Workshop Overview

A Joint USDA ARS/CSREES Animal Production and Well-Being Workshop was held in Kansas City, Missouri on April 10-12, 2006. A total of 150 individuals participated in the workshop representing the animal and poultry industries, commodity organizations, consumer groups and other non-government organizations, academia, as well as several federal agencies (ARS, CSREES, ERS, NRCS).

The workshop was designed to allow stakeholders the opportunity to provide input in to the five-year strategic planning cycle of research and education in this national program area. The full agenda and copies of presentations given during the workshop are available on the ARS National Program web-site at: http://www.ars.usda.gov/research/programs/programs.htm?NP_CODE=101 . Also available on the web-site is a list of attendees.

The purpose of this document is to provide a summary of the input received at the workshop. What follows is the report of each of the five "Species" breakout sessions from the workshop (Beef, Dairy, Swine, Small Ruminant, Poultry) and the four "Cross-Cutting Topical" breakout sessions (Improving Animal Adaptability and Reducing Stress in Production Environments; Development of Genome-Based Genetic Improvement Programs; Enhancing Efficiency of Nutrient Utilization in the Era of Rapidly Changing Genetics; and Production Systems for Enhancing Economic Competitiveness). Included in these reports is information that was submitted directly to USDA staff by stakeholders who were unable to attend the meeting who submitted comments via letter prior to the event.

Additionally, a summary of comments made during an open discussion of the entire workshop group are included.

Group 1: BEEF

Status: Needs to be investigated further

Priority Rating: High

Issue: Production Efficiency

Explanation: Cow-calf and feeding systems: use of feed energy, reproduction, and longevity.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:
1) Reproductive efficiency and feed efficiency of top importance.
2) Need to package feed efficiency as environmental quality and package adaptability as welfare.
3) With feed efficiency – feedlot performance is important but cow-calf efficiency is more important.
4) ARS must continue to do long-term, high risk research while also not forgetting the need for balance of short-term applied research in USDA.
5) In GPE program, could use same bulls at multiple locations?

Status: Needs to be investigated further

Priority Rating: High

Issue: End Product Quality

Explanation: Preharvest molecular characterization and interventions in conventional systems and emerging systems; postharvest quality assessment

Notes/details for reporting purposes only, will not be included in PowerPoint slides:
1) ARS has done great work in collaboration with NCBA – hope this will continue.
2) Need more work on ethnic preferences.

Group 1: BEEF

Status: New and needs to be investigated

Priority Rating: High

Issue: Information Systems for Phenotypes and DNA

Explanation: Establish open systems architecture platforms for quantitative and molecular investigations

Notes/details for reporting purposes only, will not be included in PowerPoint slides:
1) Identified as high priority as ARS has the size of populations to significant research and measure extensive phenotypes – including those in very complex and difficult traits such as adaptability, feed efficiency, longevity, and disease and stress resistance.
2) Is there any possibility of having a centralized resource population / database structure for public access (including phenotypes and DNA from outside of ARS)?
3) MARC is phenotypically rich, but short of people to do the analysis and discovery.

Status: Needs to be investigated further

Priority Rating: High

Issue: Animal Well-Being/Welfare

Explanation: Adaptability - e.g., heat, fescue tolerance, etc.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:
1) Important issues raised were heat tolerance, fescue tolerance, high altitude, and animal well-being and stress resistance.
2) Grass-fed beef work should be packaged as well-being.

Group 1: BEEF

Status: New and needs to be investigated

Priority Rating: Medium

Issue: Transgenics

Explanation: Conduct discovery research, food production currently lower priority.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:
1) Don't abandon transgenics – frame the debate by being involved in it.

Status: New and needs to be investigated

Priority Rating: Medium

Issue: Rumen microflora

Explanation: initiate developing platform for characterization and future use through metagenomics

Notes/details for reporting purposes only, will not be included in PowerPoint slides:
1) Extremely important area that needs new resources devoted to it to begin to fully characterize the rumen environment.
2) Study of interactions between host and microbe genotypes is warranted.
3) Must learn to walk before you run in this area – i.e. "platform" for this research must be built as USDA is starting from ground zero.

Group 2: DAIRY

Status: Needs to be investigated further

Priority Rating: High

Issue: Nutrient Intake and Utilization

Explanation: Basic research in this area is paramount. Need to look at triad of nutrients-microbes-host genetics. Priority should be rumen, but all areas of gut need to be explored. Need ways to measure and capture information. Gene expression/regulation studies are warranted.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

This can also have a bioenergy/By-Product component.
Research ways to reduce methane loss from cows.
Metagenetics of rumen microbes.

Status: Needs to be investigated further

Priority Rating: High

Issue: Reproductive Efficiency

Explanation: Need to investigate triad of nutrition-immune system-genetics. Make selection tools more accurate. Study expression/regulation of important genes. Evaluate economic impact.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

This is an integration of animal well-being and production.Reproductive efficiency has gone down as production has gone up.

Group 2: DAIRY

Farmers are using aggressive treatment with hormones to manage the problem. Not a consumer-friendly long-term viable solution.

