0.2976
12/3/08	1	34	P	SC	0.3	3	34003	43.77	36.03	168.18	46.83	0.2785
12/3/08	1	34	P	SC	0.3	4	34004	45.81	38.75	176.11	51.66	0.2933
12/3/08	1	34	P	SC	0.3	5	34005	44.03	37.22	155.10	49.09	0.3165
12/9/08	1	1	N	PB	0.3	1	1001	40.63	33.95	126.10	40.00	0.3172

12/9/08	1	1	N	PB	0.3	2	1002	38.90	32.44	137.40	40.95	0.2980
12/9/08	1	1	N	PB	0.3	3	1003	40.35	34.61	135.42	42.93	0.3170
12/9/08	1	1	N	PB	0.3	4	1004	47.38	41.20	158.55	52.62	0.3319
12/9/08	1	1	N	PB	0.3	5	1005	42.54	35.62	133.41	44.28	0.3319
12/9/08	1	2	N	ddW	0	1	2001	53.99	45.15	162.99	53.48	0.3281
12/9/08	1	2	N	ddW	0	2	2002	43.19	35.90	135.76	45.60	0.3359
12/9/08	1	2	N	ddW	0	3	2003	44.64	37.03	136.88	44.92	0.3282
12/9/08	1	2	N	ddW	0	4	2004	52.20	43.60	144.45	50.10	0.3468
12/9/08	1	2	N	ddW	0	5	2005	43.89	36.15	139.22	44.64	0.3206
12/9/08	1	3	P	SP	0.2	1	3001	50.69	41.32	129.09	47.62	0.3689
12/9/08	1	3	P	SP	0.2	2	3002	51.51	41.43	140.20	50.66	0.3613
12/9/08	1	3	P	SP	0.2	3	3003	54.88	44.07	145.51	53.56	0.3681
12/9/08	1	3	P	SP	0.2	4	3004	48.80	39.49	140.26	48.29	0.3443
12/9/08	1	3	P	SP	0.2	5	3005	46.42	39.04	123.60	44.53	0.3603
12/9/08	1	4	P	SB	0.2	1	4001	54.94	47.38	169.77	60.18	0.3545
12/9/08	1	4	P	SB	0.2	2	4002	51.78	43.88	164.18	55.93	0.3407
12/9/08	1	4	P	SB	0.2	3	4003	55.01	46.81	167.57	59.26	0.3536
12/9/08	1	4	P	SB	0.2	4	4004	52.48	44.47	174.91	58.16	0.3325
12/9/08	1	4	P	SB	0.2	5	4005	55.05	47.45	179.78	63.16	0.3513
12/9/08	1	5	P	PC	0.2	1	5001	42.43	35.56	133.40	46.39	0.3478
12/9/08	1	5	P	PC	0.2	2	5002	46.53	39.66	133.78	48.25	0.3607
12/9/08	1	5	P	PC	0.2	3	5003	46.57	39.17	147.88	51.03	0.3451
12/9/08	1	5	P	PC	0.2	4	5004	43.99	38.39	136.24	48.08	0.3529
12/9/08	1	5	P	PC	0.2	5	5005	.	.	.	.	.
12/9/08	1	6	N	Control	0	1	6001	55.02	48.46	180.13	65.10	0.3614
12/9/08	1	6	N	Control	0	2	6002	60.12	49.68	189.78	65.62	0.3458
12/9/08	1	6	N	Control	0	3	6003	61.34	51.25	195.96	66.24	0.3380
12/9/08	1	6	N	Control	0	4	6004	63.18	53.40	206.18	73.84	0.3581
12/9/08	1	6	N	Control	0	5	6005	60.91	52.68	191.36	66.95	0.3499
12/9/08	1	7	P	PB	0.1	1	7001	46.29	38.34	140.78	47.72	0.3390
12/9/08	1	7	P	PB	0.1	2	7002	46.72	37.87	156.22	49.27	0.3154
12/9/08	1	7	P	PB	0.1	3	7003	46.40	37.24	143.05	45.03	0.3148
12/9/08	1	7	P	PB	0.1	4	7004	43.56	35.34	150.01	47.53	0.3168
12/9/08	1	7	P	PB	0.1	5	7005	43.49	35.26	128.98	44.06	0.3416
12/9/08	1	8	N	PB	0.2	1	8001	44.30	37.54	131.18	45.74	0.3487

12/9/08	1	8	N	PB	0.2	2	8002	48.23	40.90	158.19	51.93	0.3283
12/9/08	1	8	N	PB	0.2	3	8003	39.92	33.69	140.83	47.73	0.3389
12/9/08	1	8	N	PB	0.2	4	8004	43.56	35.05	146.37	45.54	0.3111
12/9/08	1	8	N	PB	0.2	5	8005	45.38	38.36	136.03	45.72	0.3361
12/9/08	1	9	P	SP	0.1	1	9001	40.80	33.15	118.94	40.12	0.3373
12/9/08	1	9	P	SP	0.1	2	9002	41.77	33.86	128.24	42.00	0.3275
12/9/08	1	9	P	SP	0.1	3	9003	41.75	33.44	116.99	40.45	0.3458
12/9/08	1	9	P	SP	0.1	4	9004	38.24	30.45	110.03	35.36	0.3214
12/9/08	1	9	P	SP	0.1	5	9005	42.13	32.79	125.56	41.53	0.3308
12/9/08	1	10	N	SC	0.1	1	10001	49.01	41.19	156.42	51.70	0.3305
12/9/08	1	10	N	SC	0.1	2	10002	43.91	37.77	140.90	46.96	0.3333
12/9/08	1	10	N	SC	0.1	3	10003	44.25	37.93	139.00	46.63	0.3355
12/9/08	1	10	N	SC	0.1	4	10004	40.42	35.03	127.23	43.71	0.3436
12/9/08	1	10	N	SC	0.1	5	10005	41.97	36.82	124.99	44.75	0.3580
12/9/08	1	11	P	SC	0.1	1	11001	45.86	38.54	138.35	49.70	0.3592
12/9/08	1	11	P	SC	0.1	2	11002	50.61	41.76	161.05	54.67	0.3395
12/9/08	1	11	P	SC	0.1	3	11003	48.04	38.98	148.06	49.73	0.3359
12/9/08	1	11	P	SC	0.1	4	11004	41.85	34.57	131.64	45.13	0.3428
12/9/08	1	11	P	SC	0.1	5	11005	51.00	43.17	156.34	57.60	0.3684
12/9/08	1	12	N	PC	0.1	1	12001	40.79	35.01	129.54	43.56	0.3363
12/9/08	1	12	N	PC	0.1	2	12002	38.37	32.33	122.95	41.66	0.3388
12/9/08	1	12	N	PC	0.1	3	12003	43.27	37.26	138.21	46.22	0.3344
12/9/08	1	12	N	PC	0.1	4	12004	46.07	38.57	149.20	50.47	0.3383
12/9/08	1	12	N	PC	0.1	5	12005	38.84	33.85	131.05	44.30	0.3380
12/9/08	1	13	P	SP	0.3	1	13001	48.87	39.43	138.71	50.33	0.3628
12/9/08	1	13	P	SP	0.3	2	13002	48.07	37.99	141.89	48.16	0.3394
12/9/08	1	13	P	SP	0.3	3	13003	52.36	41.02	156.57	52.48	0.3352
12/9/08	1	13	P	SP	0.3	4	13004	46.55	38.17	135.86	46.49	0.3422
12/9/08	1	13	P	SP	0.3	5	13005	49.59	39.12	149.35	50.78	0.3400
12/9/08	1	14	N	SC	0.2	1	14001	41.13	35.05	145.37	45.55	0.3133
12/9/08	1	14	N	SC	0.2	2	14002	39.37	32.67	141.68	41.32	0.2916
12/9/08	1	14	N	SC	0.2	3	14003	41.53	35.29	129.27	41.63	0.3220
12/9/08	1	14	N	SC	0.2	4	14004	41.23	35.28	138.41	45.67	0.3300
12/9/08	1	14	N	SC	0.2	5	14005	39.94	34.50	138.26	42.77	0.3093
12/9/08	1	15	N	PB	0.1	1	15001	46.16	37.87	151.74	50.20	0.3308

12/9/08	1	15	N	PB	0.1	2	15002	54.90	44.66	170.41	57.47	0.3372
12/9/08	1	15	N	PB	0.1	3	15003	45.82	39.03	148.67	50.53	0.3399
12/9/08	1	15	N	PB	0.1	4	15004	48.13	40.46	154.98	51.59	0.3329
12/9/08	1	15	N	PB	0.1	5	15005	47.76	39.09	156.57	52.32	0.3342
12/9/08	1	16	P	PC	0.1	1	16001	48.89	41.88	154.88	53.89	0.3479
12/9/08	1	16	P	PC	0.1	2	16002	52.95	45.46	154.68	56.82	0.3673
12/9/08	1	16	P	PC	0.1	3	16003	47.39	39.40	142.38	49.68	0.3489
12/9/08	1	16	P	PC	0.1	4	16004	50.52	43.69	155.08	53.86	0.3473
12/9/08	1	16	P	PC	0.1	5	16005	51.06	41.41	158.63	53.85	0.3395
12/9/08	1	17	P	SB	0.1	1	17001	47.64	38.05	154.87	49.77	0.3214
12/9/08	1	17	P	SB	0.1	2	17002	42.61	35.53	141.40	45.46	0.3215
12/9/08	1	17	P	SB	0.1	3	17003	43.43	35.99	145.03	45.91	0.3166
12/9/08	1	17	P	SB	0.1	4	17004	49.65	30.80	168.03	53.92	0.3209
12/9/08	1	17	P	SB	0.1	5	17005	45.49	37.89	154.23	49.02	0.3178
12/9/08	1	18	N	SC	0.3	1	18001	34.75	28.95	139.08	37.38	0.2688
12/9/08	1	18	N	SC	0.3	2	18002	37.92	30.62	144.51	39.37	0.2724
12/9/08	1	18	N	SC	0.3	3	18003	39.19	32.86	149.20	41.42	0.2776
12/9/08	1	18	N	SC	0.3	4	18004	36.63	29.92	140.38	36.83	0.2624
12/9/08	1	18	N	SC	0.3	5	18005	38.56	31.52	147.68	42.46	0.2875
12/9/08	1	19	P	PC	0.3	1	19001	39.00	33.11	135.03	41.11	0.3045
12/9/08	1	19	P	PC	0.3	2	19002	39.68	33.90	146.89	44.20	0.3009
12/9/08	1	19	P	PC	0.3	3	19003	32.83	27.22	118.12	32.84	0.2780
12/9/08	1	19	P	PC	0.3	4	19004	38.73	31.62	134.61	39.80	0.2957
12/9/08	1	19	P	PC	0.3	5	19005	38.22	32.57	132.43	41.54	0.3137
12/9/08	1	20	P	SC	0.3	1	20001	40.30	34.70	144.31	43.98	0.3048
12/9/08	1	20	P	SC	0.3	2	20002	41.61	35.85	142.96	45.82	0.3205
12/9/08	1	20	P	SC	0.3	3	20003	39.67	33.23	141.17	41.41	0.2933
12/9/08	1	20	P	SC	0.3	4	20004	41.48	35.77	155.16	46.48	0.2996
12/9/08	1	20	P	SC	0.3	5	20005	43.15	36.97	138.72	44.96	0.3241
12/9/08	1	21	N	SP	0.3	1	21001	.	.	.	.	.
12/9/08	1	21	N	SP	0.3	2	21002	48.31	40.18	161.52	54.93	0.3401
12/9/08	1	21	N	SP	0.3	3	21003	48.16	40.01	157.35	51.18	0.3253
12/9/08	1	21	N	SP	0.3	4	21004	47.77	39.55	159.49	51.94	0.3257
12/9/08	1	21	N	SP	0.3	5	21005	47.98	39.05	154.38	52.66	0.3411
12/9/08	1	22	N	SB	0.1	1	22001	49.91	42.71	149.26	53.90	0.3611

