

## **HIGH PRORITY RESEARCH AREAS UNDER DIFFERENT THEMES-2009**

High Priority research areas on which researchers can bid for their proposals of both crop and livestock sectors are listed in order of priority under each Theme. All proposals will compete separately at the theme level. The relative importance of the themes is indicated in percentage terms in the parentheses. Letter “A” denotes Crop Sector, “B” denotes Livestock Sector and “AB” denote both Crop and Livestock Sectors.

Before preparing the research proposal to submit to PARB for funding, please note that:

Only **Applied Research** projects are accepted in PARB. We define applied research where certain machines or chemicals are modified, germplasm is improved or varieties are developed, processes are modified or improved, pests control is developed, standards are developed, or information is generated for the immediate use under the Punjab conditions by our stakeholders.

We don't accept **Development** projects. We define development projects where already developed technology, such as machine, chemical, variety, process, standards, information, etc. is proposed to be promoted to the stakeholders.

## **Theme-1: Enhancing Productivity on Sustainable Basis of Major Farming Systems (35%)**

### **A. Crop Sector**

#### **Sub-theme 1A.1: Rice-wheat System**

- 1A.1.1 Improve productivity of the rice-wheat system by identifying gene sources, developing transgenic, and open pollinated cultivars to enhance yield potential and to control wheat diseases including karnal bunt & rusts and bacterial leaf blight in rice
- 1A.1.2. Reduce time conflict between rice & wheat by developing early maturing Basmati varieties, and management practices.
- 1A.1.3. Improve salt tolerance in rice and wheat
- 1A.1.4. Improve sustainability of the rice-wheat system through crop rotation.
- 1A.1.5. Develop economically viable labour saving technologies for rice and wheat

#### **Sub-theme 1A.2: Cotton-wheat System**

- 1A.2.1. Improve productivity of the cotton-wheat system by identifying gene sources, developing transgenic, and open pollinated cultivars to enhance yield potential and to control/manage rusts, karnal bunt, , and high temperature at maturity in wheat and Cotton Leaf Curl Virus disease, bollworms, & mealybug in cotton
- 1A.2.2. Reduce time conflict between cotton & wheat by developing early maturing cotton varieties, and management practices.
- 1A.2.3 Improve sustainability of the cotton-wheat system through developing early maturing cotton varieties, and management practices.

#### **Sub-theme 1A.3: Mixed-cropping System**

- 1A.3.1. Develop high yielding varieties of sugarcane having high sucrose and good ratooning
- 1A.3.2. Develop appropriate management practices for weed control in sugarcane and maize
- 1A.3.3. Develop genotypes of wheat and sugarcane tolerant to salinity and sodicity
- 1A.3.4. Improve productivity in maize by developing high-yielding hybrids with heat & drought tolerance
- 1A.3.5. Develop appropriate and economically viable labour saving technologies in sugarcane and maize
- 1A.3.6. High yield/multi-cut and improved quality fodder for summer under irrigated environment

### **Sub-theme 1A.4: Low-input Intensity and Rainfed System**

- 1A.4.1. Develop high-yielding, and low input responsive varieties of wheat and maize
- 1A.4.2. Develop high-yielding, disease resistant, (blight in chickpea and lentil and wilt in chickpea, yellow mosaic virus in mungbean) varieties of Pulses
- 1A.4.3. Developing high yielding, drought tolerant, low input responsive and herbicide resistant groundnut varieties
- 1A.4.4. Develop high-yielding varieties of sorghum and millet
- 1A.4.5. Crop rotation research for rainfed areas
- 1A.4.6. High yield/ multi-cut and improved quality fodder
- 1A.4.7. Protocol for establishment of certified mother plants of fruits (Olive, Peaches, Grapes, Stone fruits, etc)
- 1A.4.8. Fodder preservation techniques like hay, silage, etc.
- 1A.4.9. Research on forages fortification for better production
- 1A.4.10. Develop economically viable labour saving technologies for groundnut and wheat

### **Sub-theme 1A.5: Peri-urban production system**

1A.5.1 Develop high yielding vegetables hybrids/varieties (especially in tomatoes, potatoes and chillies) tolerant to heat and frost

1A.5.2. Integrated pests control methods including resistant varieties for vegetables grown in peri-urban areas especially in:

<b>Crop</b>	<b>Insects</b>	<b>Diseases</b>
Potatoes	Mites, whitefly, jassid, armyworm, aphids	Viruses, lateblight, Rhizoctonia, common scab, Fusarium wilt, Mycoplasma
Onions	Thrips	Downy mildew, purple blotch
Cucurbits	Red pumpkin beetle, fruit fly	Powdery and downy mildews, anthracnose, wilt
Peas	-	Wilt and powdery mildew
Chillies	Helicoverpa, sucking pests	Root and collar rot, viruses
Tomatoes	Helicoverpa, sucking pests	Phytophthora blight, viruses, wilt
Okra	<i>Earis sp.</i> Sucking pests, shoot borer	Wilt, viruses, <i>Meloidogyne sp</i>
Brinjal	Fruit and shoot borer, sucking pests, red mites	Root and collar rot, <i>Meloidogyne sp.</i> Leaf spots
Bittergourd	Fruit fly	Myrothecium leaf spot and seed borne diseases
Cabbage	Cabbage top borer, armyworm, cabbage butterfly and semi looper	Cabbage stem and head rot, downy mildew

1A.5.3. Develop suitable technologies for enhancing food quality and reducing seasonality through tunnel and green house cultivation

1A.5.4. Documenting food quality such as pesticide(s) residue, heavy metal contamination and mycotoxins in major fruits and vegetables, and develop remedial technologies and measures.

1A.5.5. Develop technologies for safe use of sewerage water and biosolids

## **B. Livestock Sector**

### **Sub-theme-1B.1. Productivity enhancement of Milk in large ruminants**

- 1B.1.1. Development of cost effective, good quality feed/total mix ration, and feed supplements
- 1B.1.2. Determination of nutritional requirements at different physiological stages
- 1B.1.3. Development of management and nutrition schemes and other measures for the purpose of
  - Reduction in puberty age of animals
  - Reducing inter-calving interval
  - Increasing production life of dairy animals
  - Reduction of disease(s) incidence
  - Reduction in birth related problems
- 1B.1.4. Epidemiology and control of important diseases especially Foot and Mouth Disease, Haemorrhagic septicemia, Black quarter, Mastitis, Brucellosis, Endo and Ecto-parasites, Hemo-parasites etc.
- 1B.1.5. Development and improvement of semen preservation techniques
- 1B.1.6. Hormonal management and manipulation of summer (low productivity period) oestrus especially in buffalo through, nutrition, management, etc.
- 1B.1.7. Research on determination of timing of ovulation and optimal timing of insemination to increase conception rate
- 1B.1.8. Determination of better techniques for determination of heat period especially in buffalo to increase production
- 1B.1.9. Development of effective control of Protozoa diseases causing abortions and reproductive problems especially in cow using breeding, reproductive, nutrition, or management approaches
- 1B.1.10. Development of milk replacers and early weaning diets for calves
- 1B.1.11. Studies on the cause and control/management of early calf mortality
- 1B.1.12. Selection and characterization of different breeds of camel for milk

### **Sub-theme-1B.2. Productivity enhancement of meat in large ruminants**

- 1B.2.1. Development of cost effective, balanced, and good quality feed/ Total Mix Ration, and feed supplements for fattening

1B.2.2. Studies on identification of appropriate age of calves of buffalo and cattle for optimum beef production under different plans of nutrition

1B.2.3. Research on growth hormones/enzymes for better growth and fattening of animals

1B.2.4. Development of better specific breeds for meat

### **Sub-theme-1B.3. Productivity enhancement in small ruminants**

1B.3.1. Improving the productivity and reducing the cost of rearing of small ruminant by:

- Specifying feeding requirements for enhanced meat and milk (specially in goat) production
- Specifying appropriate mineral requirements and feed supplements for grazing animals
- Identifying optimum age for optimum meat production
- Identifying cost-effective non-conventional feeds

1B.3.2. Control of following diseases through balanced nutrition, appropriate management practices, and/or developing appropriate breed

- Enterotoxaemia
- Contagious caprine pulmo-pneumonia
- Sheep pox
- Parasites associated with grazing

1B.3.3. Research on increasing fecundity of goat and sheep through different techniques like balanced nutrition, appropriate management practices and/or improving/developing better breeds etc.