Status: Needs to be investigated further

Priority Rating: High

Issue: Genetic Improvement and Genomic Tools

Explanation: Need wider range of phenotypes. ARS should remain repository of data. Emphasize health, fertility and well-being. Incorporate molecular data into genetic evaluations. Continue aggressive genomics program.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Parentage verification and tracability panels are part of this. Need to improve uniformity of data collection from farm. ARS can provide leadership to help bring this about. Whole genome data is exciting opportunity. Feel the genetic improvement and genomics tools areas should be combined as these two efforts need to be complementary. Transgenic work should be maintained and perhaps focused as a research tool until wider public acceptance of products occurs.

Status: Needs to be investigated further

Priority Rating: High

Issue: Animal Behavior/ Well-Being

Explanation: Important to develop standard methods and measures. Important to educate producers and practitioners on how to recognize problems.

Group 2: DAIRY

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Improved management has increased well-being. Modern management is not necessarily antagonistic to animal well-being. It's important that CSREES include this point in extension efforts.

Status: Needs to be investigated further

Priority Rating: Medium

Issue: Conserve and Characterize Germplasm

Explanation: Keep current repositories. There is a need to both conserve germplasm and to characterize it. May need to expand current repositories to include non-domestic breeds.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Some concern about totally directing preservation activities to feed genomic research. Conservation aspects continue to be valued. ARS has dairy efforts under way to specifically feed genomic research needs.

Status: Needs to be investigated further

Priority Rating: Low

Issue: Growth and Development

Explanation: Focus should be on heifer growth. Also, mammary gland growth and regeneration in terms. Studies

Group 2: DAIRY

of structural conformation needs of high producing cows would also be valuable.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Status: Needs to be investigated further

Priority Rating: Low

Issue: Product Quality

Explanation: Work in this area should focus on improving the nutrional value of milk and enhancing important milk components.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

This is an area that could be funded with producer check-off dollars. May be best to spend ARS dollars elsewhere. Could also be a fruitful area for transgenics but don't see commercialization of transgenic dairy cows on the horizon.

Status: Should no longer be investigated

Priority Rating: N/A

Issue: Integrated Systems

Group 2: DAIRY

Explanation: **Panel felt this was an important area, but that important decision making tools should be incorporated into other objectives and programs.**

Notes/details for reporting purposes only, will not be included in PowerPoint slides

Group 3: SWINE

This report is organized under two individual categories. The first category is broadly categorized as infrastructure and pertains to issues that impact all species under the USDA ARS-CSREES programming umbrella.

The Swine review committee encourages continued high risk and long term research that is out of reach for academia and private industry but that demonstrates long range application and promises to add value to the swine industry. We would encourage USDA-ARS and CSREES to continue to be a world leader for issues that impact food production systems. The US is a global leader in food production and technology. However, continuing improvements in production technologies and efficiencies will be required to ensure the continued viability of the meat animal industries in the US. in the face of increasing international competition from countries with lower production costs and other emerging competitive advantages such as geography, labor and energy costs.

1. Genomics-Infrastructure-Bioinformatics-Systems

These are issues central to all meat species involved in the next 5 year plan. **We are at a critical juncture in the future of animal production.** There are fewer resources available through the USDA and Land Grant University systems and dramatically increasing needs for expertise, research and technological advances. The genome promises to provide significant and real advances in technology and production sciences. However, there are not adequate resources currently to realize the potential for this science. In addition, the problems, issues and opportunities now confronting the pork industry are large and complicated and have enormous implications for the continued viability of the pork industry. These issues will require cooperative, system based research approaches to problem solving and resources that are currently not available in many cases.

There is a critical, real need for a centralized, large scale production unit system to address contemporary issues confronting the swine industry. The swine industry in the US will not be able to continue to compete globally without these resources. Land grant universities no longer have the staffing nor resources to address the large scale, systems based requirements for problem solving in the industry. This facility would be supported cooperatively by industry and staffed by USDA personnel as well as research entities from contributing industry groups and land grant universities. This facility would provide infrastructure for continuing USDA research as well as provide a format for large scale research of relevance to the swine industry via coordinated projects developed and conducted by industry and university research scientists.

Group 3: SWINE

There is an absolutely critical and real need for recruitment and training of research and technical staff. The food animal industries are a vital and integral part of the US food system and research and development programs have been chronically under-funded over the past several years. Unfortunately, the industry is now in a period where emerging issues are very large and very complex with enormous implications for the future supply of food. These issues are not simple and require systems based approaches for resolution. The chronic lack of funding for agriculture in many cases precludes opportunities to address these issues effectively. The US will not remain a world leader in the production of safe and wholesome food if adequate resources are not developed. In addition, the lack of funding and support for education and staff development has redirected many of the brightest minds into other disciplines where support and funding exists. Consequently, there is a critical lack of personnel for existing programming efforts and fewer young minds being developed in all disciplines. The significance of these issues can not be understated and need urgent and prioritized consideration.

The swine review committee encourages ARS-CRSEES to develop a platform for stakeholder based feedback relative to developing issues and technologies. Develop a system that would provide pertinent information on a timely manner to producers and industry. This system should serve to introduce significant new technologies as well as provide an early warning/alert component for future technological developments relevant to the industry.