12/9/08	1	22	N	SB	0.1	2	22002	52.90	45.75	161.05	56.72	0.3522
12/9/08	1	22	N	SB	0.1	3	22003	.	.	.	.	.
12/9/08	1	22	N	SB	0.1	4	22004	47.77	40.82	156.90	54.24	0.3457
12/9/08	1	22	N	SB	0.1	5	22005	48.60	39.84	164.33	52.48	0.3194
12/9/08	1	23	N	PC	0.3	1	23001	34.22	29.12	145.58	40.44	0.2778
12/9/08	1	23	N	PC	0.3	2	23002	36.18	29.97	147.03	40.11	0.2728
12/9/08	1	23	N	PC	0.3	3	23003	34.46	29.15	137.11	36.70	0.2677
12/9/08	1	23	N	PC	0.3	4	23004	41.22	34.98	144.82	46.07	0.3181
12/9/08	1	23	N	PC	0.3	5	23005	33.60	28.80	133.16	36.77	0.2761
12/9/08	1	24	P	SB	0.3	1	24001	48.22	40.12	179.02	55.22	0.3085
12/9/08	1	24	P	SB	0.3	2	24002	45.36	38.19	160.31	51.09	0.3187
12/9/08	1	24	P	SB	0.3	3	24003	41.58	34.39	139.16	43.73	0.3142
12/9/08	1	24	P	SB	0.3	4	24004	48.63	39.52	159.21	52.71	0.3311
12/9/08	1	24	P	SB	0.3	5	24005	47.35	39.33	169.97	51.65	0.3039
12/9/08	1	25	N	PC	0.2	1	25001	42.77	36.11	154.74	46.93	0.3033
12/9/08	1	25	N	PC	0.2	2	25002	42.39	37.17	156.97	48.71	0.3103
12/9/08	1	25	N	PC	0.2	3	25003	41.95	35.86	151.91	48.64	0.3202
12/9/08	1	25	N	PC	0.2	4	25004	41.76	36.02	142.41	44.89	0.3152
12/9/08	1	25	N	PC	0.2	5	25005	38.47	32.60	144.45	42.32	0.2930
12/9/08	1	26	N	SB	0.3	1	26001	46.21	38.45	146.94	47.72	0.3248
12/9/08	1	26	N	SB	0.3	2	26002	48.11	41.85	165.36	53.85	0.3257
12/9/08	1	26	N	SB	0.3	3	26003	46.57	39.69	143.33	49.49	0.3453
12/9/08	1	26	N	SB	0.3	4	26004	46.12	38.71	144.05	46.17	0.3205
12/9/08	1	26	N	SB	0.3	5	26005	45.18	39.90	140.83	49.91	0.3544
12/9/08	1	27	P	PB	0.2	1	27001	53.75	42.81	177.31	56.61	0.3193
12/9/08	1	27	P	PB	0.2	2	27002	55.72	46.63	177.76	61.47	0.3458
12/9/08	1	27	P	PB	0.2	3	27003	55.28	46.09	181.44	59.84	0.3298
12/9/08	1	27	P	PB	0.2	4	27004	48.98	40.36	159.72	53.02	0.3320
12/9/08	1	27	P	PB	0.2	5	27005	53.65	43.66	178.89	58.71	0.3282
12/9/08	1	28	N	SP	0.2	1	28001	43.25	34.15	125.25	43.72	0.3491
12/9/08	1	28	N	SP	0.2	2	28002	44.94	37.40	148.64	48.38	0.3255
12/9/08	1	28	N	SP	0.2	3	28003	52.79	41.32	174.91	56.33	0.3221
12/9/08	1	28	N	SP	0.2	4	28004	47.97	39.34	152.10	50.18	0.3299
12/9/08	1	28	N	SP	0.2	5	28005	48.79	41.14	157.80	53.90	0.3416
12/9/08	1	29	N	SP	0.1	1	29001	54.98	44.53	172.09	56.45	0.3280

12/9/08	1	29	N	SP	0.1	2	29002	49.33	39.62	151.95	49.58	0.3263
12/9/08	1	29	N	SP	0.1	3	29003	46.87	38.59	150.46	48.33	0.3212
12/9/08	1	29	N	SP	0.1	4	29004	53.10	42.59	159.07	53.74	0.3378
12/9/08	1	29	N	SP	0.1	5	29005	46.39	35.96	143.46	46.25	0.3224
12/9/08	1	30	P	PB	0.3	1	30001	54.53	45.72	176.20	59.00	0.3348
12/9/08	1	30	P	PB	0.3	2	30002	54.95	46.62	186.72	60.85	0.3259
12/9/08	1	30	P	PB	0.3	3	30003	56.71	48.32	192.24	63.16	0.3285
12/9/08	1	30	P	PB	0.3	4	30004	57.95	48.46	184.74	62.21	0.3367
12/9/08	1	30	P	PB	0.3	5	30005	51.70	43.52	149.98	54.24	0.3616
12/9/08	1	31	P	Control	0	1	31001	62.74	51.97	210.44	69.94	0.3324
12/9/08	1	31	P	Control	0	2	31002	68.56	55.41	223.13	75.85	0.3399
12/9/08	1	31	P	Control	0	3	31003	64.06	53.24	196.69	69.22	0.3519
12/9/08	1	31	P	Control	0	4	31004	64.10	52.27	213.52	71.36	0.3342
12/9/08	1	31	P	Control	0	5	31005	66.05	51.85	219.17	68.84	0.3141
12/9/08	1	32	N	SB	0.2	1	32001	53.89	46.61	173.35	60.15	0.3470
12/9/08	1	32	N	SB	0.2	2	32002	52.91	44.06	175.25	59.84	0.3415
12/9/08	1	32	N	SB	0.2	3	32003	45.30	36.41	136.72	47.84	0.3499
12/9/08	1	32	N	SB	0.2	4	32004	45.53	38.36	148.01	49.13	0.3319
12/9/08	1	32	N	SB	0.2	5	32005	50.37	41.53	161.87	55.54	0.3431
12/9/08	1	33	P	ddW	0	1	33001	49.55	39.83	160.59	51.24	0.3191
12/9/08	1	33	P	ddW	0	2	33002	47.38	37.08	151.18	45.76	0.3027
12/9/08	1	33	P	ddW	0	3	33003	46.56	37.39	144.39	47.27	0.3274
12/9/08	1	33	P	ddW	0	4	33004	50.69	38.41	170.08	51.00	0.2999
12/9/08	1	33	P	ddW	0	5	33005	47.07	36.60	145.55	44.98	0.3090
12/9/08	1	34	P	SC	0.2	1	34001	45.89	39.49	168.20	53.55	0.3184
12/9/08	1	34	P	SC	0.2	2	34002	43.03	36.66	140.15	46.73	0.3334
12/9/08	1	34	P	SC	0.2	3	34003	46.07	39.73	146.20	49.59	0.3392
12/9/08	1	34	P	SC	0.2	4	34004	43.35	36.82	160.29	49.55	0.3091
12/9/08	1	34	P	SC	0.2	5	34005	44.42	37.14	156.70	48.34	0.3085
1/13/09	1	1	P	SP	0.3	1	1001	58.47	46.74	182.25	63.60	0.3490
1/13/09	1	1	P	SP	0.3	2	1002	55.38	42.25	172.46	56.40	0.3270
1/13/09	1	1	P	SP	0.3	3	1003	50.58	40.01	142.94	53.59	0.3749
1/13/09	1	1	P	SP	0.3	4	1004	56.38	45.30	174.96	60.57	0.3462
1/13/09	1	1	P	SP	0.3	5	1005	51.65	41.31	161.52	57.94	0.3587
1/13/09	1	2	P	ddW	0	1	2001	53.59	43.38	158.10	56.50	0.3574

1/13/09	1	2	P	ddW	0	2	2002	60.06	49.94	179.56	63.79	0.3553
1/13/09	1	2	P	ddW	0	3	2003	59.60	49.10	187.64	64.15	0.3419
1/13/09	1	2	P	ddW	0	4	2004	57.08	46.88	180.15	60.93	0.3382
1/13/09	1	2	P	ddW	0	5	2005	48.74	39.04	158.81	51.22	0.3225
1/13/09	1	3	N	ddW	0	1	3001	54.46	43.04	167.40	55.31	0.3304
1/13/09	1	3	N	ddW	0	2	3002	54.22	44.86	174.07	57.75	0.3318
1/13/09	1	3	N	ddW	0	3	3003	55.71	44.69	169.81	56.64	0.3335
1/13/09	1	3	N	ddW	0	4	3004	52.55	43.66	161.88	53.10	0.3280
1/13/09	1	3	N	ddW	0	5	3005	53.48	43.78	168.24	57.12	0.3395
1/13/09	1	4	N	PC	0.3	1	4001	39.27	33.02	148.16	39.85	0.2690
1/13/09	1	4	N	PC	0.3	2	4002	41.82	34.37	154.24	45.60	0.2956
1/13/09	1	4	N	PC	0.3	3	4003	44.43	38.69	163.25	52.65	0.3225
1/13/09	1	4	N	PC	0.3	4	4004	44.22	37.49	148.26	47.71	0.3218
1/13/09	1	4	N	PC	0.3	5	4005	44.12	37.48	146.11	46.56	0.3187
1/13/09	1	5	P	Control	0	1	5001	77.97	62.18	260.07	88.12	0.3388
1/13/09	1	5	P	Control	0	2	5002	75.23	58.73	234.30	81.73	0.3488
1/13/09	1	5	P	Control	0	3	5003	67.90	54.94	232.23	77.56	0.3340
1/13/09	1	5	P	Control	0	4	5004	70.81	56.32	229.08	76.93	0.3358
1/13/09	1	5	P	Control	0	5	5005	70.25	56.19	237.18	79.55	0.3354
1/13/09	1	6	N	SP	0.2	1	6001	54.85	43.73	167.10	58.68	0.3512
1/13/09	1	6	N	SP	0.2	2	6002	57.53	43.08	171.58	57.59	0.3356
1/13/09	1	6	N	SP	0.2	3	6003	60.53	47.16	190.31	66.43	0.3491
1/13/09	1	6	N	SP	0.2	4	6004	44.99	35.41	132.55	43.91	0.3313
1/13/09	1	6	N	SP	0.2	5	6005	51.08	41.12	140.87	51.82	0.3679
1/13/09	1	7	P	PB	0.3	1	7001	53.13	44.88	163.29	56.66	0.3470
1/13/09	1	7	P	PB	0.3	2	7002	51.05	41.39	157.10	54.17	0.3448
1/13/09	1	7	P	PB	0.3	3	7003	54.56	43.98	178.54	60.68	0.3399
1/13/09	1	7	P	PB	0.3	4	7004	57.49	47.92	190.19	63.96	0.3363
1/13/09	1	7	P	PB	0.3	5	7005	52.46	44.27	175.58	60.55	0.3449
1/13/09	1	8	N	SP	0.3	1	8001	45.89	36.58	136.29	48.13	0.3531
1/13/09	1	8	N	SP	0.3	2	8002	54.64	46.06	156.84	59.19	0.3774
1/13/09	1	8	N	SP	0.3	3	8003	47.06	38.36	145.63	49.31	0.3386
1/13/09	1	8	N	SP	0.3	4	8004	44.64	35.38	123.26	46.68	0.3787
1/13/09	1	8	N	SP	0.3	5	8005	52.25	42.61	159.99	56.70	0.3544
1/13/09	1	9	N	PC	0.1	1	9001	51.48	43.29	174.54	57.74	0.3308

