

# Title of Technology: Anaaji Drum-Hermatic Commodity Storage Container

## Hermetic Technology



Anaaji bag  
(50 kg)



Anaaji drum  
(160 L)

## Options for measuring RH



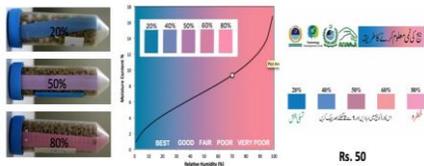
Rs. 500



Rs. 1,000



Rs. 100,000



Rs. 50

## Challenges/issues

- Food supplies are limited in developing countries by both yield gaps and postharvest losses. Reducing wastage can improve food quality, safety and security, as up to one-third of food produced is lost after harvest.
- The primary cause of such losses is poor storage conditions, especially high moisture contents (MC) that promote mold and insect damage. In autumn season, open-air drying is unable to reduce commodity MC to safe levels that prevent fungal growth.
- Even when harvest occurs in dry seasons and the commodities can be dried to low MC, they are predominantly stored in porous (e.g., jute or woven) bags, allowing increases in MC during monsoon seasons and enabling product spoilage.

## Interventions/Technology Brief

- Dry Chain Technology is the drying of seeds and grains at appropriate moisture contents whether through natural or artificial means after harvest followed by hermetic packaging to make the product dry and keep it dry until used in the value chain.
- While this relatively simple procedure would largely prevent or mitigate postharvest losses of dry commodities. In dry areas and seasons, seeds can be dried in the field and packaged in hermetic bags to prevent moisture absorption during high humidity periods particularly in monsoon season.
- This pesticide-free organic storage monitors seed moisture contents and does not require any equipment or energy input and preserves the quality and germination capacity of stored grains, oilseeds and pulses.
- The use of modern hermetic storage technologies is limited in Pakistan. These storage methods preserve grain in a flexible system and create unfavourable conditions for pests and fungus development.

## Outcomes/input

- Cost effective hermetic Anaaji bags and drums are developed locally which are very effective for cereals, oilseeds and pulses storage without compromising seed and grain qualities.
- “Anaaji Drum” is hermetically sealed plastic drum having 160 L capacity that can prevent both moisture and oxygen penetration into seeds and thus reduced the storage losses.
- Hygrometer is attached with this drum, which monitors

	<p>moisture contents of seeds indirectly by measuring equilibrium relative humidity inside the drum.</p> <ul style="list-style-type: none"> <li>• “Anaaji bag” is an improved multilayer hermetic grain storage technology, which requires no fumigation or chemical application that preserves quality and germination capacity of stored seeds.</li> <li>• A humidicator strip is developed to monitor relative humidity of product. The color of strip turns blue in dry seed and red in wet seed. It can store grains and pulses for over a year without gain or loss in moisture, insect pest infestation and fungal growth.</li> <li>• A license agreement with a private company has been signed and this technology being promoted in South Punjab and Sindh with the collaboration of leading NGOs in Pakistan</li> </ul>
	<p><b>Way Forward/Future Strategy</b></p> <ul style="list-style-type: none"> <li>• As seeds and cereal grains are stored similarly by smallholders, expanded use of these technologies will improve dry product quality in Pakistan for both domestic consumption and export.</li> <li>• Access, cost and affordability of technology is the only solution for sustainable development of product. These technologies are being promoted to smallholder farmers, national seed companies and research institutions.</li> </ul>
<p>Contributor Name:</p> <ul style="list-style-type: none"> <li>• Dr Irfan Afzal, Associate Professor, Department of Agronomy, UAF</li> </ul>	<p><b>Industry:</b></p> <p>Annaji, Islamabad</p>

Title of Technology:

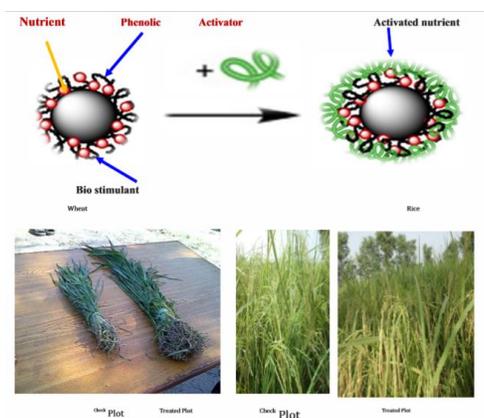
Biostimulant Based Liquid Fertilizer

**Challenge/ Issues**

- Nutrient deficiencies and nutrient imbalances occur due to low organic matter and alkaline calcareous nature of Pakistani soils.
- These factors reduce availability of nutrients in soil, which results in low use efficiency of applied fertilizers and reduction in crop yields. The situation demands to develop innovative fertilizer product decorated with some nutrient activators to keep nutrient available

**Interventions/ Technology Brief**

- A phenolic and activator based liquid fertilizer containing 8-8-15% NPK has been developed.
- It works as a fertilizer supplement and improves efficiency of soil applied fertilizers.
- When this product is supplemented with soil applied fertilizers, it not only keeps nutrients in available form for longer periods but also makes easy access of plant roots for absorption.
- Three liters of liquid fertilizer are applied with one irrigation and two applications are done one month after the first application.