The swine review committee encourages continued sophisticated collaboration between ARS and CSREES. Focus on long term, high risk basic research which could then be passed to land-grant university research programs for applied research, implementation and technology transfer.

There is broad based support for further research in transgenics and similar technologies, particularly at the basic genomic level, but a current reluctance to develop industry level tools and technologies. The swine industry would encourage that all research in these areas be as high profile and as transparent as possible, with continued dissemination of information particularly relating to food safety and animal well-being to industry and consumers. Eventual adoption of these technologies at the producer level may provide significantly improved production efficiencies for the industry and provide a competitive advantage for US producers. GMO products in the plant industries have been successfully adopted and are now common place in the global community.

Genome Funding Issues – The swine review committee is concerned about these relative disadvantages in current funding levels. Swine research funding is

Group 3: SWINE

generally lower than competing species based on GNP, even though the swine genome is much more applicable and relevant for comparisons to the human genome. The issues should be addressed in subsequent budgets and planning decisions. Specifically;

i. Current genome funding will produce less coverage than competing protein species, ie, 3X vs 8X in beef, poultry and dairy.
ii. No USDA-ARS or other funding is currently in place for SNP research & discovery.
iii. There are many fewer resource populations and existing databases currently available for continued genomic research in the swine industry relative to the beef, poultry and dairy industries.

Summary: Section 1 Programming Issues/Needs

a. Functional genomics (HIGHEST Priority)

- Implications for all industry priorities are clear and significant.
- Needs for capturing and describing phenotypes and determining application, including dynamic populations coordinated with the germplasm storage and preservation components and centralized database development.
- Needs to develop new technologies for genetic evaluation, including molecular, genomic and proteomic research information.
- Needs for novel data base development and information systems, centralized data collection and management.
- Critical need for industry relevant, centralized research and training facilities.

b. Bio-informatics (HIGHEST Priority)

- Critical need for personnel recruitment, training and development.
- Need for a bio-informatics centralized training facility for all disciplines.
- Critical need for programming and database development/management.
- Need for development of collaborative systems to develop programs and recruit students and staff.

c. Continued outreach development (HIGH Priority)

Group 3: SWINE

- Continue USDA outreach cooperation with the National Pork Center of Excellence.
- Develop specific avenues to relay research and technological information directly to industry stakeholders in a timely and efficient manner.
- Provide on-going interaction with industry relative to emerging issues. Serve as a window for future needs and technology development, identification of emerging issues and technologies.
- Explore opportunities to collaborate with academia and industry for research and outreach.

d. Systems Development - Holistic Program Development (HIGH Priority)

- Identify resources for collaborative research in and out of USDA systems.
- Develop collaborative programs across academia and industry. Promote application of applied research and technology transfer in the land grant system after the "high risk" research has been completed by ARS.
- Identify and develop large scale research resources.
    - Recruit industry cooperators for complex systems based approaches to problem solving.
    - Develop centralized research and database management programs for systems based applications for all priorities.
    - Identify and develop new/re-directed research facilities.
        - Develop focus on large "industry based" populations.
        - Facilitate genomic research across all research priorities.
        - Facilitate systems approach to problem solving for all priorities.

2. Industry Issues

The following research/programming issues for swine were identified by the swine review committee. These are issues of significant importance to the swine industry, which can not be easily addressed by other research entities, but clearly have a significant impact on pork production sustainability and producer/industry competitiveness and profitability. These are issues that will directly impact the efficiency and viability of the pork industry, but require research that is long term, complex and difficult to administer.

Group 3: SWINE

a. Biological Efficiencies (HIGH)

- Address research needs to evaluate genetic components of disease resistance & animal well-being.
- Address research needs for nutrient utilization including genomic and cellular level research.
- Address sow longevity and mortality issues including housing systems and lameness, in sows as well as grow-finish hogs, and implications for female lifetime productivity.
- Address research needs for reproductive efficiency including:
  - Male reproduction issues.
  - Female reproduction issues.
  - Pre-weaning mortality and maternal ability/performance.
- Address evolving energy utilization input costs etc and their impact on production and production efficiencies. Including the evaluation of alternative feed ingredients and alternatives to non-antimicrobial production enhancers.

b. Animal Well-being & Welfare (HIGH)

- Address research needs for measurement of factors implicated in swine well-being and interpretation response variables
- Address research needs for identification of mechanisms that define, impact and mediate swine well-being and production.
- Address research needs relating to health and disease incidence and their relationships to swine well-being, production and biological efficiencies.

c. Environmental Issues

- Address research relating to odor abatement and environmental impact mediation through improved/modified nutrient utilization efficiency.

d. Pork Quality

- Address research needs to genetically and nutritionally enhance the “quality” of fresh and processed pork. Address both nutritional enhancement and consumer eating satisfaction as well as management and production implications.
- Address research needs to develop new tools (genomic and others) for measurement of pork quality attributes pre-harvest.
- Address research needs to evaluate and mitigate tenderness issues for the pork industry.