1/13/09	1	9	N	PC	0.1	2	9002	53.31	43.13	166.68	57.74	0.3464
1/13/09	1	9	N	PC	0.1	3	9003	56.94	47.66	179.36	65.25	0.3638
1/13/09	1	9	N	PC	0.1	4	9004	49.56	39.86	161.66	53.33	0.3299
1/13/09	1	9	N	PC	0.1	5	9005	48.04	38.53	161.49	51.39	0.3182
1/13/09	1	10	N	SC	0.2	1	10001	43.32	36.23	153.01	45.55	0.2977
1/13/09	1	10	N	SC	0.2	2	10002	47.54	37.14	159.04	49.56	0.3116
1/13/09	1	10	N	SC	0.2	3	10003	44.79	38.12	158.19	51.86	0.3278
1/13/09	1	10	N	SC	0.2	4	10004	44.79	37.38	143.29	47.89	0.3342
1/13/09	1	10	N	SC	0.2	5	10005	43.55	37.17	147.76	49.08	0.3322
1/13/09	1	11	P	SP	0.1	1	11001	46.77	37.28	144.12	45.88	0.3183
1/13/09	1	11	P	SP	0.1	2	11002	50.40	38.35	145.18	48.86	0.3365
1/13/09	1	11	P	SP	0.1	3	11003	44.71	32.75	134.65	42.15	0.3130
1/13/09	1	11	P	SP	0.1	4	11004	50.97	39.14	142.30	48.25	0.3391
1/13/09	1	11	P	SP	0.1	5	11005	46.78	35.50	139.01	45.93	0.3304
1/13/09	1	12	P	PC	0.2	1	12001	47.96	40.75	151.26	52.02	0.3439
1/13/09	1	12	P	PC	0.2	2	12002	48.77	40.14	154.27	53.57	0.3472
1/13/09	1	12	P	PC	0.2	3	12003	47.91	40.50	155.22	53.82	0.3467
1/13/09	1	12	P	PC	0.2	4	12004	46.02	39.49	157.96	50.23	0.3180
1/13/09	1	12	P	PC	0.2	5	12005	48.97	41.33	162.73	54.15	0.3328
1/13/09	1	13	P	SB	0.1	1	13001	57.76	47.99	181.01	62.95	0.3478
1/13/09	1	13	P	SB	0.1	2	13002	54.95	43.82	161.88	58.72	0.3627
1/13/09	1	13	P	SB	0.1	3	13003	55.77	43.89	170.12	58.76	0.3454
1/13/09	1	13	P	SB	0.1	4	13004	46.34	36.69	136.71	46.67	0.3414
1/13/09	1	13	P	SB	0.1	5	13005	56.83	46.15	176.18	60.22	0.3418
1/13/09	1	14	P	PB	0.2	1	14001	54.36	45.29	173.23	60.14	0.3472
1/13/09	1	14	P	PB	0.2	2	14002	58.61	49.44	183.04	65.72	0.3590
1/13/09	1	14	P	PB	0.2	3	14003	54.75	44.39	185.89	63.27	0.3404
1/13/09	1	14	P	PB	0.2	4	14004	53.93	43.98	174.97	61.30	0.3503
1/13/09	1	14	P	PB	0.2	5	14005	57.57	48.24	166.21	63.16	0.3800
1/13/09	1	15	N	PB	0.3	1	15001	45.13	36.86	153.27	48.10	0.3138
1/13/09	1	15	N	PB	0.3	2	15002	47.97	38.92	155.65	52.98	0.3404
1/13/09	1	15	N	PB	0.3	3	15003	44.95	35.50	142.81	46.44	0.3252
1/13/09	1	15	N	PB	0.3	4	15004	47.50	39.03	142.75	51.50	0.3608
1/13/09	1	15	N	PB	0.3	5	15005	46.40	37.47	158.85	51.18	0.3222
1/13/09	1	16	N	SB	0.1	1	16001	54.95	43.73	164.98	59.08	0.3581

1/13/09	1	16	N	SB	0.1	2	16002	51.93	42.65	161.17	55.78	0.3461
1/13/09	1	16	N	SB	0.1	3	16003	49.40	41.11	150.79	54.22	0.3596
1/13/09	1	16	N	SB	0.1	4	16004	49.61	42.69	149.81	54.44	0.3634
1/13/09	1	16	N	SB	0.1	5	16005	51.73	42.47	160.99	53.35	0.3314
1/13/09	1	17	N	SC	0.1	1	17001	51.53	41.94	169.48	55.59	0.3280
1/13/09	1	17	N	SC	0.1	2	17002	47.62	39.19	142.71	47.30	0.3314
1/13/09	1	17	N	SC	0.1	3	17003	48.56	38.39	152.32	50.86	0.3339
1/13/09	1	17	N	SC	0.1	4	17004	47.93	40.10	154.94	52.95	0.3417
1/13/09	1	17	N	SC	0.1	5	17005	50.35	41.84	148.73	52.01	0.3497
1/13/09	1	18	P	SC	0.2	1	18001	48.16	41.47	152.85	50.78	0.3322
1/13/09	1	18	P	SC	0.2	2	18002	54.83	47.68	167.28	60.15	0.3596
1/13/09	1	18	P	SC	0.2	3	18003	51.50	44.04	165.50	56.64	0.3422
1/13/09	1	18	P	SC	0.2	4	18004	49.23	41.06	167.49	55.51	0.3314
1/13/09	1	18	P	SC	0.2	5	18005	54.62	46.81	185.22	62.85	0.3393
1/13/09	1	19	N	Control	0	1	19001	73.38	61.54	239.11	82.29	0.3442
1/13/09	1	19	N	Control	0	2	19002	66.83	54.61	231.47	76.00	0.3283
1/13/09	1	19	N	Control	0	3	19003	62.35	49.79	209.18	68.94	0.3296
1/13/09	1	19	N	Control	0	4	19004	63.83	52.16	213.78	70.23	0.3285
1/13/09	1	19	N	Control	0	5	19005	72.85	57.85	238.80	81.08	0.3395
1/13/09	1	20	P	SP	0.2	1	20001	59.10	47.23	162.95	58.75	0.3605
1/13/09	1	20	P	SP	0.2	2	20002	52.56	43.54	143.69	54.23	0.3774
1/13/09	1	20	P	SP	0.2	3	20003	54.86	42.78	157.44	54.50	0.3462
1/13/09	1	20	P	SP	0.2	4	20004	50.39	40.47	145.48	50.75	0.3488
1/13/09	1	20	P	SP	0.2	5	20005	55.57	43.58	161.12	56.60	0.3513
1/13/09	1	21	P	SC	0.3	1	21001	44.30	37.65	151.24	46.44	0.3071
1/13/09	1	21	P	SC	0.3	2	21002	44.41	38.05	163.91	48.58	0.2964
1/13/09	1	21	P	SC	0.3	3	21003	43.50	36.86	154.01	47.13	0.3060
1/13/09	1	21	P	SC	0.3	4	21004	47.59	40.64	159.19	49.42	0.3104
1/13/09	1	21	P	SC	0.3	5	21005	44.63	38.41	152.29	48.96	0.3215
1/13/09	1	22	N	SP	0.1	1	22001	47.55	37.18	139.47	45.75	0.3280
1/13/09	1	22	N	SP	0.1	2	22002	46.27	38.22	133.53	46.45	0.3479
1/13/09	1	22	N	SP	0.1	3	22003	49.31	40.76	143.55	50.82	0.3540
1/13/09	1	22	N	SP	0.1	4	22004	48.26	37.38	133.61	46.34	0.3468
1/13/09	1	22	N	SP	0.1	5	22005	49.08	39.81	147.63	49.32	0.3341
1/13/09	1	23	N	PC	0.2	1	23001	40.96	35.27	132.72	42.36	0.3192

1/13/09	1	23	N	PC	0.2	2	23002	42.39	36.53	149.29	46.24	0.3097
1/13/09	1	23	N	PC	0.2	3	23003	38.92	33.74	134.91	41.41	0.3069
1/13/09	1	23	N	PC	0.2	4	23004	43.61	37.64	148.78	47.81	0.3213
1/13/09	1	23	N	PC	0.2	5	23005	35.24	30.07	126.92	37.87	0.2984
1/13/09	1	24	N	SC	0.3	1	24001	37.54	32.00	142.45	41.92	0.2943
1/13/09	1	24	N	SC	0.3	2	24002	38.80	33.11	133.93	40.96	0.3058
1/13/09	1	24	N	SC	0.3	3	24003	40.58	33.60	148.78	44.03	0.2959
1/13/09	1	24	N	SC	0.3	4	24004	38.42	31.61	147.05	42.53	0.2892
1/13/09	1	24	N	SC	0.3	5	24005	36.63	30.40	125.96	38.71	0.3073
1/13/09	1	25	P	PC	0.1	1	25001	51.34	42.03	160.93	55.46	0.3446
1/13/09	1	25	P	PC	0.1	2	25002	52.14	41.93	165.37	55.37	0.3348
1/13/09	1	25	P	PC	0.1	3	25003	53.75	44.24	172.79	57.19	0.3310
1/13/09	1	25	P	PC	0.1	4	25004	50.87	42.63	157.42	54.88	0.3486
1/13/09	1	25	P	PC	0.1	5	25005	51.32	41.41	163.18	55.61	0.3408
1/13/09	1	26	N	SB	0.2	1	26001	44.52	37.64	141.06	49.72	0.3525
1/13/09	1	26	N	SB	0.2	2	26002	51.61	41.77	165.09	55.65	0.3371
1/13/09	1	26	N	SB	0.2	3	26003	48.57	40.75	147.53	53.95	0.3657
1/13/09	1	26	N	SB	0.2	4	26004	49.32	40.67	144.25	52.33	0.3628
1/13/09	1	26	N	SB	0.2	5	26005	52.28	42.82	166.87	58.59	0.3511
1/13/09	1	27	P	SC	0.1	1	27001	56.93	47.28	173.51	63.47	0.3658
1/13/09	1	27	P	SC	0.1	2	27002	61.07	49.51	185.67	65.02	0.3502
1/13/09	1	27	P	SC	0.1	3	27003	53.11	42.50	164.58	55.38	0.3365
1/13/09	1	27	P	SC	0.1	4	27004	52.71	43.77	151.35	55.89	0.3693
1/13/09	1	27	P	SC	0.1	5	27005	54.59	44.68	156.11	58.23	0.3730
1/13/09	1	28	P	PC	0.3	1	28001	44.32	37.68	144.00	46.28	0.3214
1/13/09	1	28	P	PC	0.3	2	28002	46.99	40.44	150.38	50.41	0.3352
1/13/09	1	28	P	PC	0.3	3	28003	42.17	36.08	149.48	47.44	0.3174
1/13/09	1	28	P	PC	0.3	4	28004	45.16	38.67	156.04	51.63	0.3309
1/13/09	1	28	P	PC	0.3	5	28005	46.45	37.20	155.89	50.87	0.3263
1/13/09	1	29	P	SB	0.2	1	29001	48.72	39.09	152.43	51.85	0.3402
1/13/09	1	29	P	SB	0.2	2	29002	52.03	42.94	166.03	58.04	0.3496
1/13/09	1	29	P	SB	0.2	3	29003	54.14	44.50	170.98	57.42	0.3358
1/13/09	1	29	P	SB	0.2	4	29004	54.59	43.35	177.59	61.07	0.3439
1/13/09	1	29	P	SB	0.2	5	29005	49.41	41.61	146.10	53.76	0.3680
1/13/09	1	30	P	PB	0.1	1	30001	54.59	43.46	167.98	58.17	0.3463