**Outcomes/ Input**

- Two applications are sufficient for wheat, rice, maize and vegetable crops while for sugarcane and orchards, three applications are recommended.
- Activator Application of this fertilizer with recommended rates of fertilizers boosts up the crop yield up to 30% by improving tillering, seed setting and providing protection against most of the biotic (some soil borne diseases & insect attacks) and a-biotic stresses (temperature and moisture stresses)

**Way Forward/ Future Strategy**

- The product is getting attention of farmers of the Punjab, Sindh and KPK. The product is sold by Patron Chemicals Multan

Contributor Name: -

Prof. Dr. Muhammad Yaseen

Soil Fertility and Plant Nutrition,  
Institute of Soil & Environmental  
Sciences, University of Agriculture,  
Faisalabad

**Industry:**

Patron Chemicals Multan

Title of Technology:

Uni-Micropower

	<p><b>Challenge/ Issues</b></p> <ul style="list-style-type: none"> <li>• Micronutrients play an active role in the plant metabolic processes. Decrease in availability of micronutrients in soils and their limited uptake by plants due to alkaline and calcareous soil nature has widened the gap between potential yield and average farmer's obtained yield of a crop.</li> </ul>
	<p><b>Interventions/ Technology Brief</b></p> <ul style="list-style-type: none"> <li>• To narrow down this gap, foliar feeding of micronutrients emerged as an innovative technology as it can be 10 to 20 times more efficient than soil application. However, this efficiency is not always achieved in actual practice due to unfavorable weather and improper formulation and application techniques.</li> <li>• Therefore, judging what foliar material to apply, when to apply and how to apply are important principles to make best use of this technique. The addition of bio-stimulant to micronutrients formulation is effective to maximize feeding efficiency of foliar spray.</li> <li>• Demonstration trials were extensively conducted on farmer's fields of nine villages at Toba Tek Singh. Foliar feeding was supplemented with farmer's soil applied fertilizers which was taken as control. Multinutrients foliar feeding spray contained 4.7% Zn, 2% Fe, 1% B, 2% Mn and 0.3% Cu amended with one bio-stimulant and surfactant</li> </ul>
	<p><b>Outcomes/ Input</b></p> <ul style="list-style-type: none"> <li>• This spray was applied at rate of 500, 1000 and 1500 mL per acre in splits on wheat and cotton crops without disturbing farmer's followed agronomic practices.</li> <li>• Comparative results on growth parameters of wheat and cotton between sprayed and unsprayed plots were shown to mass gatherings of farmers and surrounding areas by holding farmer's field days.</li> <li>• The product was registered as Uni-Micropower.</li> </ul>
<p><b>Contributor Name:-</b></p> <ul style="list-style-type: none"> <li>• Prof. Dr. Muhammad Yaseen, Soil Fertility and Plant Nutrition, Institute of Soil &amp; Environmental Sciences, University of Agriculture, Faisalabad</li> </ul>	<p><b>Way Forward/ Future Strategy</b></p> <p><b>Industry:</b></p> <p>HR Chemicals Pvt Ltd Multan</p>

Title of Technology: PB-896- A Promising Cotton Line at Final Stage of Approval as Variety

	<p><b>Challenge/ Issues</b></p> <ul style="list-style-type: none"> <li>Keeping in view the importance of cotton in economy of the country, Cotton Research Group in the Department of Plant Breeding and Genetics is maintaining and developing new germplasm having more ginning turnout, good fiber quality traits, and tolerant to biotic and abiotic stresses.</li> </ul>
	<p><b>Interventions/ Technology Brief</b></p> <ul style="list-style-type: none"> <li>Under the current scenario of climate change, cotton research team has developed an elite line PB-896 that showed overwhelming performance and secured top position among non-<i>Bt</i> group in National Coordinated Varietal Trials (NCVT)- 2015-16 in Punjab province, conducted by Pakistan Central Cotton Committee (PCCC) at various research institutes/centers.</li> <li>This bulk is developed by hybridization of local and exotic genotypes available in the germplasm available with group. The bulk has produced 39% higher production than CIM-573 (standard) even though cotton situation was poor during this cropping season in Pakistan.</li> <li>This strain has potential of 3000 to 3500 kg/ha. It has 40% GOT and 30 mm staple length. Because of high GOT and staple length it would also be preferred by cotton ginner as well as textile industrialists. This elite line has good tolerance against cotton leaf curl disease which is one of the factors for reducing yield in Indo-Pak continent.</li> </ul>
	<p><b>Outcomes/ Input</b></p> <ul style="list-style-type: none"> <li>PB-896 addresses the issues in an excellent manner because it possesses hairiness traits which protect from infestation of sucking insects i.e. whitey and aphids. In near future, there will be shortage of female pickers in cotton growing areas of Pakistan.</li> <li>To overcome this up-coming problem, PB-896 is suitable for mechanical picking due to its semi-erect plant shape uniform boll opening.</li> <li>In next year cotton season, the potential of PB-896 will be explored by using various agronomic practices with collaboration of Department of Agronomy, UAF</li> </ul>
	<p><b>Way Forward/ Future Strategy</b></p> <ul style="list-style-type: none"> <li>This line can tolerate heat and water stress; therefore, it has potential to boost production in different agro-ecological zones of Punjab.</li> <li>Therefore, it is believed that it would be approved as commercial variety by the Government of the Punjab.</li> </ul>
<p>Contributor Name:-</p> <ul style="list-style-type: none"> <li>Dr. Iftikhar Ahmad Khan,</li> <li>Dr. Faqir Muhammad Azhar,</li> <li>Prof. Dr. Hafeez Ahmad Sadaqat,</li> <li>Dr. Tanwir Ahmad Malik,</li> <li>Dr. Tariq Manzoor Khan,</li> <li>Dr. Masooma Naseer Cheema</li> <li>Muhammad Tehseen Azhar Department of Plant Breeding and Genetics, UAF</li> </ul>	<p><b>Industry:</b> National Seed Company</p>