Group 4: SMALL RUMINANTS

Status: Needs to be investigated further

Priority Rating: High

Issue: Reproductive Efficiency Limits Profitability

Explanation: Lifetime reproductive efficiency focusing on uterine health / embryonic and fetal survival, and assisted reproduction technologies including germ plasm conservation should be emphasized.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Status: Needs to be investigated further

Priority Rating: High

Issue: Characterize genetic variation among breeds, animals within breeds, and alleles in distinct production environments.

Explanation: This characterization should emphasize fitness traits, lifetime productivity, meat and wool quality, and disease and parasite resistance/tolerance.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

• Focus on meeting consumer expectations: large lean carcasses, tender palatable meat,
• Focus on meeting producer expectations: highly productive, profitable, easy-care animals that are well adapted to the production environment and can have a fine uniform wool clip.

Group 4: SMALL RUMINANTS

Status: Needs to be investigated further

Priority Rating: High

Issue: Suboptimal nutrient intake, utilization, and partitioning limits all aspects of production; nutrition is the largest cost factor in production.

Explanation: This should include elements from previous action plan, including grazing behavior, rumen microbiology.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Group 5: POULTRY

Status: Needs to be investigated further

Priority Rating: Low

Issue: Reproductive Efficiency

Explanation: Considered to be the responsibility of the breeder companies. (Most important for broiler and turkey industries.)

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Reproductive efficiency is an issue for broiler & turkey production industries because as birds become more efficient at producing meat, their reproductive efficiency is decreasing. Initially considered important but not when compared with other research priorities.

Only research is at Beltsville.
Not a lot related to broilers loss of egg production & hatch rates continually going down noted by Carla Price.
Vaccines not as efficient - related to genetic slection in turkey - noted by Gretta Irwin;.

Should we ask ARS to focus limited resources on this isssue?

Recommend relocating the gamete/embryo storage and cryopreservation component under Genomic Tools. Turkey industry is strongly supportive of resolving semen cryopreservation issues.

Status: Needs to be investigated further

Priority Rating: High

Issue: Conserve, Characterize and Use of Genetic Resources

Group 5: POULTRY

Explanation: Populations are valuable and should be maintained. Recommend combining this with the Genomic Tools component.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Poultry species are losing more genetic variability than any other commodity. Genetic resources of the poultry industries are in the hands of only a few companies. Recovering from mistakes will be difficult if we have no genetic diversity left. Long term support that ARS should be providing, as industry cannot afford to do this and universities are no longer the main repositories. PSA association (summer 05) discussed the Jackson Labs model to make rare poultry populations more readily available. More active stance from USDA needed on this issue.

Value of East Lansing lines: strong value to preserve - recover from mistakes we may make in the future - Kevin Vinchattle offered assistance from Iowa Association to support lines in danger.

Ken Klippen also lobbied to keep ADOL birds; Jackson Lab model discussed; congressional earmark; active stance needs to be taken by USDA.

Status: Should no longer be investigated

Priority Rating: Low

Issue: Genetic Improvement

Explanation: Specifically referring to (1) developing breeding objectives and (2) accelerating selection response. Recommend moving (3) health and well-being and (4) transgenic poultry under Genomic Tools.

Group 5: POULTRY

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Transgenic poultry should only be investigated as tools and/or models to solve research problems; the group was emphatic that transgenic animals not be developed for mainstream production purposes.

Should ARS be developing breeding objectives for poultry? Genetic selection for disease resistance - university asked the question but industry believes companies will take care of this; basic research should come from ARS - ADD TO GENETIC IMPROVEMENT

Transgenic poultry: Carla - NO - gets flooded with phone calls from consumers - will bring too much grief to ARS; Ken - step way from this even though can see the value; Kevin V. concurs but keep basic work in this area because public will come around when the world needs the food. Use as a tool not as production.

Status: Needs to be investigated further

Priority Rating: High

Issue: Genomic Tools and Genetic Resources

Explanation: Extremely important for all three commodities. Combined the relevant sections of Components 2, 3 and 4.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Added: Preserving genetic resources. This includes gamete and embryo storage and cryopreservation. Currently have no reliable method for cryopreservation of avian gametes. Need to have basic research on this to understand why and determine how to get around the problem.

Added: Transgenic poultry. As stated previously, this is viewed as important for developing of tools for understanding genetic aspects of control. But it is not desired at all for production aspects.

Group 5: POULTRY

Comprehensive maps, genotyping, tools and reagents are all very important. Need to sequence the turkey genome.

Genomic enhancement systems not needed for poultry. Need more application tools for breeding, not bioinformatic analysis.

Public access to the chicken genome sequence is very important for the poultry industries; however, need more practical applications of markers in the breeding programs.

Development of validated SNP markers across populations is critical for chickens and turkeys.

Status: Needs to be investigated further

Priority Rating: High

Issue: Nutrient Intake and Use

Explanation: Fundamental problem in poultry production.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Meet nutrient needs of birds with changing diet sources; feed costs 60% - serious issue; fats will go into biodiesel so what will go into feed; how low can energy be restricted and birds still grow? What will the impact be of shifting to dried distiller's grains be in poultry production systems?

Should basic nutrient requirement work be conducted at ARS? Not very many practical nutritional experiments being done and published to modify NRC standards. No one uses the current NRC standards b/c they are so irrelevant to the modern poultry industries.