1/13/09	1	30	P	PB	0.1	2	30002	55.00	43.01	156.75	55.48	0.3539
1/13/09	1	30	P	PB	0.1	3	30003	47.24	38.67	145.47	49.85	0.3427
1/13/09	1	30	P	PB	0.1	4	30004	58.12	45.16	174.64	59.85	0.3427
1/13/09	1	30	P	PB	0.1	5	30005	52.32	42.13	144.92	53.29	0.3677
1/13/09	1	31	N	SB	0.3	1	31001	44.11	38.28	144.00	48.99	0.3402
1/13/09	1	31	N	SB	0.3	2	31002	44.93	39.00	146.33	48.75	0.3332
1/13/09	1	31	N	SB	0.3	3	31003	47.78	40.76	148.13	54.61	0.3687
1/13/09	1	31	N	SB	0.3	4	31004	48.42	39.90	161.94	49.56	0.3060
1/13/09	1	31	N	SB	0.3	5	31005	48.09	39.50	155.06	50.61	0.3264
1/13/09	1	32	N	PB	0.1	1	32001	46.37	37.97	149.61	50.41	0.3369
1/13/09	1	32	N	PB	0.1	2	32002	56.37	43.99	164.54	58.13	0.3533
1/13/09	1	32	N	PB	0.1	3	32003	48.46	38.84	149.86	51.13	0.3412
1/13/09	1	32	N	PB	0.1	4	32004	54.66	45.54	177.19	60.46	0.3412
1/13/09	1	32	N	PB	0.1	5	32005	56.28	46.39	186.20	61.93	0.3326
1/13/09	1	33	P	SB	0.3	1	33001	49.28	41.57	147.54	53.60	0.3633
1/13/09	1	33	P	SB	0.3	2	33002	51.65	43.51	165.20	56.97	0.3449
1/13/09	1	33	P	SB	0.3	3	33003	54.98	45.57	174.25	58.38	0.3350
1/13/09	1	33	P	SB	0.3	4	33004	57.37	48.95	185.26	63.75	0.3441
1/13/09	1	33	P	SB	0.3	5	33005	50.85	41.77	158.40	55.53	0.3506
1/13/09	1	34	N	PB	0.2	1	34001	52.51	43.20	159.24	58.35	0.3664
1/13/09	1	34	N	PB	0.2	2	34002	51.01	42.86	156.20	56.30	0.3604
1/13/09	1	34	N	PB	0.2	3	34003	47.54	39.82	150.29	53.14	0.3536
1/13/09	1	34	N	PB	0.2	4	34004	46.43	38.05	140.89	48.93	0.3473
1/13/09	1	34	N	PB	0.2	5	34005	47.43	39.58	144.96	51.59	0.3559

Date	Week	Sample	PSENorm	Trt	Level	Rep	TestID	Springiness	Chewiness	A1Work	A2Work
12/3/08	1	1	N	SP	0.3	1	1001	1.3712	20.51	0.1530	0.0496
12/3/08	1	1	N	SP	0.3	2	1002	1.3474	16.20	0.1362	0.0425
12/3/08	1	1	N	SP	0.3	3	1003	1.3199	19.75	0.1499	0.0487
12/3/08	1	1	N	SP	0.3	4	1004	1.3683	20.85	0.1572	0.0518
12/3/08	1	1	N	SP	0.3	5	1005	1.3485	20.54	0.1704	0.0529
12/3/08	1	2	P	SC	0.2	1	2001	1.2936	19.77	0.1735	0.0544
12/3/08	1	2	P	SC	0.2	2	2002	1.2972	19.45	0.1721	0.0534
12/3/08	1	2	P	SC	0.2	3	2003	1.2952	19.25	0.1485	0.0492

12/3/08	1	2	P	SC	0.2	4	2004	1.3463	17.08	0.1781	0.0498
12/3/08	1	2	P	SC	0.2	5	2005	1.3371	20.89	0.1795	0.0561
12/3/08	1	3	P	PB	0.2	1	3001	1.4524	29.90	0.2020	0.0694
12/3/08	1	3	P	PB	0.2	2	3002	1.3567	28.04	0.1781	0.0640
12/3/08	1	3	P	PB	0.2	3	3003	1.3486	28.58	0.1901	0.0674
12/3/08	1	3	P	PB	0.2	4	3004	1.3792	24.66	0.1725	0.0593
12/3/08	1	3	P	PB	0.2	5	3005	1.3245	26.37	0.1750	0.0623
12/3/08	1	4	P	SB	0.3	1	4001	1.2594	22.98	0.1589	0.0563
12/3/08	1	4	P	SB	0.3	2	4002	1.2363	19.75	0.1556	0.0518
12/3/08	1	4	P	SB	0.3	3	4003	1.3195	22.89	0.1755	0.0584
12/3/08	1	4	P	SB	0.3	4	4004	1.3875	23.72	0.1780	0.0597
12/3/08	1	4	P	SB	0.3	5	4005	1.2508	22.99	0.1671	0.0577
12/3/08	1	5	N	SB	0.1	1	5001	1.3801	27.33	0.1881	0.0651
12/3/08	1	5	N	SB	0.1	2	5002	1.3221	22.69	0.1568	0.0546
12/3/08	1	5	N	SB	0.1	3	5003	1.3168	20.29	0.1662	0.0519
12/3/08	1	5	N	SB	0.1	4	5004	1.3613	22.24	0.1700	0.0561
12/3/08	1	5	N	SB	0.1	5	5005	1.2849	20.54	0.1578	0.0518
12/3/08	1	6	N	SC	0.1	1	6001	1.2576	19.09	0.1584	0.0507
12/3/08	1	6	N	SC	0.1	2	6002	1.2229	17.61	0.1467	0.0472
12/3/08	1	6	N	SC	0.1	3	6003	1.2561	18.97	0.1552	0.0501
12/3/08	1	6	N	SC	0.1	4	6004	1.3296	18.51	0.1449	0.0479
12/3/08	1	6	N	SC	0.1	5	6005	1.2339	18.67	0.1462	0.0487
12/3/08	1	7	N	SC	0.2	1	7001	1.3116	16.39	0.1572	0.0469
12/3/08	1	7	N	SC	0.2	2	7002	1.3074	15.88	0.1628	0.0472
12/3/08	1	7	N	SC	0.2	3	7003	1.2930	16.71	0.1597	0.0474
12/3/08	1	7	N	SC	0.2	4	7004	1.3301	16.89	0.1553	0.0474
12/3/08	1	7	N	SC	0.2	5	7005	1.3001	18.14	0.1461	0.0474
12/3/08	1	8	N	PB	0.3	1	8001	1.3075	17.15	0.1517	0.0473
12/3/08	1	8	N	PB	0.3	2	8002	1.3333	18.48	0.1507	0.0496
12/3/08	1	8	N	PB	0.3	3	8003	1.3014	17.41	0.1490	0.0461
12/3/08	1	8	N	PB	0.3	4	8004	1.2573	18.90	0.1454	0.0489
12/3/08	1	8	N	PB	0.3	5	8005	1.2688	18.90	0.1561	0.0507
12/3/08	1	9	P	PB	0.3	1	9001	1.3525	22.99	0.1649	0.0555
12/3/08	1	9	P	PB	0.3	2	9002	1.3240	23.56	0.1745	0.0597
12/3/08	1	9	P	PB	0.3	3	9003	1.3486	21.53	0.1699	0.0555

12/3/08	1	9	P	PB	0.3	4	9004	1.2942	26.01	0.1636	0.0606
12/3/08	1	9	P	PB	0.3	5	9005	1.3561	25.23	0.1679	0.0601
12/3/08	1	10	P	SP	0.2	1	10001	1.2368	22.20	0.1458	0.0521
12/3/08	1	10	P	SP	0.2	2	10002	1.3320	24.65	0.1768	0.0582
12/3/08	1	10	P	SP	0.2	3	10003	1.3414	22.37	0.1499	0.0521
12/3/08	1	10	P	SP	0.2	4	10004	1.2477	26.26	0.1538	0.0576
12/3/08	1	10	P	SP	0.2	5	10005	1.2906	24.25	0.1628	0.0562
12/3/08	1	11	P	SB	0.1	1	11001	1.3242	22.98	0.1558	0.0549
12/3/08	1	11	P	SB	0.1	2	11002	1.3807	27.21	0.1727	0.0611
12/3/08	1	11	P	SB	0.1	3	11003	1.3677	23.55	0.1722	0.0566
12/3/08	1	11	P	SB	0.1	4	11004	1.3352	26.20	0.1775	0.0619
12/3/08	1	11	P	SB	0.1	5	11005	1.3775	22.37	0.1708	0.0556
12/3/08	1	12	N	PB	0.2	1	12001	1.2884	22.12	0.1491	0.0529
12/3/08	1	12	N	PB	0.2	2	12002	1.2589	18.45	0.1600	0.0497
12/3/08	1	12	N	PB	0.2	3	12003	1.3054	24.07	0.1642	0.0581
12/3/08	1	12	N	PB	0.2	4	12004	1.3372	20.51	0.1522	0.0510
12/3/08	1	12	N	PB	0.2	5	12005	1.3117	22.49	0.1689	0.0561
12/3/08	1	13	P	SB	0.2	1	13001	1.2655	23.91	0.1594	0.0566
12/3/08	1	13	P	SB	0.2	2	13002	1.3214	26.44	0.1772	0.0631
12/3/08	1	13	P	SB	0.2	3	13003	1.2866	22.30	0.1492	0.0541
12/3/08	1	13	P	SB	0.2	4	13004	1.2591	22.83	0.1598	0.0558
12/3/08	1	13	P	SB	0.2	5	13005	1.2842	24.75	0.1620	0.0578
12/3/08	1	14	N	SP	0.1	1	14001	1.3836	23.37	0.1628	0.0550
12/3/08	1	14	N	SP	0.1	2	14002	1.1892	17.65	0.1216	0.0421
12/3/08	1	14	N	SP	0.1	3	14003	1.2864	20.74	0.1429	0.0494
12/3/08	1	14	N	SP	0.1	4	14004	1.2788	22.94	0.1512	0.0543
12/3/08	1	14	N	SP	0.1	5	14005	1.2461	21.93	0.1464	0.0517
12/3/08	1	15	P	PC	0.1	1	15001	1.3266	28.00	0.1777	0.0648
12/3/08	1	15	P	PC	0.1	2	15002	1.3450	30.04	0.1951	0.0696
12/3/08	1	15	P	PC	0.1	3	15003	1.3216	30.54	0.1826	0.0688
12/3/08	1	15	P	PC	0.1	4	15004	1.3187	28.63	0.1898	0.0668
12/3/08	1	15	P	PC	0.1	5	15005	1.3115	24.79	0.1655	0.0588
12/3/08	1	16	N	PC	0.2	1	16001	1.2524	16.72	0.1608	0.0475
12/3/08	1	16	N	PC	0.2	2	16002	1.3368	19.23	0.1489	0.0491
12/3/08	1	16	N	PC	0.2	3	16003	1.2180	15.50	0.1503	0.0439