Title of Technology: Solar Milk Chiller

	<p><b>Challenge/ Issues</b></p> <ul style="list-style-type: none"> <li>• Pakistan is the 4<sup>th</sup> largest milk producing country in the world (34 million tons annually) while the larger proportion of producers are small scale farmers (&gt;80%). Unfortunately, only 5% of this milk is processed while other is handled by Milkman which is mostly unhygienic at high health risks especially for the infants.</li> <li>• Moreover, the farming community do not get proper price for milk due to non-availability of processing facilities at farm level. The pasteurized milk can be preserved for longer shelf life thus increasing its shelf life and marketability</li> </ul>
	<p><b>Interventions/ Technology Brief</b></p> <ul style="list-style-type: none"> <li>• The promotion of small-scale agro-based industries for value addition and income generation using innovative solar technologies can become a multiplier in rural development.</li> <li>• An energy efficient solar milk chiller has been developed as a part of research and demand of the livestock department of the Government of Punjab as well as the farming community who wish to process and store milk in the chilled form.</li> </ul>
	<p><b>Outcomes/ Input</b></p> <ul style="list-style-type: none"> <li>• The milk processing is a rapid growing business but high energy running cost is a serious problem.</li> <li>• With solar based technology milk is chilled with cheapest source of energy which is solar energy available in Pakistan for more than 300 sunny days in a year.</li> </ul>
	<p><b>Way Forward/ Future Strategy</b></p> <ul style="list-style-type: none"> <li>• Solar energy is the medium of energy production for this technology and the milk is cooled down to 4°C in the chiller within two hours (standard time by WHO).</li> </ul>
<p>Contributor Name:-</p> <ul style="list-style-type: none"> <li>• Dr. Anjum Munir,</li> <li>• Khawar Saeed Khan</li> <li>• Dr. Abdul Ghafoor, Department of Energy Systems Engineering, UAF Department of Farm Machinery &amp; Power, UAF</li> </ul>	<p><b>Industry:</b></p> <p>PAMICO Pvt. Ltd Company</p>

Title of Technology:

Solar Distillation System



### Challenge/ Issues

- The promotion of small scale agro-based industries by using innovative solar collectors can open new opportunities in rural development.
- Essential oils extraction from medicinal and aromatic plants is one of the medium temperature agro-based industries.
- These oils are used for medicinal and pharmaceutical purposes, food and food ingredients, herbal tea, cosmetics, perfumery, aromatherapy, pest, and disease control, dying in textiles, gelling agents, plant growth regulators and paper making. Essential oils are extracted from various parts of the plant like leaves, roots, wood, bark, seeds/fruits, owners, buds, branches, twigs.

### Interventions/ Technology Brief

- Out of all extraction methods, the distillation methods have advantages of extracting pure and refined essential oils by evaporating the volatile essence of the plant material.
- At present, there are large and centralized distillation units mostly located in city areas.
- Due to their high operating costs, these are, sometimes, unmanageable by farmers or even groups of farmers in most of the developing countries. Further, some essential oils come from extremely delicate owners and leaves that must be processed soon after harvesting.

### Outcomes/ Input

- The solar distillation system was designed as a fixed installation of Scheffler reflector (10m<sup>2</sup> surface area) and all parts of the reflector stand were fabricated and assembled at University of Agriculture, Faisalabad, Pakistan.
- The Scheffler concentrator is a lateral part of a paraboloid and does not require any manual tracking during the whole day once it is set. Further, it provides a fixed focus for all the days of the year which can be best utilized during different distillation experiments.
- The solar distillation system comprises a primary reflector, secondary reflector, photovoltaic tracking system, distillation still, condenser, Florentine vessels.

### Way Forward/ Future Strategy

- The on-farm solar distillation is a decentralized approach to reduce the post-harvest losses and to prevent spoilage of essential oil components by processing the fresh medicinal plants

Contributor Name:-

- Dr. Anjum Munir,
- Arslan Afzal, Department of Energy Systems Engineering, & Department of Farm Machinery & Power, UAF

**Industry:**

PAMICO Industries

Title of Technology:

Solar Dehydrator



**Challenge/ Issues**

- Drying is a complex and energy intensive process used for the preservation of food material.
- Due to the increasing cost of electricity and fossil fuels, application of solar energy for drying of various agricultural products has become the need of the time.
- It is not only economical but also ceases the gas emissions. By solar drying, huge amount of national revenue can be saved by avoiding the spoilage of agricultural products due to non-availability of conventional processing facilities

**Interventions/ Technology Brief**

- Keeping in view the energy crises and small farming community a new solar tunnel dryer (STD) has been designed and developed at University of Agriculture Faisalabad to meet the drying needs of small farmers and small co-operatives.
- Instead of forcing the air through the depth of product, it is just directed over the product spread in a thin layer.
- The distinct feature of this dryer is the use of glass windows instead of plastic material (polythene dryer) which become fade due to dust and temperature creating hurdle for the transmitting of sun rays into the collector and drying chamber. The glass can easily be washed in case of dust problems.