Need nutritional information for all bird commodities as the nutrient requirements and growth rates have changed. Basic research with multiple impacts and strong industry application. Birds are being grown to heavier weights – need nutrition work to optimize systems under these specifications.

Group 5: POULTRY

Air emission - phosphorus, ammonia, nitrogen sulfide excretion.

Regulating gene function - broilers growing slower and nutritional programs are being increased - is this gene expression being affected by diet? noted by Gretta Irwin.

Status: Should no longer be investigated

Priority Rating: Low

Issue: Growth and Development

Explanation: Primary breeders should be working on this issue not ARS.

Status: Needs to be investigated further

Priority Rating: Medium

Issue: Product Quality

Explanation: Need to continue on genetic/nutrition interaction aspect only.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Considerable concern about future meat quality. Rapid changes in yields may cause problems for broiler and turkey industries. Egg product quality is being dealt with adequately by industry.

Interactions of genetics and nutrition work being done at MS ARS location.

Group 5: POULTRY

Status: Needs to be investigated further

Priority Rating: High

Issue: Scientific Measures of Well-Being and Stress / General Animal Welfare

Explanation: This is a front-line issue for industry.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Provide objective-based scientific data in collaboration with industry to ensure practical/application basis. Need to define what well-being means but do not want a government-mandated production system. How can ARS do this and be viewed as non-biased? Need research documenting that production practices are safe and humane. Research should work with on-farm audits. Examples of management issues: lighting programs; molting programs; beak trimming; air quality; temp & humidity; stocking densities.

The metrics of well being need to be defined; production practices are very different in US and Europe - so how do we or do we establish international standards?

More people managing animals that do not have innate instincts for proper human interactions and mnitoring disease; lack of places for training the folks who will work in the industry.

This is of high importance for all three commodities (layers, broilers, turkeys).

Letters from industry members consistently pointed out the need for development of optimum lighting protocols (from a systems biology perspective incorporating genetics, physiology, nutrition, etc). Same was expressed relative to ambient temperature needs.

Topic 1:
IMPROVING ANIMAL ADAPTABILITY AND REDUCING STRESS IN PRODUCTION ENVIRONMENTS

Status:

Priority Rating: High

Issue: Enhance Lifetime Profitabilty (longevity)

Explanation: Research should be directed at increasing dairy, swine, beef and sheep lifetime profitabilty through increased longevity.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Focus on increasing production efficiency and enhancing economic competitiveness is an underlying theme.

Status:

Priority Rating: High

Issue: How do we measure welfare/well-being?

Explanation: A need exists to identify objective measures of welfare/well-being including productivity, physiology, immunology and mental health; in order to enhance well-being.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

A need exists to identify which measures are best. It is important to identify negative conditions prior to a negative impact on animal well-being/welfare. Focus on increasing production efficiency and enhancing economic competitiveness is an underlying theme.

Topic 1:
IMPROVING ANIMAL ADAPTABILITY AND REDUCING STRESS IN PRODUCTION ENVIRONMENTS

Status:

Priority Rating: High

Issue: Continue research into production practices that ensure well-being while minimizing pain.

Explanation: All potentially aversive production practices should be evaluated in order to optimize well-being.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Focus on increasing production efficiency and enhancing economic competitiveness is an underlying theme.

Status:

Priority Rating: High

Issue: Animal's ability to adapt or environment adapted to animal.

Explanation: A need to determine if an animal is adapted to its current environment needs to be assessed and environmental modification explored as necessary

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Focus on increasing production efficiency and enhancing economic competitiveness is an underlying theme.

Topic 2:
DEVELOPMENT OF GENOME-BASED GENETIC IMPROVEMENT PROGRAMS

Status:

Priority Rating: High

Issue: National Phenotypic/Genotypic Repository

Explanation: Collection of existing phenotypic, genotypic, pedigree, and QTL data along with DNA, RNA, tissue samples will facilitate comprehensive data anaylsis. The repository would be publicly available. ARS should coordinate activity due to long term commitment.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Schook - Capture phenotypes, become integrated

Taylor - Capture genetic (pedigree) and phenotypic information in comprehensive databases, DNA, tissues, etc.

Data at different locations that are not being coordinated.

ARS coordinates activity and maintains database due to long-term commitment. Public access to database.

Health data is a high priority.

Develop common QTL database.

Deveolop analytical tools.

Status: New and needs to be investigated

Priority Rating: High

Issue: Paucity of Scientists with Quantitative Training

Topic 2:
DEVELOPMENT OF GENOME-BASED GENETIC IMPROVEMENT PROGRAMS

Explanation: **Expertise in quantitative genetics, statistics, and population genetics is in short supply. There is an aging faculty that represents a critical mass with this expertise. Training grants are urgently needed to meet the rapidly growing demand.**

Notes/details for reporting purposes only, will not be included in PowerPoint slides:
Gunsett - Whose responsibility to train students?
ARS should play an important facilitation role in training of students.