1B.3.4. Research on control of early mortality of lambs/kids by using balanced nutrition and control of diseases

1B.3.5. Grazing/pastures management for better production

## **Theme-2: Promoting Diversification and Commercialization in Agriculture (15%)**

### **A. Crop Sector**

#### **Sub-theme- 2A.1: Improving Profitability of Horticultural and Medicinal Plants**

2A.1.1. Develop improved propagation techniques especially through tissue culture in fruits (datepalm, mango (for rootstock), guava,), and floriculture crops (bulb plants, foliage plants) for mass multiplication to improve nursery/ seedling plants quality

- 2A.1.2. Control of decline and sudden death in citrus, mango and guava
- 2A.1.3. Control of economic pests in horticulture crops (especially in citrus, guava, mango, datepalm, and lichi)
- 2A.1.4. Identifying appropriate integrated pest management (IPM) approaches to reduce production cost, protect environment, improve product quality, and protect environment especially in important fruits and vegetables of the Punjab
- 2A.1.5. Identification of indigenous vegetables germplasm especially in tomatoes, potatoes, chillies, and cucurbits to enhance productivity, improve nutrient contents, enhance consumer acceptability and create tolerance to biotic and abiotic stresses
- 2A.1.6. Develop suitable, economically viable, and socially acceptable machines for mechanical planting, pruning and harvesting of fruits and vegetables.
- 2A.1.7. Identification of water saving practices and technologies, and disease free seeds and seedling for important horticultural crops.
- 2A.1.8. Development of appropriate management practices for increasing fertilizer and pesticide use efficiency
- 2A.1.9. Control of fruit drop in horticultural crops especially in citrus and mango
- 2A.1.10. Identification of appropriate intercropping systems for young orchards
- 2A.1.11. Identification of high value medicinal plants and develop appropriate production technology suitable for commercialized local production

**Sub-theme 2A.2: Improvement in Productivity of Pulses in irrigated areas**

- 2A.2.1. Improve the responsiveness of pulses to different inputs, especially water and fertilizers so that they can be grown in the intensive cultivation systems
- 2A.2.2. Improve productivity of major pulses (gram, lentil, mungbean, urdbean) in irrigated areas by developing high yielding varieties and develop resistance against following diseases and insects.

<b>Crop</b>	<b>Insects</b>	<b>Diseases</b>
Gram	Cut worm, pod borer, armyworm,	Blight, wilt, root rot,
Lentil	Cut worm, pod borer	Blight, wilt, root rot, grey mold, rust
Mungbeans	Asponella bug, stored grain pests	Cercospora leaf spot, mungbean yellow mosaic virus
Urdbean/Black gram	Army worm	Urdbean leaf crinkle virus, mungbean yellow mosaic virus

### **Sub-theme 2A.3: Improvement in profitability of commercial crops**

- 2A.3.1. Improve the competitiveness of sugarbeet as a sugar crop by developing appropriate varieties, production technologies and harvesting & processing machines
- 2A.3.2. Improve the competitiveness of sunflower, sesame, linseed, castor and canola by developing high-yielding hybrids/ varieties with better oil contents and quality.

### **Sub-theme 2A.4: Mechanization for diversification, enhance efficiency, and commercialization**

- 2A.4.1. Exact technologies for precision agriculture
- 2A.4.2. Develop economically viable seed drills/planters, harvesting, threshing and processing machines especially for pulses and oilseeds
- 2A.4.3. Develop economically viable and socially acceptable machines for fodder harvesting, mechanical transplanting for vegetables and rapeseed swath and pickup header

## **B. Livestock sector**

### **Sub-theme 2B.1. Promoting Diversification and Commercialization in livestock**

- 2B.1.1. Development of cost effective quality feed by exploring different local conventional and non-conventional feeding sources, and standardization of feeding requirements for various commercial and backyard poultry breeds, especially for different:
- age, sex and stage of production
  - season and eco-region,
  - open and controlled houses environment
- 2B.1.2. Development of cost effective control and vaccines of the prevalent and new emerging diseases including Bird flu/ Avian influenza, Infectious Bursal Disease, New Castle Disease, Mycoplasma and Salmonella
- 2B.1.3. Control of metabolic disorders by using nutritional, and management approaches
- 2B.1.4. Development of suitable breeds for backyard poultry under local conditions, and development of optimum management (including shed and space requirements) and nutritional practices for the existing and new breed in different eco-regions to enhance poultry production efficiency
- 2B.1.5. Identification of growth promoters for enhanced production
- 2B.1.6. Development of cost effective aqua/fish feed both of floating and sinking types



2B.1.7. Control of fish diseases

2B.1.8. Reduce mortality of neonates by improving the survival rate of different hatched fish