**Outcomes/ Input**

**Way Forward/ Future Strategy**

Contributor Name:-

- Dr. Anjum Munir ,
- Dr. Abdul Ghafoor
- Dr. Waseem Amjad, Department of Energy Systems Engineering, & Department of Farm Machinery & Power, University of Agriculture, Faisalabad

**Industry:**

Power Pack Pvt Ltd

Title of Technology:

Zone Disk Tiller

	<b>Challenge/ Issues</b> <ul style="list-style-type: none"><li>• For successful adoption of till plant technology in rice-wheat rotation system and to avoid the delay in wheat sowing, a technically and economically acceptable tractor drawn Power Take Off (PTO) driven “Zone Disk Tiller Drill”(ZDTD) has been designed, developed, fabricated, and tested for sowing wheat in standing paddy crop residue fields directly after harvesting paddy crop.</li></ul>
	<b>Interventions/ Technology Brief</b> <ul style="list-style-type: none"><li>• The extensive experiments were conducted in the untilled paddy fields of Sheikhpura (Mananwala) and Faisalabad (Jaranwala, University of Agri. FSD.) during the wheat growing seasons of 1998 to 2012.</li><li>• The crop was planted successfully in 9”rows by seven wavy coulters revolving at 172 RPM mounted on a common shaft ahead of the furrow openers.</li></ul>
	<b>Outcomes/ Input</b> <ul style="list-style-type: none"><li>• The machine is one of its own kinds in the world. The savings in diesel energy, labor, and irrigation water were found 75%, 50% &amp; 30%, respectively, as compared with conventional method of wheat planting in Pakistan. Moreover, 14-15% yield was increased in this new system of crop planting.</li></ul>
	<b>Way Forward/ Future Strategy</b> <ul style="list-style-type: none"><li>• This machine can be used for planting maize, barley, and grams. Moreover, an extra shaft can be developed to use this machine as a rotavator if needed.</li></ul>
<b>Contributor Name:</b> - <ul style="list-style-type: none"><li>• Prof. Dr. Muhammad Iqbal Department of Farm Machinery and Power, University Agriculture, Faisalabad</li></ul>	<b>Industry:</b> Noorani Industries, Faisalabad

Title of Technology:

Sisal Decorticator

 <p>Sisal Decorticating Machine</p> <p>Sisal Fibres</p>	<p><b>Challenge/ Issues</b></p> <ul style="list-style-type: none"><li>• Sisal fiber is extracted from the leaves of <i>Agave sisalana</i> that is the Mexican plant and is now mainly cultivated in Tanzania, Brazil, Indonesia and India.</li><li>• Sisal plant is present in Pakistan and can be grown in the country due to its xerophytic nature. Due to its strength and durability, it is placed in the category of “hard fibers”. Sisal fibers have the ability to be utilized into simpler end uses like twines, ropes and other packing materials, sisal fabrics, buffs, mats, carpets, filters and handicrafts. Moreover, specialized high value end uses include geo-textiles and fiber reinforced composites. However, in the presence of the sisal fiber s in the country and also having the potential of being grown at vast areas, the country is lacking in the sisal processing machinery.</li></ul> <p><b>Interventions/ Technology Brief</b></p> <ul style="list-style-type: none"><li>• Sisal fiber decorticator has been designed and developed in the Department of Fibre.</li><li>• The developed decorticator machine is smarter than the other internationally available machines.</li><li>• The decortication machine has been developed on the basis of respaidor design.</li><li>• The sisal leaves one subjected to the action of blunt knives attached to a fast moving cylinder and feed plates.</li><li>• This action eliminates the green matter from the leaves and the fiber are decorticated.</li></ul> <p><b>Outcomes/ Input</b></p> <ul style="list-style-type: none"><li>• The Decortications action is more effective due to the special design of decortivating cylinder and knife. Hence, fiber come out clean and are almost free of green matter.</li></ul> <p><b>Way Forward/ Future Strategy</b></p>
<p><b>Contributor Name:-</b></p> <ul style="list-style-type: none"><li>• Dr. Assad Farooq, Department of Fibre and Textile Technology, University of Agriculture, Faisalabad</li></ul>	<p><b>Industry:</b></p> <p>Jute Industry Pvt Ltd</p>

Title of Technology: UniGold-A Naked Neck Poultry Breed

	<p><b>Challenge/ Issues</b></p> <ul style="list-style-type: none"> <li>• In Pakistan, poor production potential of local/rural poultry breeds make them less profitable but still they have their cultural importance especially in case of Aseel breed which is mainly raised for cock fighting.</li> <li>• Local chicken breeds are the only birds which are being raised and utilized by poor and landless farmers in villages.</li> <li>• Desi hens are found in every village of Pakistan but facing threats from exotic breeds by being replaced progressively by crossbreds of Fayoumi and Rhode Island Red which are disseminated by Poultry Production Department.</li> <li>• These birds are being produced by using two exotic parent breeds. Therefore, need was felt to develop our own local breed that can perform better under village conditions and could be propagated locally to save cost of import of exotic germplasm.</li> </ul>
	<p><b>Interventions/ Technology Brief</b></p> <ul style="list-style-type: none"> <li>• Development of UniGold Rural UniGold is a newly developed egg laying breed for backyard poultry production.</li> <li>• Breed has been developed at University of Agriculture Faisalabad with the help of funds from Punjab Agriculture Research Board (PARB). Locally available indigenous and adapted breeds have been used to have barring as the main color.</li> <li>• Two strains (full neck and naked neck) have been developed and tested for their performance under low to medium input systems in central and southern Punjab.</li> </ul>
	<p><b>Outcomes/ Input</b></p> <ul style="list-style-type: none"> <li>• Breed has capacity to produce as high as 210 colored eggs with average weight of 50g as reported by Poultry Research Institute of Government of Punjab</li> </ul>
	<p><b>Way Forward/ Future Strategy</b></p> <ul style="list-style-type: none"> <li>• Upscaling of the breed is expected through an Indigenous Chicken Research and Development Centre being anticipated to be erected at UAF in the near future.</li> </ul>
<p><b>Contributor Name:</b> -</p> <ul style="list-style-type: none"> <li>• Prof. Dr. Muhammad Sajjad Khan, Institute of Animal Sciences, University of Agriculture, Faisalabad</li> </ul>	<p><b>Industry:</b></p> <p>Poultry Sector Pvt Ltd</p>