12/3/08	1	16	N	PC	0.2	4	16004	1.3451	19.40	0.1526	0.0501
12/3/08	1	16	N	PC	0.2	5	16005	1.2096	14.99	0.1499	0.0447
12/3/08	1	17	N	PB	0.1	1	17001	1.3399	25.79	0.1731	0.0607
12/3/08	1	17	N	PB	0.1	2	17002	1.3046	24.89	0.1677	0.0587
12/3/08	1	17	N	PB	0.1	3	17003	1.2713	21.85	0.1562	0.0549
12/3/08	1	17	N	PB	0.1	4	17004	1.3056	23.60	0.1808	0.0597
12/3/08	1	17	N	PB	0.1	5	17005	1.2319	21.86	0.1633	0.0549
12/3/08	1	18	P	ddW	0	1	18001	1.2949	23.78	0.1638	0.0569
12/3/08	1	18	P	ddW	0	2	18002	1.3000	22.19	0.1550	0.0532
12/3/08	1	18	P	ddW	0	3	18003	1.2517	22.01	0.1642	0.0545
12/3/08	1	18	P	ddW	0	4	18004	1.2610	21.47	0.1468	0.0510
12/3/08	1	18	P	ddW	0	5	18005	1.2535	21.69	0.1460	0.0506
12/3/08	1	19	P	SP	0.3	1	19001	1.2898	21.68	0.1455	0.0514
12/3/08	1	19	P	SP	0.3	2	19002	1.2868	20.93	0.1467	0.0482
12/3/08	1	19	P	SP	0.3	3	19003	1.2667	21.76	0.1523	0.0515
12/3/08	1	19	P	SP	0.3	4	19004	1.2295	23.04	0.1419	0.0523
12/3/08	1	19	P	SP	0.3	5	19005	1.2457	22.12	0.1487	0.0516
12/3/08	1	20	P	PC	0.2	1	20001	1.2389	20.75	0.1380	0.0498
12/3/08	1	20	P	PC	0.2	2	20002	1.3193	24.41	0.1545	0.0567
12/3/08	1	20	P	PC	0.2	3	20003	1.2541	21.64	0.1469	0.0517
12/3/08	1	20	P	PC	0.2	4	20004	1.2610	20.89	0.1428	0.0504
12/3/08	1	20	P	PC	0.2	5	20005	1.2520	18.96	0.1387	0.0470
12/3/08	1	21	N	SB	0.3	1	21001	1.2617	18.04	0.1494	0.0486
12/3/08	1	21	N	SB	0.3	2	21002	1.2529	16.58	0.1434	0.0450
12/3/08	1	21	N	SB	0.3	3	21003	1.2624	19.14	0.1606	0.0519
12/3/08	1	21	N	SB	0.3	4	21004	1.2772	0.66	0.1361	0.0433
12/3/08	1	21	N	SB	0.3	5	21005	1.2122	15.74	0.1387	0.0434
12/3/08	1	22	P	Control	0	1	22001	1.4289	33.92	0.1938	0.0728
12/3/08	1	22	P	Control	0	2	22002	1.3843	32.14	0.1925	0.0720
12/3/08	1	22	P	Control	0	3	22003	1.3573	29.37	0.1964	0.0694
12/3/08	1	22	P	Control	0	4	22004	1.3588	33.75	0.2068	0.0763
12/3/08	1	22	P	Control	0	5	22005	1.3941	32.70	0.2176	0.0763
12/3/08	1	23	N	SP	0.2	1	23001	1.3313	22.66	0.1502	0.0520
12/3/08	1	23	N	SP	0.2	2	23002	1.2474	17.10	0.1265	0.0419
12/3/08	1	23	N	SP	0.2	3	23003	1.2794	17.91	0.1356	0.0442

12/3/08	1	23	N	SP	0.2	4	23004	1.3035	19.93	0.1401	0.0478
12/3/08	1	23	N	SP	0.2	5	23005	1.2866	22.35	0.1401	0.0510
12/3/08	1	24	N	Control	0	1	24001	1.3515	29.02	0.2123	0.0719
12/3/08	1	24	N	Control	0	2	24002	1.3723	28.74	0.2082	0.0727
12/3/08	1	24	N	Control	0	3	24003	1.3689	30.27	0.2127	0.0728
12/3/08	1	24	N	Control	0	4	24004	1.4120	31.23	0.2131	0.0739
12/3/08	1	24	N	Control	0	5	24005	1.4098	34.98	0.2130	0.0785
12/3/08	1	25	N	SC	0.3	1	25001	1.3452	18.14	0.1673	0.0504
12/3/08	1	25	N	SC	0.3	2	25002	1.4190	25.39	0.1760	0.0614
12/3/08	1	25	N	SC	0.3	3	25003	1.2961	16.34	0.1416	0.0447
12/3/08	1	25	N	SC	0.3	4	25004	1.3479	18.44	0.1591	0.0496
12/3/08	1	25	N	SC	0.3	5	25005	1.3915	22.62	0.1850	0.0604
12/3/08	1	26	N	PC	0.3	1	26001	1.2702	15.52	0.1713	0.0471
12/3/08	1	26	N	PC	0.3	2	26002	1.3048	16.33	0.1526	0.0455
12/3/08	1	26	N	PC	0.3	3	26003	1.3344	17.18	0.1637	0.0481
12/3/08	1	26	N	PC	0.3	4	26004	1.4119	19.36	0.1709	0.0521
12/3/08	1	26	N	PC	0.3	5	26005	1.3213	18.66	0.1743	0.0520
12/3/08	1	27	N	PC	0.1	1	27001	1.2485	19.94	0.1672	0.0529
12/3/08	1	27	N	PC	0.1	2	27002	1.2830	20.01	0.1527	0.0514
12/3/08	1	27	N	PC	0.1	3	27003	1.2379	17.88	0.1695	0.0503
12/3/08	1	27	N	PC	0.1	4	27004	1.2125	19.35	0.1504	0.0498
12/3/08	1	27	N	PC	0.1	5	27005	1.2724	18.69	0.1513	0.0491
12/3/08	1	28	P	PB	0.1	1	28001	1.3868	26.31	0.1766	0.0597
12/3/08	1	28	P	PB	0.1	2	28002	1.2812	20.87	0.1620	0.0522
12/3/08	1	28	P	PB	0.1	5	28003	1.3380	24.96	0.1613	0.0576
12/3/08	1	28	P	PB	0.1	3	28004	1.2575	21.91	0.1552	0.0535
12/3/08	1	28	P	PB	0.1	4	28005	1.3545	25.05	0.1701	0.0584
12/3/08	1	29	P	SP	0.1	1	29001	1.2424	18.07	0.1319	0.0430
12/3/08	1	29	P	SP	0.1	2	29002	1.3214	24.72	0.1518	0.0551
12/3/08	1	29	P	SP	0.1	3	29003	1.2720	26.76	0.1654	0.0600
12/3/08	1	29	P	SP	0.1	4	29004	1.1811	17.20	0.1319	0.0425
12/3/08	1	29	P	SP	0.1	5	29005	1.2288	19.63	0.1362	0.0464
12/3/08	1	30	N	SB	0.2	1	30001	1.3222	22.12	0.1550	0.0535
12/3/08	1	30	N	SB	0.2	2	30002	1.2778	21.60	0.1507	0.0520
12/3/08	1	30	N	SB	0.2	3	30003	1.4049	24.17	0.1752	0.0591

12/3/08	1	30	N	SB	0.2	4	30004	1.3573	20.91	0.1552	0.0512
12/3/08	1	30	N	SB	0.2	5	30005	1.2864	18.15	0.1412	0.0460
12/3/08	1	31	N	ddW	0	1	31001	1.2907	23.80	0.1728	0.0584
12/3/08	1	31	N	ddW	0	2	31002	1.3025	24.89	0.1661	0.0598
12/3/08	1	31	N	ddW	0	3	31003	1.3095	22.10	0.1722	0.0571
12/3/08	1	31	N	ddW	0	4	31004	1.3686	24.88	0.1722	0.0602
12/3/08	1	31	N	ddW	0	5	31005	1.3343	22.54	0.1637	0.0559
12/3/08	1	32	P	PC	0.3	1	32001	1.2533	14.58	0.1579	0.0438
12/3/08	1	32	P	PC	0.3	2	32002	1.3363	15.46	0.1366	0.0418
12/3/08	1	32	P	PC	0.3	3	32003	1.3547	15.49	0.1496	0.0432
12/3/08	1	32	P	PC	0.3	4	32004	1.2824	17.71	0.1510	0.0472
12/3/08	1	32	P	PC	0.3	5	32005	1.3493	17.17	0.1607	0.0482
12/3/08	1	33	P	SC	0.1	1	33001	1.4326	28.24	0.1772	0.0634
12/3/08	1	33	P	SC	0.1	2	33002	1.3866	27.45	0.1719	0.0611
12/3/08	1	33	P	SC	0.1	3	33003	1.3340	25.94	0.1536	0.0571
12/3/08	1	33	P	SC	0.1	4	33004	1.3584	29.50	0.1705	0.0636
12/3/08	1	33	P	SC	0.1	5	33005	1.3279	29.90	0.1901	0.0682
12/3/08	1	34	P	SC	0.3	1	34001	1.3528	18.71	0.1594	0.0503
12/3/08	1	34	P	SC	0.3	2	34002	1.3737	16.35	0.1607	0.0478
12/3/08	1	34	P	SC	0.3	3	34003	1.2998	15.84	0.1682	0.0468
12/3/08	1	34	P	SC	0.3	4	34004	1.3332	17.91	0.1761	0.0517
12/3/08	1	34	P	SC	0.3	5	34005	1.3189	18.38	0.1551	0.0491
12/9/08	2	1	N	PB	0.3	1	1001	1.1782	15.18	0.1261	0.0400
12/9/08	2	1	N	PB	0.3	2	1002	1.2623	14.63	0.1374	0.0410
12/9/08	2	1	N	PB	0.3	3	1003	1.2404	15.87	0.1354	0.0429
12/9/08	2	1	N	PB	0.3	4	1004	1.2772	20.08	0.1586	0.0526
12/9/08	2	1	N	PB	0.3	5	1005	1.2431	17.55	0.1334	0.0443
12/9/08	2	2	N	ddW	0	1	2001	1.1845	20.98	0.1630	0.0535
12/9/08	2	2	N	ddW	0	2	2002	1.2702	18.43	0.1358	0.0456
12/9/08	2	2	N	ddW	0	3	2003	1.2131	17.77	0.1369	0.0449
12/9/08	2	2	N	ddW	0	4	2004	1.1491	20.80	0.1445	0.0501
12/9/08	2	2	N	ddW	0	5	2005	1.2349	17.38	0.1392	0.0446
12/9/08	2	3	P	SP	0.2	1	3001	1.1525	21.55	0.1291	0.0476
12/9/08	2	3	P	SP	0.2	2	3002	1.2228	22.76	0.1402	0.0507
12/9/08	2	3	P	SP	0.2	3	3003	1.2153	24.55	0.1455	0.0536

