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Rapid extraction of proteins from sorghum using sonication and its relationship to ethanol fermentation

Sorghum proteins form web-like cross-links during the fermentation process. These cross-links tie up starch and reduce its availability for fermentation. Thus, protein cross-linking is a measure of fermentation quality in sorghum. In order to predict the fermentation efficiency of sorghum, a rapid method to extract polymeric proteins from sorghum using ultrasound was employed. The amount of extractable protein in sorghum was correlated to the ethanol efficiency. Thus, area of proteins from mashed sorghum using sonication could be used as an indicator for predicting fermentation quality of sorghum.

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Tubulin superfamily genes in *Tribolium castaneum*, and use of a Tubulin promoter to drive transgene expression

Recent advances in genomics and bioinformatics have opened the door to rapid discovery and analysis of genes that regulate important biological phenomena. Gene transfer technology is needed to fully understand and exploit potentially useful genes discovered through genomics. In this research, we developed new techniques that can be used to understand the regulation of expression of biopesticide target genes, such as those involved in central nervous or molting processes, diuresis, and other vital physiological systems. Such techniques will be used to discover, characterize and exploit insect control genes in pest insects.

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Improved viscoelastic zein-starch doughs for leavened gluten-free breads: Their rheology and microstructure

Celiac disease is an autoimmune enteropathy triggered by protein sequences in wheat, rye and barley. Permitted gluten-free grains include rice, maize and sorghum. Traditional gluten-free breads are made from soft, batter-like doughs based on these gluten-free grains, and are often of very poor quality. It has long been known that certain maize proteins and starch form a dough very similar to wheat dough when mixed at 35-40 °C. However, use of this phenomenon for bread production was not possible. In the present study, we succeeded in the development of superior gluten-free bread from zein dough, which closely resembled wheat bread. We also studied the structural and physicochemical background of zein doughs. We could derive several conclusions relevant for practical baking and significant theoretical understanding. The new type of zein dough can also be used for specialties like soft pretzels and rolls not feasible with traditional gluten-free batters. These results may also help in the development of improved sorghum breads.

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Durability and breakage of feed pellets during repeated elevator handling

An estimated 80% of non-ruminant animal feed in the U.S. is pelleted — a form that improves the efficiency of feeding and the convenience of feed handling. Feed pellets need to be durable and of high quality to withstand the handling and transportation process after production. To evaluate breakage and durability of corn-meal-type feed pellets, the pellets were repeatedly transferred between two storage bins in the USDA-ARS, Grain Marketing and Production Research Center research elevator at Manhattan, Kansas, and results were compared with that of shelled corn. The apparent size of feed pellets decreased with repeated transfers, whereas the amount of broken pellets increased, but by significantly different amounts than with shelled corn. Both feed pellets and shelled corn withstood eight repeated elevator handlings without a significant change in durability as measured by the standard tumbling box test, although the accumulated breakage of feed pellets was 50% after eight transfers as compared to 6.2% for shelled corn. Analysis of dust removed by the cyclone separators showed that these feed pellets generated less dust emissions per unit mass of pellet handled than did shelled corn. These results will be valuable for feed and grain handlers for evaluating and improving their handling and transportation procedures.

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Analysis of repetitive DNA distribution patterns in the *Tribolium castaneum* genome

Most insects have about the same total number of genes (about 15,000), but the total sizes of their genomes can vary by a factor of more than 100. This is because genes themselves represent only a small fraction of the total DNA in an insect's chromosomes. Much of the DNA has unknown function or consists of many copies of repeated sequences. We analyzed the types and chromosomal distribution of this repetitive DNA in the red flour beetle, and found that it comprises almost half of the total DNA on the chromosomes. Understanding this "gene-poor" component of insect DNA will help us understand the function of adjacent "gene-rich" regions, which in turn will lead to a better understanding of many important aspects of insect biology.

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Aggregate stability as affected by polyacrylamide molecular weight, soil texture and water quality

Non toxic, anionic polyacrylamide (PAM) together with a source of electrolytes, such as gypsum, was found to be very effective in controlling seal formation, runoff and erosion because it slows both the physical disintegration of surface aggregates and the chemical dispersion of the soil clays. These potential reimbursements from using PAM for soil aggregate stability are affected due to complex relations among PAM properties (molecular weight) and soil properties (texture, solution chemistry). Some uncertainty exists regarding the issue of how PAM stabilizes soil aggregates: whether PAM penetrates into aggregates or whether it adsorbs on the aggregates' exterior surfaces, and thus stabilizes only these exterior surfaces. We assumed that (i) the effects of PAM on soil aggregate stability may depend on the ability of PAM to penetrate into aggregates and thus stabilize both exterior and interior aggregate surfaces; and (ii) penetration of PAM into aggregates depends on PAM molecular weight (MW) and solution chemistry. We examined the impact of two PAM polymers having medium and high MW on the stability of soil aggregates from four semi arid soils varying in clay content. Aggregate stability, estimated from the sensitivity of the aggregates to slaking and was determined using distilled water and Gypsum solution. Two sizes of aggregates were used: 0.5-1.0 and 1.0-2.0 mm. Penetration of PAM into the aggregates was estimated comparing the stability of the small size aggregates to that of the large size aggregates. The results indicated that aggregate stability (i) increased with the increase in soil clay content, (ii) maintained a greater level with gypsum solution than distilled water, and (iii) was greater for the PAM-treated aggregates than the control. Aggregate stability was found to depend on the combined effects of PAM MW, solution salinity, and aggregate size. Because most of the PAM added to the aggregates was adsorbed on the exterior surfaces of the aggregates, the small fraction of the PAM that entered into the aggregates' pores, had no significant impact on aggregate stability. Thus, to enhance aggregates' resistance to slaking, it is enough to stabilize the exterior surfaces of the aggregates with PAM. Treating aggregates with PAM, irrespective of its MW, improved their stability in comparison to that of untreated aggregates. No specific PAM was selected as a preferable, because the effects of the PAM varied among the soils tested and depended on initial aggregate size and water type. The choice of PAM to be used as a soil amendment, however, needs to be made in accordance with the soil to be treated and the specific conditions prevailing in the field.

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Separation of teff (*Eragrostis tef* (Zucc.) Trotter) prolamins by free-zone capillary electrophoresis

Teff is an extremely small cereal grain from Ethiopia where it is used to make the traditional flatbread injera. Teff is also used in celiac-safe food products due to its gluten-free status. Limited research has been reported on protein properties of this interesting grain. Previous reports have described multiple methods for examining seed protein polymorphism. A free zone capillary electrophoresis (FZCE) method was developed to separate teff storage proteins. Optimization included sample extraction method, capillary temperature, buffer composition and additives. Using the optimized method 17 Ethiopian lines were analyzed. Results showed that FZCE is a useful in evaluating seed protein polymorphism. This method will allow the identification of teff lines and assist breeders in the development of teff.

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