Title of Technology: Mastitis Diagnostic Kit / Mastitis Vaccine

 	<p><b>Challenge/ Issues</b></p> <ul style="list-style-type: none"> <li>• At least 20% cows and buffaloes in Pakistan produce unwholesome milk because of mastitis (inflammation or swelling of udder).</li> <li>• Most of the diseased animals are affected by sub-clinical or hidden form of mastitis.</li> <li>• Milk of mastitis affected animals contains higher than normal number (200,000/ml) of white blood cells (pus cells).</li> </ul> <p><b>Interventions/ Technology Brief</b></p> <ul style="list-style-type: none"> <li>• Increased number of white blood cells in milk can be detected by mixing milk with 3% solution of Surf Excel (Muhammad et al., 2010).</li> <li>• Tropical Animal Health and Production, 42:457-464) in equal proportions (Surf Field Mastitis Test; SFMT).</li> <li>• Development and Commercialization of Mastitis Vaccine to control the scourge of mastitis, several candidate mastitis vaccines were investigated at the University Agriculture, Faisalabad. The most promising results in mastitis control were obtained with vaccine incorporating a biofilm producing local isolate of Staphylococcus aureus.</li> </ul> <p><b>Outcomes/ Input</b></p> <ul style="list-style-type: none"> <li>• Both SFMT kit and mastitis vaccine available as an output of an agreement inked between Business Incubation Center, University of Agriculture, Faisalabad and Um Enterprises, Karachi.</li> </ul> <p><b>Way Forward/ Future Strategy</b></p>
<p><b>Contributor Name: -</b></p> <ul style="list-style-type: none"> <li>• Prof. Dr. Ghulam Muhammad, Department of Clinical Medicine and Surgery, University of Agriculture, Faisalabad</li> </ul>	<p><b>Industry:</b></p> <p>UM Enterprises, Karachi.</p>

**Title of Technology:** Protocols for Commercially Processed Products of Mango, Kinnow, Potato and Tomato

<p>Photographs of development work of the project (Team, Lab, Industry and equipment)</p>  	<p><b>Challenges / Issues:</b></p> <p>Two major challenges to Pakistan economy Human health Providing safe food That's why we have to introduce most suitable processing/packaging techniques used to:</p> <ul style="list-style-type: none"> <li>• Process food in safer environment free from contaminants and smoothening process in sequence</li> <li>• Store food product for longer storage time</li> <li>• Without danger of their spoilage and food safety risk factors</li> <li>• Also help in reducing the final cost of production with increased profit margin</li> </ul> <p><b>Technology Brief:</b></p> <p>Main steps of the project to reduce re-contamination problem and extend shelf-life of products in food processing industries.</p> <ul style="list-style-type: none"> <li>• <b>1<sup>st</sup> step:</b> Survey and sampling of processing areas, equipment used in industry, packaging and raw material of food additives along with fresh fruits and vegetables</li> <li>• <b>2<sup>nd</sup> step:</b> Evaluating the samples through different physico-chemical tests in laboratories of NIFSAT, UAF and Post Harvest Research Centre, AARI and identify critical control points in existing processing line</li> <li>• <b>3<sup>rd</sup> Step:</b> Processing of different products in Shezan Industry through standardized techniques</li> <li>• <b>4<sup>th</sup> Step:</b> Evaluating processed products through sensory and physico-chemical tests in laboratory of Shezan industry along NIFSAT, UAF and Postharvest Research Centre, AARI</li> <li>• <b>5<sup>th</sup> Step:</b> Developed technology will be shared with processing industries including Shezan Int. Ltd.</li> </ul>
	<p><b>Future Strategy:</b></p> <ul style="list-style-type: none"> <li>• Standardize ingredient recipe, processing sequence and packaging technique of selected food products</li> <li>• Extension in storage life through reduction in microbial contamination. Capacity building of local industry in developed processing techniques through trainings and e-media</li> </ul>
<p><b>Contributor Name:</b> Dr. Inam-ur-Raheem(PI)</p>	<p><b>Industry:</b> Shezan International Ltd. Lahore</p>