2B.1.9. Standardization of culture techniques of *Macrobrachium* (Prawn) under local conditions, as alternate to fish culture especially in brackish areas

2B.1.10. Development and testing of hybrid vigour of different geographical strains of culture-able species of fish for development of better hybrid breeds

2B.1.11. Development of better breeds and management practices for size and productivity of quail

### **Theme-3: Conserving Resources and Protecting Environment (25%)**

#### **A. Crop sector**

##### **Sub-theme 3A.1: Soil, fertilizers, pesticides and land**

3A.1.1. Develop cropping pattern and integrated nutrient management methodologies to decrease nutrient depletion in soil and enhance organic matter contents

3A.1.2. Develop nutrient efficient varieties, especially in wheat, cotton, sugarcane, rice, maize and vegetables

3A.1.3. Improve fertilizers use efficiency through liquid and band placement

3A.1.4. Develop fertilizer use recommendations for different cropping systems

3A.1.5. Develop appropriate technologies to reduce soil erosion, desertification, soil compaction, and salinity & sodicity

3A.1.6. Research on developing efficient methods for composting

3A.1.7. Standardization of spraying techniques

3A.1.8. Developing alternatives of chemicals used in crops and livestock sector for improving health and productivity

3A.1.9. Development and validation of IPM models of different pests in various crops (especially in cotton and vegetables where maximum pesticide is used)

3A.1.10. Develop standards for the use of additives in spray mixtures to reduce pesticide doses

3A.1.11. Develop better land use options for Thal and Cholistan areas (crops, plants, grasses, small ruminant, etc.)

### **Sub-theme 3A.2: Water use Efficiency**

- 3A.2.1. Research on alternatives of flood irrigation at farm level by on farm storage, sprinkler irrigation and trickle irrigation and develop optimum input and management schemes for each
- 3A.2.2. Improve water use efficiency by adapting direct seeding in rice and furrow-bed system in other crops
- 3A.2.3. Develop rain water harvesting and conservation technologies for rainfed and dry regions
- 3A.2.4. Determination of optimum water requirements under alternative irrigation technologies of different crops grown under different soil types in different zones

### **Sub-theme 3AB.3: Environmental Efficiency of Crop and Livestock Production**

- 3AB.3.1. Management of pollinators particularly honeybees for sustainable agriculture crop yields of cross pollinated crops
- 3AB.3.2. Studies on fate and pathway(s) of agrochemicals particularly pesticides in soil, water, and food chain including livestock products and environment
- 3AB.3.3. Documenting the impact of pesticides and livestock production in close proximity of humans on environment including human/animal health.
- 3AB.3.4. Developing technologies for reducing pesticides and heavy metals residues in different food commodities including livestock products
- 3AB.3.5. Technologies for crop and livestock residue management for the conservation/ protection of environment.

## **Theme-4: Improving International Competitiveness through Improved Value Chain and Value Addition (15%)**

### **AB. Crop and Livestock Sectors**

#### **Sub-theme 4AB.1: Linking small farmers with efficient market system and value addition**

- 4B.1.1. Development of starter culture, stabilizers, etc from local sources
- 4AB.1.2. Development of Standards for safe processing of milk, meat (especially for Buffalo and Cattle), and fruits and vegetable products
- 4AB.1.3. Development of processing and preservation techniques for various livestock, cereals, and horticultural products for long life/storage and improved quality.

- 4AB.1.4. Development of new products and by-products from various livestock, cereals, and horticultural commodities
- 4AB.1.5. Documenting contaminants (pesticides, veterinary drugs, toxins, heavy metals, etc) in livestock and horticultural products and develop technologies to reduce the contaminants.
- 4AB.1.6. Analysis of value chain of major fruits (citrus, mango,) vegetables (tomato, onion, garlic, chillies) and livestock products (milk, meat, yogurt, leather) and develop technologies/data to overcome constraints at different food chain level.
- 4AB.1.7. Assess contractual arrangements in different food production and marketing (sugarcane, mango, citrus, certain vegetables, livestock and fisheries products, etc.) and suggest ways to improve these arrangements for the fair share of all parties.
- 4AB.1.8. Development of cheap, good quality packaging material for livestock and horticulture products for increasing their shelf life
- 4AB.1.9. Evaluation of nutraceutical value and development of socially acceptable foods from indigenous vegetables and milk.