12/9/08	2	3	P	SP	0.2	4	3004	1.2228	20.55	0.1403	0.0483
12/9/08	2	3	P	SP	0.2	5	3005	1.1406	19.08	0.1236	0.0445
12/9/08	2	4	P	SB	0.2	1	4001	1.2702	24.74	0.1698	0.0602
12/9/08	2	4	P	SB	0.2	2	4002	1.2746	22.48	0.1642	0.0559
12/9/08	2	4	P	SB	0.2	3	4003	1.2660	24.63	0.1676	0.0593
12/9/08	2	4	P	SB	0.2	4	4004	1.3078	22.82	0.1749	0.0582
12/9/08	2	4	P	SB	0.2	5	4005	1.3311	25.74	0.1798	0.0632
12/9/08	2	5	P	PC	0.2	1	5001	1.3046	19.25	0.1334	0.0464
12/9/08	2	5	P	PC	0.2	2	5002	1.2166	20.42	0.1338	0.0483
12/9/08	2	5	P	PC	0.2	3	5003	1.3028	20.94	0.1479	0.0510
12/9/08	2	5	P	PC	0.2	4	5004	1.2524	19.44	0.1362	0.0481
12/9/08	2	5	P	PC	0.2	5	5005	.	.	.	.
12/9/08	2	6	N	Control	0	1	6001	1.3434	26.71	0.1801	0.0651
12/9/08	2	6	N	Control	0	2	6002	1.3209	27.46	0.1898	0.0656
12/9/08	2	6	N	Control	0	3	6003	1.2925	26.80	0.1960	0.0662
12/9/08	2	6	N	Control	0	4	6004	1.3828	31.29	0.2062	0.0738
12/9/08	2	6	N	Control	0	5	6005	1.2709	27.08	0.1914	0.0670
12/9/08	2	7	P	PB	0.1	1	7001	1.2447	19.53	0.1408	0.0477
12/9/08	2	7	P	PB	0.1	2	7002	1.3010	19.17	0.1562	0.0493
12/9/08	2	7	P	PB	0.1	3	7003	1.2092	17.66	0.1431	0.0450
12/9/08	2	7	P	PB	0.1	4	7004	1.3449	18.56	0.1500	0.0475
12/9/08	2	7	P	PB	0.1	5	7005	1.2496	18.56	0.1290	0.0441
12/9/08	2	8	N	PB	0.2	1	8001	1.2184	18.82	0.1312	0.0457
12/9/08	2	8	N	PB	0.2	2	8002	1.2697	20.10	0.1582	0.0519
12/9/08	2	8	N	PB	0.2	3	8003	1.4167	19.17	0.1408	0.0477
12/9/08	2	8	N	PB	0.2	4	8004	1.2993	17.61	0.1464	0.0455
12/9/08	2	8	N	PB	0.2	5	8005	1.1919	18.18	0.1360	0.0457
12/9/08	2	9	P	SP	0.1	1	9001	1.2103	16.66	0.1189	0.0401
12/9/08	2	9	P	SP	0.1	2	9002	1.2404	16.97	0.1282	0.0420
12/9/08	2	9	P	SP	0.1	3	9003	1.2096	17.46	0.1170	0.0405
12/9/08	2	9	P	SP	0.1	4	9004	1.1612	14.27	0.1100	0.0354
12/9/08	2	9	P	SP	0.1	5	9005	1.2665	17.65	0.1256	0.0415
12/9/08	2	10	N	SC	0.1	1	10001	1.2552	20.33	0.1564	0.0517
12/9/08	2	10	N	SC	0.1	2	10002	1.2433	18.20	0.1409	0.0470
12/9/08	2	10	N	SC	0.1	3	10003	1.2294	18.25	0.1390	0.0466

12/9/08	2	10	N	SC	0.1	4	10004	1.2478	17.33	0.1272	0.0437
12/9/08	2	10	N	SC	0.1	5	10005	1.2154	18.26	0.1250	0.0448
12/9/08	2	11	P	SC	0.1	1	11001	1.2896	21.24	0.1384	0.0497
12/9/08	2	11	P	SC	0.1	2	11002	1.3091	22.49	0.1611	0.0547
12/9/08	2	11	P	SC	0.1	3	11003	1.2758	20.59	0.1481	0.0497
12/9/08	2	11	P	SC	0.1	4	11004	1.3055	18.73	0.1316	0.0451
12/9/08	2	11	P	SC	0.1	5	11005	1.3343	25.07	0.1563	0.0576
12/9/08	2	12	N	PC	0.1	1	12001	1.2442	17.07	0.1295	0.0436
12/9/08	2	12	N	PC	0.1	2	12002	1.2886	16.75	0.1230	0.0417
12/9/08	2	12	N	PC	0.1	3	12003	1.2405	17.95	0.1382	0.0462
12/9/08	2	12	N	PC	0.1	4	12004	1.3085	20.39	0.1492	0.0505
12/9/08	2	12	N	PC	0.1	5	12005	1.3087	17.18	0.1311	0.0443
12/9/08	2	13	P	SP	0.3	1	13001	1.2764	22.63	0.1387	0.0503
12/9/08	2	13	P	SP	0.3	2	13002	1.2677	20.68	0.1419	0.0482
12/9/08	2	13	P	SP	0.3	3	13003	1.2794	22.45	0.1566	0.0525
12/9/08	2	13	P	SP	0.3	4	13004	1.2180	19.40	0.1359	0.0465
12/9/08	2	13	P	SP	0.3	5	13005	1.2981	21.89	0.1494	0.0508
12/9/08	2	14	N	SC	0.2	1	14001	1.2996	16.75	0.1454	0.0456
12/9/08	2	14	N	SC	0.2	2	14002	1.2648	14.52	0.1417	0.0413
12/9/08	2	14	N	SC	0.2	3	14003	1.1797	15.78	0.1293	0.0416
12/9/08	2	14	N	SC	0.2	4	14004	1.2945	17.61	0.1384	0.0457
12/9/08	2	14	N	SC	0.2	5	14005	1.2397	15.32	0.1383	0.0428
12/9/08	2	15	N	PB	0.1	1	15001	1.3256	20.24	0.1517	0.0502
12/9/08	2	15	N	PB	0.1	2	15002	1.2868	23.83	0.1704	0.0575
12/9/08	2	15	N	PB	0.1	3	15003	1.2946	20.16	0.1487	0.0505
12/9/08	2	15	N	PB	0.1	4	15004	1.2751	20.43	0.1550	0.0516
12/9/08	2	15	N	PB	0.1	5	15005	1.3384	21.36	0.1566	0.0523
12/9/08	2	16	P	PC	0.1	1	16001	1.2868	21.89	0.1549	0.0539
12/9/08	2	16	P	PC	0.1	2	16002	1.2499	24.31	0.1547	0.0568
12/9/08	2	16	P	PC	0.1	3	16003	1.2609	20.85	0.1424	0.0497
12/9/08	2	16	P	PC	0.1	4	16004	1.2328	21.63	0.1551	0.0539
12/9/08	2	16	P	PC	0.1	5	16005	1.3004	22.54	0.1586	0.0539
12/9/08	2	17	P	SB	0.1	1	17001	1.3080	20.03	0.1549	0.0498
12/9/08	2	17	P	SB	0.1	2	17002	1.2795	17.53	0.1414	0.0455
12/9/08	2	17	P	SB	0.1	3	17003	1.2756	17.54	0.1450	0.0459

12/9/08	2	17	P	SB	0.1	4	17004	1.7506	27.89	0.1680	0.0539
12/9/08	2	17	P	SB	0.1	5	17005	1.2937	18.71	0.1542	0.0490
12/9/08	2	18	N	SC	0.3	1	18001	1.2912	12.06	0.1391	0.0374
12/9/08	2	18	N	SC	0.3	2	18002	1.2858	13.28	0.1445	0.0394
12/9/08	2	18	N	SC	0.3	3	18003	1.2605	13.71	0.1492	0.0414
12/9/08	2	18	N	SC	0.3	4	18004	1.2309	11.83	0.1404	0.0368
12/9/08	2	18	N	SC	0.3	5	18005	1.3471	14.93	0.1477	0.0425
12/9/08	2	19	P	PC	0.3	1	19001	1.2416	14.74	0.1350	0.0411
12/9/08	2	19	P	PC	0.3	2	19002	1.3038	15.57	0.1469	0.0442
12/9/08	2	19	P	PC	0.3	3	19003	1.2065	11.01	0.1181	0.0328
12/9/08	2	19	P	PC	0.3	4	19004	1.2587	14.41	0.1346	0.0398
12/9/08	2	19	P	PC	0.3	5	19005	1.2754	15.29	0.1324	0.0415
12/9/08	2	20	P	SC	0.3	1	20001	1.2674	15.57	0.1443	0.0440
12/9/08	2	20	P	SC	0.3	2	20002	1.2781	17.05	0.1430	0.0458
12/9/08	2	20	P	SC	0.3	3	20003	1.2462	14.50	0.1412	0.0414
12/9/08	2	20	P	SC	0.3	4	20004	1.2994	16.15	0.1552	0.0465
12/9/08	2	20	P	SC	0.3	5	20005	1.2161	17.01	0.1387	0.0450
12/9/08	2	21	N	SP	0.3	1	21001	.	.	.	.
12/9/08	2	21	N	SP	0.3	2	21002	1.3671	22.46	0.1615	0.0549
12/9/08	2	21	N	SP	0.3	3	21003	1.2792	20.04	0.1574	0.0512
12/9/08	2	21	N	SP	0.3	4	21004	1.3133	20.43	0.1595	0.0519
12/9/08	2	21	N	SP	0.3	5	21005	1.3485	22.07	0.1544	0.0527
12/9/08	2	22	N	SB	0.1	1	22001	1.2620	22.75	0.1493	0.0539
12/9/08	2	22	N	SB	0.1	2	22002	1.2398	23.10	0.1611	0.0567
12/9/08	2	22	N	SB	0.1	3	22003	.	.	.	.
12/9/08	2	22	N	SB	0.1	4	22004	1.3288	21.94	0.1569	0.0542
12/9/08	2	22	N	SB	0.1	5	22005	1.3173	20.45	0.1643	0.0525
12/9/08	2	23	N	PC	0.3	1	23001	1.3887	13.20	0.1456	0.0404
12/9/08	2	23	N	PC	0.3	2	23002	1.3383	13.21	0.1470	0.0401
12/9/08	2	23	N	PC	0.3	3	23003	1.2590	11.61	0.1371	0.0367
12/9/08	2	23	N	PC	0.3	4	23004	1.3170	17.27	0.1448	0.0461
12/9/08	2	23	N	PC	0.3	5	23005	1.2767	11.85	0.1332	0.0368
12/9/08	2	24	P	SB	0.3	1	24001	1.3764	20.47	0.1790	0.0552
12/9/08	2	24	P	SB	0.3	2	24002	1.3378	19.34	0.1603	0.0511
12/9/08	2	24	P	SB	0.3	3	24003	1.2716	16.61	0.1392	0.0437