Title of Technology: - Modified Bran Flours



**Challenge/ Issues**

- Cereals are cultivated for their edible grains and are consumed as staple diet worldwide, providing plentiful calories and nutrients together with useful functional components for value addition.
- The most important botanical parts of grain include endosperm, bran and germ. Approximately, 14 - 19% part of the kernel is bran. Bran is considered as milling byproduct despite of its yield being
- Cereal brans grasp a significant position in food applications in the current atmosphere of increasing consumer consciousness about health foods.
- By using appropriate processing techniques, the biological value of bran could be improved, and at the same time the technological drawbacks, such as unappealing taste and loss of volume in bread could be overcome.
- The foremost objective to formulate composite flour is to acquire a product better than its individual ingredients, with improved performances and better economies.
- Replacement of a portion of wheat flour not only brings economic benefits but also leads towards ensuring food security.
- As according to FAO 320 million dollars could be saved annually if wheat flour substituted at the rate of 20% with non-wheat flour and at 30% substitution savings may be 480 million dollars annually.
- Nutrient-dense substitutes like cereal brans can be used to fabricate flour blends with good sensory and physical attributes and importantly superior nutritional composition

**Interventions/ Technology Brief**

- Despite of as many health benefits the bran is utilized in food products in inadequate proportion because of the technical problems and quality defects as for example in breads, increased crumb firmness, darkened crumb, reduced loaf volume, reduced tolerance to fermentation, and most prominently loss of palatability due to gritty structure of bran. Bran can therefore be modified to curb all the quality defects.
- The modifications might include particle size reduction, heat treatment, soaking, fermentation and altering the constituent polymers solubility i.e. dietary fiber. Enzymes could be greatly helpful to modify and dissolve lofty polysaccharides releasing the bound constituents and altering dietary fiber solubility.
- The technology developed at NIFSAT, UAF will be transferred to millers primarily to ensure provision of nutritious flour to public. The industrial partner will install the facilities required for production of these products.

	<ul style="list-style-type: none"> <li>• The products will be marketed by the distribution channel of the industry. In this project, the final product would be “CereBran Flour” formulated with native and/or modified cereal brans.</li> </ul> <p><b>Outcomes/ Input</b></p> <ul style="list-style-type: none"> <li>• To overcome this problem, we need to bring in low-cost, diversified and better-quality nutritious foods to common people diets. Replacement of wheat flour even at the rate of 20% with different cereal brans would be an important step leading towards ensuring food security and managing malnutrition in Pakistan.</li> <li>• The industry will market the composite flours in different packaging sizes i.e. 2Kg, 5Kg and 10Kg.</li> <li>• The project will be an effort to manage the malnutrition in Pakistan and food security for ever increasing population. Local raw material like sorghum and millet, mostly under-utilized crops for food uses would be brought into human consumption.</li> <li>• Farming community would be involved and encouraged to grow more of these crops, so small-scale farmers would be benefitted.</li> </ul> <p><b>Way Forward/ Future Strategy</b></p>
<p><b>Contributor Name: -</b></p> <ul style="list-style-type: none"> <li>• Dr. Imran Pasha, Principal Investigator</li> <li>• Prof. Dr. Tahir Zahoor, Co-Principal Investigator</li> <li>• Dr. Farah Ahmad Project Coordinator</li> </ul>	<p><b>Industry:</b></p> <p>Shafi Flour Mill, Faisalabad</p>

**Title of Technology:** Artificial Intelligence Based Prediction System for Textile Processing Industry.



**Challenges/Issues**

- Finishes application on dyed fabric can result in plenty of changes in fabric characteristics including mechanical properties and color change. The most crucial of these problems is the shade change of the final fabric after the application of functional chemicals.
- This problem eventually resulted in lots of reprocessing to rematch the shade in dyeing and even often in rejection.
- This problem is pestering the dyers from several years and the only possible solution is the adjustment of actual dyeing recipe on the judgment of final shade after finishing application based on their experience over the years as there is no other method to fix the shade after finishing, which has reached at the point of no return.

**Interventions/ Technology Brief**

- Artificial neural networks (ANN) are computing systems that are inspired by, but not necessarily identical to, the biological neural networks that constitute animal brains. Such systems "learn" to perform tasks by considering examples, generally without being programmed with any task-specific rules.
- The core of the presented technology is to predict the shade change after application of finish by using artificial neural networks which includes the development of an intelligent predictive system to foresee the behavior of shade change after finishing application.
- This Artificial Neural Network model will help textile colorist to predict shade changes in the fabric even before first dyeing.
- The Intelligent shade change predictive system which is the ultimate product of this project will be very beneficial for the local industry

**Outcomes/Input**

- The shade predicting software is a new technological advancement developed for the use of textile wet processing industry.
- The developed software will be disseminated in the form of android application.
- The predictive system can foresee the behavior of shade after the application of certain functional finishes

**Way Forward/ Future Strategy**

- This software will help to reduce the reprocess and rejection rate due to change in shade, hence will save the massive cost and time. Furthermore, this system will be disseminated to working staff of the industry through android application.
- This will help them taking timely decision of the dyeing recipe adjustment according to final finishing recipe.
- The software will be commercialized through academia-Industry chapter of ORIC and Business Incubation Center of UAF.

**Contributor Name**  
 Dr. Assad Farooq (PI)  
 Ms. Farida Irshad (Co-PI)

**Industry:**  
 Kay&Emms Pvt Ltd, Faisalabad

Title of Technology: Post-Mortem Aging Technology: A Way to Improve Nutritional and Sensorial Quality of Meat



**Challenges/Issues**

- In Pakistan, meat markets have been established by municipal and local authorities.
- However, the marketing of meat is characterized by several factors including hold of private sector, absence of reliable data on main marketing channels, inadequacy of slaughtering and marketing infrastructure & improper storage and transportation facilities.
- Locally, the meat is usually subjected to marketing for consumption immediately after slaughtering. Practically, aging is not performed for local consumption of meat. However, the desired consistency of meat tenderness could be achieved by incorporation of freezing and additional aging period.
- These methods can be incorporated for the normal commercial products to improve the meat tenderness.
- Additionally, by providing proper aging, international marketing of meat can also be explored in a much effective way.