Status:

Priority Rating: High

Issue: Development of Statistical Analysis Techniques for Application to Genetic Evaluation

Explanation: **Incorporation of genetic marker information into genetic evaluations is an urgent need. Research on statistical methodology to accommodate high-density SNPs is a major constraint to application of genomics research. Needs to be species neutral.**

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Deliverables to industries.
Incorporation of marker information into genetic evaluations - responsibilities?
Research on statistical methodology to accommodate high-density SNPs.
Thallman - validation of DNA tests so far. Genotypic data not available from breed associations for analyses.
Van Tassell - Problem recognized, but clearly behind schedule.
Schook - Need significant additional resources. Shortage of graduate students.
Anderson - Software needs to apply to all species.

Topic 2:
DEVELOPMENT OF GENOME-BASED GENETIC IMPROVEMENT PROGRAMS

Status:

Priority Rating: Medium

Issue: Preservation of Unique Germplasm

Explanation: There is need to maintain unique genetic lines in species where cryopreservation is not feasible. There was a conclusion that appropriately characterizing the problem is essential to gaining public support (eg, relating to avian influenza).

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Losing unique poultry lines - need resources to maintain lines.
Need to use lines in researchable questions - formulate issues in appropriate manner.

Topic 3:

ENHANCING EFFICIENCY OF NUTRIENT UTILIZATION IN THE ERA OF RAPIDLY CHANGING GENETICS

Status: New and needs to be investigated

Priority Rating: High

Issue: Alternative Feed Needs

Explanation: Biofuel production is utilizing feedstuffs (corn, fats) commonly used as feedstuffs by livestock and poultry. Alternative feedstuffs are needed. This necessitates characterization of composition and nutrient availability.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

How do the feeds fit into diets and sytems for nutrient utilization? Dried distillers grains are of particular concern.

Status: New and needs to be investigated

Priority Rating: High

Issue: Associative Effects Among Nutrients

Explanation: The impact of associative effects among nutrients or feeds on feed utilization is not characterized so we can predict outcomes from different diets. Need to understand mechanism and effects across gut *compartments.*

Topic 3:

ENHANCING EFFICIENCY OF NUTRIENT UTILIZATION IN THE ERA OF RAPIDLY CHANGING GENETICS

Status: New and needs to be investigated

Priority Rating: High

Issue: Nutrient x Genetic Interaction (multiple species)

Explanation: Do different genetic lines utilize nutrients differently? Different requirements? Impact of nutrition on gene expression, "programming"?

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Relevant to how we need to formulate diets? Identify genetic and phenotypic markers? Need a good phenotypic model.

Status:

Priority Rating: Low

Issue: Systems evaluation for impact of byproducts

Explanation: Utilization of feedstuffs for biofuels appears likely to have an impact on diet formulation, farm profitability, nutrient management, product salabilty and societal concerns.

Topic 3:

ENHANCING EFFICIENCY OF NUTRIENT UTILIZATION IN THE ERA OF RAPIDLY CHANGING GENETICS

Status: New and needs to be investigated

Priority Rating: High

Issue: Improvement of Forage

Explanation: There is a need to improve fiber digestibility to improve nutrient utilization. This may entail changing the plant, better understanding the role of rumen microbes and effects of the rest of the diet.

Status: New and needs to be investigated

Priority Rating: High

Issue: Anti-nutritional Factors in Feedstuffs

Explanation: How do we detect and reduce antinutritional factors (e.g., mycotoxins, factors in endophyte infected tall fescue, soy) and understand their effects on nutrient utilization. Do we have the appropriate tools to assess them?

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Effects on gene expression (Use microarrays?). Effects on function vs functional capacity.

Topic 3:

ENHANCING EFFICIENCY OF NUTRIENT UTILIZATION IN THE ERA OF RAPIDLY CHANGING GENETICS

Status: New and needs to be investigated

Priority Rating: High

Issue: Impact of Microflora

Explanation: What is the effect of gut microflora? Ruminal, small intestine, hindgut? Potential improvements through use of "probiotics", adjuvants or diet components?

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Will need to know how the treatments work.

Status: New and needs to be investigated

Priority Rating: High

Issue: Metabolism Studies / Evaluation of Feedstuffs

Explanation: We need to reassess/assess nutrient requirements of animals (different genetics than 30 yr ago). Revision/evaluation of feed analysis methods for nutritional relevance is needed. In vitro methods need to be tied to in vivo response.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

May need to reassess nutrient requirements for ration formulation.

Topic 3:

ENHANCING EFFICIENCY OF NUTRIENT UTILIZATION IN THE ERA OF RAPIDLY CHANGING GENETICS

Status: New and needs to be investigated

Priority Rating: High

Issue: Increase utilization and decrease losses

Explanation: Further evaluation of nutrient (e.g., N, P) inclusion in diets to reduce nutrient excretion.

Topic 4:

NON-TRADITIONAL PRODUCTION SYSTEMS FOR ENHANCING ECONOMIC COMPETITIVENESS

Status: Needs to be investigated further

Priority Rating: High

Issue: Limited ability to define and assess well being and stress of animals under production in pasture based systems.

Explanation: Limited data concerning the well being of animals in pasture based production systems exist.

Agreement on defining well-being & limited methods for assessing animal stress constrain researchers from developing protocols for reducing this stress.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Was not sure whether this should be a stand alone issue. It was suggested that this should actually be a main driver for all animal research - i.e., should be a component of all ARS animal research when at all possible.