12/9/08	2	24	P	SB	0.3	4	24004	1.3338	21.47	0.1592	0.0527
12/9/08	2	24	P	SB	0.3	5	24005	1.3132	18.90	0.1700	0.0517
12/9/08	2	25	N	PC	0.2	1	25001	1.2996	16.86	0.1547	0.0469
12/9/08	2	25	N	PC	0.2	2	25002	1.3105	17.24	0.1570	0.0487
12/9/08	2	25	N	PC	0.2	3	25003	1.3564	18.22	0.1519	0.0486
12/9/08	2	25	N	PC	0.2	4	25004	1.2463	16.40	0.1424	0.0449
12/9/08	2	25	N	PC	0.2	5	25005	1.2982	14.63	0.1445	0.0423
12/9/08	2	26	N	SB	0.3	1	26001	1.2411	18.63	0.1469	0.0477
12/9/08	2	26	N	SB	0.3	2	26002	1.2867	20.16	0.1654	0.0539
12/9/08	2	26	N	SB	0.3	3	26003	1.2469	20.05	0.1433	0.0495
12/9/08	2	26	N	SB	0.3	4	26004	1.1927	17.63	0.1441	0.0462
12/9/08	2	26	N	SB	0.3	5	26005	1.2509	20.03	0.1408	0.0499
12/9/08	2	27	P	PB	0.2	1	27001	1.3224	22.69	0.1773	0.0566
12/9/08	2	27	P	PB	0.2	2	27002	1.3183	25.40	0.1778	0.0615
12/9/08	2	27	P	PB	0.2	3	27003	1.2983	23.67	0.1814	0.0598
12/9/08	2	27	P	PB	0.2	4	27004	1.3137	21.36	0.1597	0.0530
12/9/08	2	27	P	PB	0.2	5	27005	1.3447	23.68	0.1789	0.0587
12/9/08	2	28	N	SP	0.2	1	28001	1.2802	19.33	0.1253	0.0437
12/9/08	2	28	N	SP	0.2	2	28002	1.2936	18.92	0.1486	0.0484
12/9/08	2	28	N	SP	0.2	3	28003	1.3633	23.18	0.1749	0.0563
12/9/08	2	28	N	SP	0.2	4	28004	1.2755	20.19	0.1521	0.0502
12/9/08	2	28	N	SP	0.2	5	28005	1.3102	21.83	0.1578	0.0539
12/9/08	2	29	N	SP	0.1	1	29001	1.2677	22.86	0.1721	0.0565
12/9/08	2	29	N	SP	0.1	2	29002	1.2514	20.14	0.1520	0.0496
12/9/08	2	29	N	SP	0.1	3	29003	1.2524	18.86	0.1505	0.0483
12/9/08	2	29	N	SP	0.1	4	29004	1.2618	22.64	0.1591	0.0537
12/9/08	2	29	N	SP	0.1	5	29005	1.2862	19.24	0.1435	0.0463
12/9/08	2	30	P	PB	0.3	1	30001	1.2905	23.56	0.1762	0.0590
12/9/08	2	30	P	PB	0.3	2	30002	1.3052	23.37	0.1867	0.0609
12/9/08	2	30	P	PB	0.3	3	30003	1.3071	24.35	0.1922	0.0632
12/9/08	2	30	P	PB	0.3	4	30004	1.2837	25.05	0.1847	0.0622
12/9/08	2	30	P	PB	0.3	5	30005	1.2463	23.30	0.1500	0.0542
12/9/08	2	31	P	Control	0	1	31001	1.3458	28.06	0.2104	0.0699
12/9/08	2	31	P	Control	0	2	31002	1.3689	31.90	0.2231	0.0759
12/9/08	2	31	P	Control	0	3	31003	1.3002	29.31	0.1967	0.0692

12/9/08	2	31	P	Control	0	4	31004	1.3652	29.25	0.2135	0.0714
12/9/08	2	31	P	Control	0	5	31005	1.3277	27.54	0.2192	0.0688
12/9/08	2	32	N	SB	0.2	1	32001	1.2905	24.13	0.1734	0.0602
12/9/08	2	32	N	SB	0.2	2	32002	1.3581	24.54	0.1753	0.0598
12/9/08	2	32	N	SB	0.2	3	32003	1.3139	20.83	0.1367	0.0478
12/9/08	2	32	N	SB	0.2	4	32004	1.2808	19.36	0.1480	0.0491
12/9/08	2	32	N	SB	0.2	5	32005	1.3373	23.11	0.1619	0.0555
12/9/08	2	33	P	ddW	0	1	33001	1.2865	20.34	0.1606	0.0512
12/9/08	2	33	P	ddW	0	2	33002	1.2341	17.70	0.1512	0.0458
12/9/08	2	33	P	ddW	0	3	33003	1.2642	19.27	0.1444	0.0473
12/9/08	2	33	P	ddW	0	4	33004	1.3278	20.18	0.1701	0.0510
12/9/08	2	33	P	ddW	0	5	33005	1.2290	17.88	0.1456	0.0450
12/9/08	2	34	P	SC	0.2	1	34001	1.3560	19.81	0.1682	0.0536
12/9/08	2	34	P	SC	0.2	2	34002	1.2747	18.29	0.1402	0.0467
12/9/08	2	34	P	SC	0.2	3	34003	1.2482	19.50	0.1462	0.0496
12/9/08	2	34	P	SC	0.2	4	34004	1.3457	18.03	0.1603	0.0496
12/9/08	2	34	P	SC	0.2	5	34005	1.3016	17.84	0.1567	0.0483
1/13/09	3	1	P	SP	0.3	1	1001	1.3607	27.76	0.1823	0.0636
1/13/09	3	1	P	SP	0.3	2	1002	1.3349	24.18	0.1725	0.0564
1/13/09	3	1	P	SP	0.3	3	1003	1.3394	25.40	0.1429	0.0536
1/13/09	3	1	P	SP	0.3	4	1004	1.3371	26.10	0.1750	0.0606
1/13/09	3	1	P	SP	0.3	5	1005	1.4026	25.99	0.1615	0.0579
1/13/09	3	2	P	ddW	0	1	2001	1.3024	24.94	0.1581	0.0565
1/13/09	3	2	P	ddW	0	2	2002	1.2773	27.25	0.1796	0.0638
1/13/09	3	2	P	ddW	0	3	2003	1.3065	26.62	0.1876	0.0642
1/13/09	3	2	P	ddW	0	4	2004	1.2997	25.09	0.1802	0.0609
1/13/09	3	2	P	ddW	0	5	2005	1.3120	20.62	0.1588	0.0512
1/13/09	3	3	N	ddW	0	1	3001	1.2851	23.12	0.1674	0.0553
1/13/09	3	3	N	ddW	0	2	3002	1.2873	23.16	0.1741	0.0578
1/13/09	3	3	N	ddW	0	3	3003	1.2674	23.55	0.1698	0.0566
1/13/09	3	3	N	ddW	0	4	3004	1.2162	20.96	0.1619	0.0531
1/13/09	3	3	N	ddW	0	5	3005	1.3047	23.69	0.1682	0.0571
1/13/09	3	4	N	PC	0.3	1	4001	1.2068	12.75	0.1482	0.0399
1/13/09	3	4	N	PC	0.3	2	4002	1.3267	16.40	0.1542	0.0456
1/13/09	3	4	N	PC	0.3	3	4003	1.3608	19.50	0.1633	0.0527

1/13/09	3	4	N	PC	0.3	4	4004	1.2726	18.11	0.1483	0.0477
1/13/09	3	4	N	PC	0.3	5	4005	1.2423	17.47	0.1461	0.0466
1/13/09	3	5	P	Control	0	1	5001	1.4172	37.44	0.2601	0.0881
1/13/09	3	5	P	Control	0	2	5002	1.3916	36.52	0.2343	0.0817
1/13/09	3	5	P	Control	0	3	5003	1.4117	32.01	0.2322	0.0776
1/13/09	3	5	P	Control	0	4	5004	1.3659	32.48	0.2291	0.0769
1/13/09	3	5	P	Control	0	5	5005	1.4157	33.36	0.2372	0.0796
1/13/09	3	6	N	SP	0.2	1	6001	1.3419	25.85	0.1671	0.0587
1/13/09	3	6	N	SP	0.2	2	6002	1.3368	25.81	0.1716	0.0576
1/13/09	3	6	N	SP	0.2	3	6003	1.4086	29.76	0.1903	0.0664
1/13/09	3	6	N	SP	0.2	4	6004	1.2400	18.48	0.1326	0.0439
1/13/09	3	6	N	SP	0.2	5	6005	1.2602	23.68	0.1409	0.0518
1/13/09	3	7	P	PB	0.3	1	7001	1.2625	23.27	0.1633	0.0567
1/13/09	3	7	P	PB	0.3	2	7002	1.3088	23.04	0.1571	0.0542
1/13/09	3	7	P	PB	0.3	3	7003	1.3797	25.58	0.1785	0.0607
1/13/09	3	7	P	PB	0.3	4	7004	1.3347	25.81	0.1902	0.0640
1/13/09	3	7	P	PB	0.3	5	7005	1.3677	24.74	0.1756	0.0606
1/13/09	3	8	N	SP	0.3	1	8001	1.3157	21.32	0.1363	0.0481
1/13/09	3	8	N	SP	0.3	2	8002	1.2851	26.50	0.1568	0.0592
1/13/09	3	8	N	SP	0.3	3	8003	1.2855	20.48	0.1456	0.0493
1/13/09	3	8	N	SP	0.3	4	8004	1.3194	22.31	0.1233	0.0467
1/13/09	3	8	N	SP	0.3	5	8005	1.3307	24.64	0.1600	0.0567
1/13/09	3	9	N	PC	0.1	1	9001	1.3338	22.71	0.1745	0.0577
1/13/09	3	9	N	PC	0.1	2	9002	1.3387	24.72	0.1667	0.0577
1/13/09	3	9	N	PC	0.1	3	9003	1.3691	28.36	0.1794	0.0653
1/13/09	3	9	N	PC	0.1	4	9004	1.3379	21.87	0.1617	0.0533
1/13/09	3	9	N	PC	0.1	5	9005	1.3338	20.39	0.1615	0.0514
1/13/09	3	10	N	SC	0.2	1	10001	1.2572	16.21	0.1530	0.0456
1/13/09	3	10	N	SC	0.2	2	10002	1.3344	19.77	0.1590	0.0496
1/13/09	3	10	N	SC	0.2	3	10003	1.3604	19.98	0.1582	0.0519
1/13/09	3	10	N	SC	0.2	4	10004	1.2812	19.18	0.1433	0.0479
1/13/09	3	10	N	SC	0.2	5	10005	1.3204	19.10	0.1478	0.0491
1/13/09	3	11	P	SP	0.1	1	11001	1.2307	18.32	0.1441	0.0459
1/13/09	3	11	P	SP	0.1	2	11002	1.2741	21.61	0.1452	0.0489
1/13/09	3	11	P	SP	0.1	3	11003	1.2870	18.01	0.1347	0.0422