**Interventions/Technology or Process Brief**

- The improvement in meat quality during the refrigerated storage has been known since the turn of the century.
- However, the mechanistic approach involved behind the changes in meat composition occurred during postmortem storage have remained elusive and controversial.
- The main objective of postmortem storage of meat is the improvement in meat tenderness as it is the major parameter considered by the consumers while purchasing meat. Additionally, protein degradation is another important phenomenon seen during the storage of meat.
- The variations in the pHu have significant influence on the rate of protein denaturation.
- The elevated pHu values are the resultant of depleted muscular glycogen reserves prior to slaughter and affect the meat quality in a considerable manner.
- The major contributors responsible for depleted glycogen level include manner and length of animal transportation, feeding restrictions, lairage time and conditions; pathological status and genetic makeup of animal.
- The mechanisms of proteolysis and meat tenderization are quite complex and influenced by various factors including animal age, gender, rate of glycolysis, solubility of collagen, sarcomere length, extent of protein degradation, ultimate pH (pHu) and ageing conditions.
- Among these, pHu and ageing time & temperature are considered the most important parameters that have great influence on meat quality during the postmortem storage.



**Outcomes**

- Post-mortem aging is aimed toward achieving flavorsome and tender meat.
- The potential to increase the value of end cuts on a beef carcass is evident in the high overall like, tenderness, juiciness, and flavor responses of the value cut utilized in this present study.
- It enhances flavor and juiciness of meat and meats products. Using an education platform like our study would allow beef consumers to learn while sampling and thus establishing a higher order learning process that could lead to action.
- In this case, requesting value cuts from their local butcher which would ultimately drive more value up the meat market chain. To enhance the trends, we should improve the impacts of private sector, reliable data on main marketing channels, inadequacy of slaughtering and marketing infrastructure & improper storage and transportation facilities and betterment in infrastructure of meat industries. These channels create jobs opportunity and employment. The meat processing manufacturers optimize the effects of aging for specific muscles, the palatability, color, and the shelf life of the aged meat products could be significantly enhanced.

**Way Forward/Future Strategy**

- To standardize post-mortem aging parameters for meat of different meat species
- To assess impact of post-mortem aging on nutritional quality and sensory attributes of meat
- To determine factors affecting quality and safety of aged meat
- Aging cause an improvement in the overall quality of meat so when quality improves living standards also improves.
- The standardization of meat and meat products different parameters of quality and safety are focused.

**Contributors**

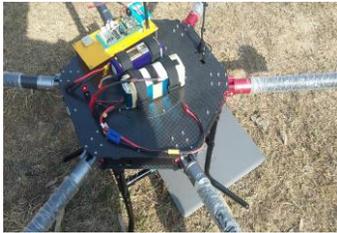
- Dr. Muhammad Issa Khan, Associate Professor, NIFSAT
- Dr. Aysha Sameen, Assistant Professor, NIFSAT
- 3. Dr. Amna Sahar, Assistant Professor, Food Engg.

**Industry:**

Hatchery Feed Mills Sheikhpura Road, Bikhi

Title of Technology:

## Sensor Based Unmanned Aerial Agro-Chemical Spraying (UAAS) System



UAV sprayer system parts



UAV system test



### Challenge/Issues

- The agro-chemicals are being applied on crops and orchards by conventional spraying systems homogeneously without considering substantial variation in plant population and canopies. Excessive application for the regions without vegetation results in over-use of the expensive agro-chemicals as well as environmental hazard.
- The conventional land- spraying machines are inconvenient for spraying in crops like sugar cane and rice. Furthermore, the continuous increasing cost of the agro-chemicals and an unprecedented dependence on these chemicals for the increased production leads to an economic threat while below-par application would restrict the crop yield..
- Globally, unmanned aerial (UAV) are also used in various precision agricultural projects for monitoring and management (spraying insecticides/pesticides) of crops and orchards. However, they are of high cost and semi-autonomous thus requiring visual control to differentiate between cropped and non-cropped area for spraying.
- The demand of the system has been increased due to non availability of the labor as well as growing of high value crops where available machinery cannot spray properly e.g. sugarcane, rice etc.

### Interventions/Technology Brief

- The purpose of this project (HEC-TDF 047) was to indigenize and assemble unmanned aerial system (UAS) for application of pesticides/weedicides.
- The prototype was imported from international market and its various processes were indigenized (including software and hardware) for making it spot application system, were developed and deployed in collaboration with SATUMA pvt limited, Islamabad.
- By integrating the system with inputs from multispectral sensors and control through “Spot Spraying Controller (SSCon)” deployed on UAS. SSCon connected with ultra high volume sprayer that allowed route planning software to direct the UAS for spot application at infected cropped area or orchard trees avoiding excessive overlap or gaps in the spray patterns.
- The SSCon device on board UAS has made it a “Sensor Based Unmanned Aerial Agro-Chemical Spraying (UAAS) System”. The UAAS system reduces the use of costly chemicals as well as environmental hazards.