Stressors that need to be studied and addressed include: environmental factors (such as heat and cold), human interaction with the animals, management, etc.

Status: New and needs to be investigated

Priority Rating: Medium

Issue: Limited empirical data concerning how utilization of grazing systems affect productive longevity of animals.

Topic 4:

NON-TRADITIONAL PRODUCTION SYSTEMS FOR ENHANCING ECONOMIC COMPETITIVENESS

Explanation: **There is the assumption that animals completing their production cycles in extensive systems have increased productive longevity versus those in intensive systems of production.**

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Longevity was discussed as going with animal well being and thus, might be better thought of as a driver or component of other animal research efforts where appropriate.

Status:

Priority Rating: N/A

Issue: **Limited information on combining non-traditional and conventional management systems to increase resource utilization.**

Explanation: **Combient Modeling**

Example: Conventional concentrated dry lot dairy with maxed nutrient credits might consider moving certain aspects of operation to pasture based systems (e.g., dry cows, cows with mastitis, heifers).

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Discussion led to this being an approach that should be encouraged in ARS research - not necessarily a stand alone research problem.

Topic 4:

NON-TRADITIONAL PRODUCTION SYSTEMS FOR ENHANCING ECONOMIC COMPETITIVENESS

Status: Needs to be investigated further

Priority Rating: Medium

Issue: There is limited empirical data quantifying the potential synergistic benefits of integrated grazing systems utilizing multiple forage-animal species.

Explanation: Empirical data exists concerning the benefits of these systems under limited situations.

Synergistic benefits of these systems are still not well defined, thereby limiting development of management protocols to fully capture all resource inputs.

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Parasite control, nutrient utilization, animal well being and stress, predation control, etc.

Status: Needs to be investigated further

Priority Rating: High

Issue: Consistent product delivery from pasture finished meat animals suffers from a lack of predictability of input (e.g., forages) quantities & qualities.

Explanation: Year round delivery of quality meat products from pasture finished meat animals requires improved understanding seasonal forage quality fluctuation & G*E interaction impacts on product quality & quantity.

Topic 4:

NON-TRADITIONAL PRODUCTION SYSTEMS FOR ENHANCING ECONOMIC COMPETITIVENESS

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

It was noted that this area was not only pertinent to pasture finished beef but also to sheep, goats and dairy.

Status: New and needs to be investigated

Priority Rating: High

Issue: Lack of data concerning how to switch from conventional farming to organic farming while maintaining economic viability.

Explanation: Farmers considering a transition to organic farming need information to guide them in making appropriate decisions during the transition to ensure sustainability of the new operation.

Status: Needs to be investigated further

Priority Rating: High

Issue: Optimum supplementation of grazing dairy animals (includes: cattle, goats, sheep)

Explanation:

Status: New and needs to be investigated

Priority Rating: High

Issue: Limited empirical data concerning effects of forage-based management and environment on equine health & production.

Topic 4:

NON-TRADITIONAL PRODUCTION SYSTEMS FOR ENHANCING ECONOMIC COMPETITIVENESS

Explanation: **Horses are effected by many of the same issues affecting other grazing species (e.g., fescue toxicosis, salmonella, reproductive effieciency, etc.). However, horses have not routinely been recognized by ARS or other agencies for research funding.**

Notes/details for reporting purposes only, will not be included in PowerPoint slides:

Concern that equine producers are required to conform to the same regulations as other forage-animal producers without gaining the research support of these groups. The equine industry contributes over $100 billion dollars to the U.S. economy a year but has no formalized support from government to aid in researching production issues it faces. Support is needed to improve and maintain an industry that contributes to not only recreational activities of U.S. citizens but also has significant impact on forage markets as an outlet for high quality (high dollar) hay and feed products (good markets for forage producers).

Status: New and needs to be investigated

Priority Rating: Medium

Issue: **Limited empirical data effects of forage-based management and environment on grazing monogastric animal (e.g., chickens, pigs) health and production.**

Topic 4:

NON-TRADITIONAL PRODUCTION SYSTEMS FOR ENHANCING ECONOMIC COMPETITIVENESS

Explanation: **Much of the information available for grazing ruminant animals does not exist for these animals which are filling a niche market. Thus, development of sustainable production systems for these animals on pasture is particularly difficult.**

Status:

Priority Rating: N/A

Issue: Animal Identification & Disease Survey

Explanation: ***After discussing this topic, it was decided that it was an APHIS issue & that APHIS would contact ARS if they needed ARS to research particular components.***

Status:

Priority Rating:

Issue: How do we retain for the producer the value added to niche products?

Explanation: ***This was not fully discussed. May not be a researchable issue - but rather a marketing issue.***

NP 101/105 Workshop
Kansas City, MO
April 12, 2006
Entire Workshop Audience
Summary of Comments

(Close of Workshop Session)

Steve Larson (Hoard's Dairyman) -- Work done by AIPL on genetic evaluation of production traits in dairy cattle is extremely important and must be continued. There is obvious need for infrastructure in the area of nutrient utilization in dairy cattle. Specifically, the need exists for an intensive nutrition-rumen microbiology/ hind gut microbe research facility.