1/13/09	3	11	P	SP	0.1	4	11004	1.2328	21.31	0.1423	0.0483
1/13/09	3	11	P	SP	0.1	5	11005	1.2938	20.00	0.1390	0.0459
1/13/09	3	12	P	PC	0.2	1	12001	1.2766	21.06	0.1513	0.0520
1/13/09	3	12	P	PC	0.2	2	12002	1.3346	22.60	0.1543	0.0536
1/13/09	3	12	P	PC	0.2	3	12003	1.3289	22.08	0.1552	0.0538
1/13/09	3	12	P	PC	0.2	4	12004	1.2720	18.61	0.1580	0.0502
1/13/09	3	12	P	PC	0.2	5	12005	1.3102	21.35	0.1627	0.0542
1/13/09	3	13	P	SB	0.1	1	13001	1.3117	26.35	0.1810	0.0630
1/13/09	3	13	P	SB	0.1	2	13002	1.3400	26.71	0.1619	0.0587
1/13/09	3	13	P	SB	0.1	3	13003	1.3388	25.79	0.1701	0.0588
1/13/09	3	13	P	SB	0.1	4	13004	1.2720	20.12	0.1367	0.0467
1/13/09	3	13	P	SB	0.1	5	13005	1.3049	25.35	0.1762	0.0602
1/13/09	3	14	P	PB	0.2	1	14001	1.3279	25.06	0.1732	0.0601
1/13/09	3	14	P	PB	0.2	2	14002	1.3293	27.97	0.1830	0.0657
1/13/09	3	14	P	PB	0.2	3	14003	1.4253	26.56	0.1859	0.0633
1/13/09	3	14	P	PB	0.2	4	14004	1.3938	26.33	0.1750	0.0613
1/13/09	3	14	P	PB	0.2	5	14005	1.3093	28.64	0.1662	0.0632
1/13/09	3	15	N	PB	0.3	1	15001	1.3049	18.48	0.1533	0.0481
1/13/09	3	15	N	PB	0.3	2	15002	1.3613	22.23	0.1557	0.0530
1/13/09	3	15	N	PB	0.3	3	15003	1.3082	19.12	0.1428	0.0464
1/13/09	3	15	N	PB	0.3	4	15004	1.3195	22.61	0.1428	0.0515
1/13/09	3	15	N	PB	0.3	5	15005	1.3659	20.42	0.1589	0.0512
1/13/09	3	16	N	SB	0.1	1	16001	1.3510	26.59	0.1650	0.0591
1/13/09	3	16	N	SB	0.1	2	16002	1.3079	23.51	0.1612	0.0558
1/13/09	3	16	N	SB	0.1	3	16003	1.3189	23.43	0.1508	0.0542
1/13/09	3	16	N	SB	0.1	4	16004	1.2752	22.99	0.1498	0.0544
1/13/09	3	16	N	SB	0.1	5	16005	1.2562	21.53	0.1610	0.0534
1/13/09	3	17	N	SC	0.1	1	17001	1.3255	22.40	0.1695	0.0556
1/13/09	3	17	N	SC	0.1	2	17002	1.2069	19.05	0.1427	0.0473
1/13/09	3	17	N	SC	0.1	3	17003	1.3248	21.48	0.1523	0.0509
1/13/09	3	17	N	SC	0.1	4	17004	1.3204	21.63	0.1549	0.0530
1/13/09	3	17	N	SC	0.1	5	17005	1.2431	21.89	0.1487	0.0520
1/13/09	3	18	P	SC	0.2	1	18001	1.2245	19.59	0.1529	0.0508
1/13/09	3	18	P	SC	0.2	2	18002	1.2615	24.87	0.1673	0.0602
1/13/09	3	18	P	SC	0.2	3	18003	1.2861	22.67	0.1655	0.0566

1/13/09	3	18	P	SC	0.2	4	18004	1.3519	22.06	0.1675	0.0555
1/13/09	3	18	P	SC	0.2	5	18005	1.3427	24.88	0.1852	0.0629
1/13/09	3	19	N	Control	0	1	19001	1.3372	33.77	0.2391	0.0823
1/13/09	3	19	N	Control	0	2	19002	1.3917	30.54	0.2315	0.0760
1/13/09	3	19	N	Control	0	3	19003	1.3846	28.45	0.2092	0.0689
1/13/09	3	19	N	Control	0	4	19004	1.3464	28.23	0.2138	0.0702
1/13/09	3	19	N	Control	0	5	19005	1.4016	34.67	0.2388	0.0811
1/13/09	3	20	P	SP	0.2	1	20001	1.2439	26.51	0.1630	0.0588
1/13/09	3	20	P	SP	0.2	2	20002	1.2455	24.71	0.1437	0.0542
1/13/09	3	20	P	SP	0.2	3	20003	1.2740	24.19	0.1574	0.0545
1/13/09	3	20	P	SP	0.2	4	20004	1.2540	22.04	0.1455	0.0508
1/13/09	3	20	P	SP	0.2	5	20005	1.2988	25.35	0.1611	0.0566
1/13/09	3	21	P	SC	0.3	1	21001	1.2335	16.78	0.1512	0.0464
1/13/09	3	21	P	SC	0.3	2	21002	1.2767	16.80	0.1639	0.0486
1/13/09	3	21	P	SC	0.3	3	21003	1.2786	17.02	0.1540	0.0471
1/13/09	3	21	P	SC	0.3	4	21004	1.2160	17.97	0.1592	0.0494
1/13/09	3	21	P	SC	0.3	5	21005	1.2747	18.29	0.1523	0.0490
1/13/09	3	22	N	SP	0.1	1	22001	1.2305	19.19	0.1395	0.0458
1/13/09	3	22	N	SP	0.1	2	22002	1.2153	19.56	0.1335	0.0465
1/13/09	3	22	N	SP	0.1	3	22003	1.2468	21.77	0.1436	0.0508
1/13/09	3	22	N	SP	0.1	4	22004	1.2397	20.75	0.1336	0.0463
1/13/09	3	22	N	SP	0.1	5	22005	1.2389	20.31	0.1476	0.0493
1/13/09	3	23	N	PC	0.2	1	23001	1.2010	15.70	0.1327	0.0424
1/13/09	3	23	N	PC	0.2	2	23002	1.2658	16.62	0.1493	0.0462
1/13/09	3	23	N	PC	0.2	3	23003	1.2273	14.66	0.1349	0.0414
1/13/09	3	23	N	PC	0.2	4	23004	1.2702	17.80	0.1488	0.0478
1/13/09	3	23	N	PC	0.2	5	23005	1.2594	13.24	0.1269	0.0379
1/13/09	3	24	N	SC	0.3	1	24001	1.3100	14.47	0.1425	0.0419
1/13/09	3	24	N	SC	0.3	2	24002	1.2371	14.68	0.1339	0.0410
1/13/09	3	24	N	SC	0.3	3	24003	1.3104	15.74	0.1488	0.0440
1/13/09	3	24	N	SC	0.3	4	24004	1.3455	14.95	0.1471	0.0425
1/13/09	3	24	N	SC	0.3	5	24005	1.2734	14.33	0.1260	0.0387
1/13/09	3	25	P	PC	0.1	1	25001	1.3195	23.35	0.1609	0.0555
1/13/09	3	25	P	PC	0.1	2	25002	1.3205	23.05	0.1654	0.0554
1/13/09	3	25	P	PC	0.1	3	25003	1.2927	23.00	0.1728	0.0572

1/13/09	3	25	P	PC	0.1	4	25004	1.2874	22.83	0.1574	0.0549
1/13/09	3	25	P	PC	0.1	5	25005	1.3429	23.49	0.1632	0.0556
1/13/09	3	26	N	SB	0.2	1	26001	1.3209	20.73	0.1411	0.0497
1/13/09	3	26	N	SB	0.2	2	26002	1.3323	23.18	0.1651	0.0557
1/13/09	3	26	N	SB	0.2	3	26003	1.3239	23.51	0.1475	0.0540
1/13/09	3	26	N	SB	0.2	4	26004	1.2867	23.02	0.1443	0.0523
1/13/09	3	26	N	SB	0.2	5	26005	1.3683	25.12	0.1669	0.0586
1/13/09	3	27	P	SC	0.1	1	27001	1.3424	27.96	0.1735	0.0635
1/13/09	3	27	P	SC	0.1	2	27002	1.3133	28.09	0.1857	0.0650
1/13/09	3	27	P	SC	0.1	3	27003	1.3031	23.29	0.1646	0.0554
1/13/09	3	27	P	SC	0.1	4	27004	1.2769	24.85	0.1514	0.0559
1/13/09	3	27	P	SC	0.1	5	27005	1.3033	26.54	0.1561	0.0582
1/13/09	3	28	P	PC	0.3	1	28001	1.2282	17.49	0.1440	0.0463
1/13/09	3	28	P	PC	0.3	2	28002	1.2465	19.64	0.1504	0.0504
1/13/09	3	28	P	PC	0.3	3	28003	1.3149	17.60	0.1495	0.0474
1/13/09	3	28	P	PC	0.3	4	28004	1.3351	19.95	0.1560	0.0516
1/13/09	3	28	P	PC	0.3	5	28005	1.3675	20.73	0.1559	0.0509
1/13/09	3	29	P	SB	0.2	1	29001	1.3264	21.98	0.1524	0.0519
1/13/09	3	29	P	SB	0.2	2	29002	1.3517	24.58	0.1660	0.0580
1/13/09	3	29	P	SB	0.2	3	29003	1.2903	23.46	0.1710	0.0574
1/13/09	3	29	P	SB	0.2	4	29004	1.4088	26.45	0.1776	0.0611
1/13/09	3	29	P	SB	0.2	5	29005	1.2920	23.49	0.1461	0.0538
1/13/09	3	30	P	PB	0.1	1	30001	1.3385	25.30	0.1680	0.0582
1/13/09	3	30	P	PB	0.1	2	30002	1.2899	25.11	0.1568	0.0555
1/13/09	3	30	P	PB	0.1	3	30003	1.2891	20.87	0.1455	0.0499
1/13/09	3	30	P	PB	0.1	4	30004	1.3253	26.40	0.1746	0.0599
1/13/09	3	30	P	PB	0.1	5	30005	1.2649	24.34	0.1449	0.0533
1/13/09	3	31	N	SB	0.3	1	31001	1.2798	19.21	0.1440	0.0490
1/13/09	3	31	N	SB	0.3	2	31002	1.2500	18.71	0.1463	0.0488
1/13/09	3	31	N	SB	0.3	3	31003	1.3398	23.60	0.1481	0.0546
1/13/09	3	31	N	SB	0.3	4	31004	1.2421	18.41	0.1619	0.0496
1/13/09	3	31	N	SB	0.3	5	31005	1.2813	20.11	0.1551	0.0506
1/13/09	3	32	N	PB	0.1	1	32001	1.3276	20.74	0.1496	0.0504
1/13/09	3	32	N	PB	0.1	2	32002	1.3214	26.32	0.1645	0.0581
1/13/09	3	32	N	PB	0.1	3	32003	1.3164	21.77	0.1499	0.0511

1/13/09	3	32	N	PB	0.1	4	32004	1.3276	24.76	0.1772	0.0605
1/13/09	3	32	N	PB	0.1	5	32005	1.3350	24.99	0.1862	0.0619
1/13/09	3	33	P	SB	0.3	1	33001	1.2894	23.08	0.1475	0.0536
1/13/09	3	33	P	SB	0.3	2	33002	1.3094	23.32	0.1652	0.0570
1/13/09	3	33	P	SB	0.3	3	33003	1.2811	23.60	0.1743	0.0584
1/13/09	3	33	P	SB	0.3	4	33004	1.3023	25.71	0.1853	0.0638
1/13/09	3	33	P	SB	0.3	5	33005	1.3294	23.70	0.1584	0.0555
1/13/09	3	34	N	PB	0.2	1	34001	1.3507	25.99	0.1592	0.0584
1/13/09	3	34	N	PB	0.2	2	34002	1.3136	24.15	0.1562	0.0563
1/13/09	3	34	N	PB	0.2	3	34003	1.3345	22.43	0.1503	0.0531
1/13/09	3	34	N	PB	0.2	4	34004	1.2859	20.74	0.1409	0.0489
1/13/09	3	34	N	PB	0.2	5	34005	1.3034	22.00	0.1450	0.0516

VITA

Name: Sonia Yvette Garza

Address: Department of Animal Science, Meat Science Section
c/o Rhonda K. Miller, PhD.
343 Kleberg Center
2471 TAMU
College Station, TX 77843

Email Address: sygarza@neo.tamu.edu

Education: B.S., Animal Science, Texas A&M University, 2007
M.S., Food Science & Technology, Texas A&M University, 2009