**Sub-theme: 4AB.2: Reducing postharvest losses and value-addition**

- 4A.2.1. Develop technologies for enhancing shelf life of fruits (especially in mango, citrus and guava), vegetables (especially in tomatoes, green chillies, okra, cucurbits and spinach), and livestock products (milk, meat).
- 4A.2.2. Development and evaluation of batch and continuous dryers for sunflower, seed cotton, groundnut, corn, paddy, canola etc.
- 4AB.2.3. Develop technologies for harvesting, pre-cooling, handling, storage and transportation of perishables (including livestock products) and grains to reduce postharvest losses
- 4AB.2.4. Develop technologies for home-based and commercial drying (such as solar-cum gas fired dryer), processing and preservation of fruits and vegetables, and livestock products
- 4AB.2.5. Assessment of post-harvest losses in major fruits (especially in guava, mango, citrus, datepalm, melons), major vegetables (especially tomatoes, potatoes, okra, chillies, cucurbits) and livestock products (milk, yougart, meat, etc.) at various market levels, and identify the strategies to control these losses where these as they occur.

### **Sub-theme 4AB.3: Taping new emerging markets**

- 4A.3.1. Develop technologies for economically viable sprout production from different crops like sesame, mungbean etc. for local and export market.
- 4AB.3.2. Study domestic and international markets demand for fruits, vegetables, essential oils, livestock and fisheries products, and develop technologies to meet these demands
- 4AB.3.3. Analysis of value chain of niche products and suggest technological and policy measures to overcome the major constraints for entering into the niche market
- 4AB.3.4. Develop techniques to control sanitary pests in crops and animals
- 4AB.3.5. Develop alternative sustainable and environmentally friendly production and marketing technologies to make organic farming an economically viable option.
- 4AB.3.6. Develop technologies for production of economical bio-fuels

### **Theme-5: Cross Cutting Issues and Knowledge Based Agriculture Policies (10%)**

#### **Sub-theme 5AB.1: Gender, WTO, and Poverty issues**

- 5AB.1.1. Impact of WTO on the structure and performance of agriculture production in Punjab in the short and long run.
- 5AB.1.2. Research on how the WTO can improve comparative advantage to the farmers of the Punjab
- 5AB.1.3. Impact of WTO on the income disparities and gender in agriculture
- 5AB.1.4. Development of agricultural poverty and productivity nexus

#### **Theme 5.2: Development of new research approaches/methodologies**

- 5A.2.1. Research on Ergonomics
- 5B.2.2. Development/improvement of effective, long duration and multiple diseases vaccines of important diseases of animals and poultry
- 5B.2.3. Research on reproductive biotechnologies for *in vitro* fertilization, culture, embryo production and cloning to increase reproduction in animals
- 5B.2.4. Development of suitable hormonal protocols for estrus and ovulation synchronization especially in buffalo for increased reproduction
- 5B.2.5. Genetic characterization of local breeds of different animals for conservation and early identification of better traits

5AB.2.6. Development of new extension methodologies and approaches

5AB.2.7. Use of machine vision and robotics in Agriculture

5AB.2.8. Research on climate change/global warming especially its impact on production of different crops and livestock products in different areas in the short and long run

5AB.2.9. Impact assessment methodologies of different projects

**Sub-theme: 5AB.3: Maintenance / Service Research**

5A.3.1. Monitoring of resistance to pesticide(s) in important pests of major crops

5A.3.2. Control of termites

5A.3.3. Develop appropriate management practices for vertebrate pests

5B.3.4. Studies on the housing and management systems of animals especially for small ruminants and poultry

5AB.3.5. Diagnosis, epidemiology and control of emerging and re-emerging infections/ infestations of livestock and pests of crops

5AB.3.6. Research on emerging sciences like biotechnology, nanotechnology etc for improving productivity in agriculture

5AB.3.7. Research on control and factors affecting mycotxin(s) production, especially aflatoxin in agricultural commodities, animal and poultry feed.

5AB.3.8. DNA marker assisted selection for different traits of crops and animals

5AB.3.9. Studies on the causes and narrowing gaps between the yields of the progressive farmers and the common farmers

5AB.3.10. Impact analysis of cotton, sugarcane, rice, wheat, citrus, mango, and livestock research carried out at Universities and research institutions

5AB.3.11. Studies on hygienic quality of food stuffs at vendor's level

5AB.3.12. Development of low cost diagnostic kits for detection of important diseases of plants, poultry and animals

5AB.3.13. Development/ improvement of assays/techniques for efficient diagnosis of crops, animal, poultry, and fish diseases