Mark Boggess (National Pork Board) – Thought that the workshop was very good and that they had good opportunity to provide input. He also stated that the stakeholders learned a lot.

Several comments were raised concerning the potential for metagenomics research to address animal production problems. It was pointed out that a basic platform to conduct metagenomics research is the first rate-limiting step.

Jackson Dzakuma (Prairie View A&M University) – Suggested that research work addressing problems in the goat industries is underrepresented and funded. He further stated that the USDA classification of goats as a minor species creates a funding disadvantage for research in this area.

Jim Kinder (Ohio State University) -- Raised the question of what is meant when we discuss the need for greater research on "phenotypes". This was a recurring theme from the input at the workshop. The point was made (by Green) that the primary definition of phenotype is a well-characterized measure that can be used to define underlying genetics and physiology in the animal system, from a systems biology perspective, that can then be used to make genetic and managemental improvement in animal and poultry production.

Paul Lewis (West Virginia University) – Addressed the question of what ARS should be doing in the area of transgenic research. ARS needs to do the fundamental transgenic animal research (discovery focus). This was the same input consistently received from all of the workshop breakout sessions. The emphasis should not be on producing transgenic animals and poultry for commercialization in to the food animal industries, basic research to develop transgenic animals (and methodology thereof) needs to be pursued (eg. of application being pharmaceutical production). (This statement was reinforced later in the discussion by Mark Boggess from the National Pork Board).

Joe Fontenot (Virginia Tech) – Stated that there is a general lack of information on rumen microbes because of inadequate number of trained scientists in rumen microbiology. The

same problem was echoed throughout the workshop in the areas of quantitative genetics and ethology.

Jeff Carroll (ARS, Lubbock) – Raised concern that the definition of animal well-being seems to be unclear to the industries and to the research communities. The response of industry is that they know that research work in animal well-being needs to be conducted to address growing consumer concerns, but, at the same time they only want the work done within the context of current production systems.

Paul Weimer (ARS, Madison) – Pointed out that there are currently only 1.3 SY in rumen microbiology in all of ARS. This deficiency will need to be addressed if the needs as expressed at the workshop are to be adequately addressed in the next 5 years.

John McGlone (Texas Tech University) -- Need national animal production training grants in CSREES in critical expertise areas. They were reiterated as quantitative genetics, rumen microbiology, ethology/animal behavior.

Duane Norman (ARS, Beltsville) – A lot of points were raised at the workshop regarding reduction of stress in production in environments. He asked the question of what is the phenotype (s) needed to address these issue?

Mary Beth Hall (ARS, Madison) – Made a plea for uniformity of measures and application across species to provide consistency in so much as possible.

Bill Tucker (Producer, VA and Legislative Affairs Director, AFGC) -- Need scientific support of community, work as a community and respond to negative press on a number of the important issues facing animal agriculture.

Kevin Vinchlatte (Iowa Poultry Association) -- Pointed out that he would have liked to see a higher ratio of stakeholders to federal employees at the workshop. He suggested that there be more dialogue with the various commodity groups prior to the meeting to gain input for priorities (Added by Green -- this is done on a routine basis with most of the commodity groups). Also stated that he thought that the species groups needed more time to give complete input.

Chuck Sattler (Select Sires) -- Need to set goals on components of longevity. Maybe slow to see advances because of the complexities of this type of trait and getting it measured accurately. Genetic and management system/housing aspects add further cloudiness to the issue.

Terry Swecker (Virginia Tech) – Stated that he does not think that producers benefit from production efficiency research as the benefits most often accrue to the consumer in lower cost of the product. He sees a need for greater research emphasis on adding value to the animal and poultry products to overcome this issue. (Later comment by Bill Tucker of AFGC reiterated this point).

Fields Gunsett (Newsham Hybrid Swine) – Need bricks and mortar facilities to carry-out relevant research along the lines that were proposed at the workshop (i.e. centralized animal and DNA resource populations with public domain databases for genotype and phenotype information). Asked the question of how can the stakeholders help in this process (i.e. is it a budget reallocation process or a "new funding required" issue?). Answer given by Green was that the industry constituencies will need to support development of new funds to make this happen, while there may be some redirection it is a bigger issue than can be handled solely with existing funding.

John McGlone (Texas Tech) -- USA needs to participate in OIE standardization of animal welfare measures and standards of care/management of food animals. Brazil is already on board and actively involved.

Wilda Martinez (ARS, North Atlantic Area) – Stated that the stakeholders need to understand that of the $230M expected to be expended in ARS research in animal production and well-being over the coming five years (assuming a flat budget), a substantial portion of this total is in overhead to maintain and operate facilities.

Altfrid Krusenbaum (Dairy Grazier, Wisconsin) – Stated that the grazing dairy industry is a growing segment and that more attention is needed to research needs in this sector. Some management aspects on supplementing pasture and spring calving were identified as specific examples.

Janice Siegford (Michigan State University) -- Commented on student interest in pet and recreational animals and not in food animal industries.

Terry Nelsen (ARS, Midwest Area) -- Scientific societies have a role in standardization of methods and measure as well as management practices (eg. animal well-being).