Development of indigenize software process for spraying



Development of indigenized

<p>three layered “Spot Spraying Controller (SSCon) System”</p>	
 <p>Demonstration of UAAS at farmer’s field in Pindi Bhattian</p>	<p><b>Outcomes/Input</b></p> <ul style="list-style-type: none"> <li>• The main project output was the development of an Unmanned Aerial Agro-Chemical Spraying (UAAS) System that should be able to spray measured and controlled volumes on those spotted areas that are effected with disease without wastage on areas that do not require spraying by recognition of cropped and non cropped areas through vegetation sensor on board UAV.</li> </ul>
 <p>Demonstration at Mr Khursheed Kasuri’s Farm, Kasur</p>	<ul style="list-style-type: none"> <li>• The overall output objective was attained through indigenize assembly of unmanned aerial system (UAS) for application of pesticides/weedicides.</li> <li>• The prototype was assembled and its various processes were indigenized (including software and hardware) for making it variable rate spot spray application system for crops and orchards.</li> <li>• It was done by integrating the system with inputs from multispectral sensor and control through “Spot Spraying Controller (SSCon)” deployed on UAS. SSCon connected with ultra high volume sprayer that allowed route planning software to direct the UAS for spot application at infected cropped area or orchard trees avoiding excessive overlap or gaps in the spray patterns.</li> </ul>
 <p>At DAWN Agri Expo 2019, Expo Center Lahore, 25-26 April,2019</p>	<ul style="list-style-type: none"> <li>• The SSCon device on board UAS has made it a “Sensor Based Unmanned Aerial Agro-Chemical Spraying (UAAS) System”, a variable rate spraying system thus reducing cost of chemicals as well as environmental hazards.</li> <li>• One provisional patent has also been filed</li> </ul>
	<p><b>Way Forward/Future Strategy</b></p> <ul style="list-style-type: none"> <li>• Large number of farmers is willing to use these systems (buy/service).</li> <li>• The technology is available but there are some hindrances in import of some parts especially high performance batteries.</li> <li>• As well as approvals from higher authorities regarding flying of such systems that also hindrance in its commercialization.</li> <li>• Business model for providing services and training to its users is also under consideration before starting mass scale production by the partner industry.</li> </ul>
<p>Contributor Name:-</p> <ul style="list-style-type: none"> <li>• Dr. M. Jehanzeb Masud Cheema, P.I, Assistant Professor, Deptt of Irrigation and Drainage, UAF.</li> <li>• Dr. Ahsan Latif, Co-P.I Deptt. of Computer Science, UAF</li> </ul>	<p><b>Industry:</b></p> <p>SATUMA Private Industries, Islamabad</p>

Title of Technology: Fruit & Vegetable Sterilizer



**Sterilization Treatment Effects**

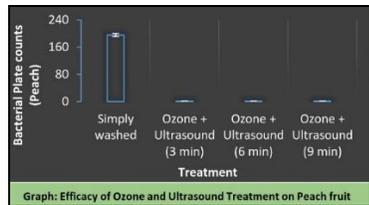


Table: Pesticide residues in strawberry samples, control vs treated (6 min combined O<sub>3</sub> and Ultrasound)

Commodity	Pesticides	Control (µg/g)	Treated (µg/g)
Strawberry	Thimathoxyamil	33.75	0
	Imidacloprid	0.63	0.014
	Acetamiprid	0.01	0.005
	Carbendazim	0.15	0.061

**Challenges/Issues**

- Food safety is a major challenge in production and supply chain of fresh fruits and vegetables.
- Poor production practices, improper harvesting and unhygienic handling contaminate fruits and vegetables with various pathogenic microbes (bacteria, viruses, amoeba etc) and pesticide residues. Fresh consumption of such food poses a serious threat to public health.
- Complex and non-traceable production and marketing system makes it relatively impossible to decontaminate fruits and vegetables at any stage except when produce reaches end-consumer.
- Heat treatments (thermal) are not feasible since fresh fruits and vegetables cannot tolerate high temperature required to kill microbial pathogens.

**Interventions/Technology Brief**

- Among various non-thermal treatments available for perishable fruits and vegetable, combined use of ozone and ultrasonic waves has been proven effective in controlling microbial proliferation and chemical decontamination.
- This hybrid technology (ultrasonic + ozone) has been incorporated in small-volume equipment to sterilize and clean fruits and vegetables making them safe for consumption.

**Outcomes/Input**

- The major objective of this project was to indigenize and introduce the equipment (imported from China) in Pakistan to help reduce day to day food safety risk to public.
- Product development was carried out by industry partner [Koldware Industries (Pvt.) Ltd, Karachi.] in collaboration with our Lab, while performance tests were conducted at Postharvest Research and Training Centre, Institute of Horticultural Sciences and NIFSAT, University of Agriculture and pesticide residue analysis was conducted at Nuclear Institute of Agriculture and Biology, Faisalabad.
- Performance tests were made on microbiological evaluation, residual analysis of targeted pesticides and any possible change in quality attributes (taste, odour, acidity, TSS etc.) of fruits and vegetables postharvest.
- The results revealed that ozone and ultrasound technology have remarkably reduction in microbial plate counts (Graph) and pesticide residues (Table) in tested fruits (grapes, peach, guava etc) and vegetables (chillies, tomato, cucumber and

	<p>cauliflower etc).</p> <ul style="list-style-type: none"> <li>• The locally developed unit is equally good performance comparable to imported unit in term of reducing microbial and chemical concentration.</li> </ul> <p><b>Way Forward/Future Strategy</b>  Koldware Industries Pvt. Ltd., Karachi has established business over 3 decades, and this “Fruits &amp; Vegetable Hybrid Sterilizer” is very relevant to their business and they would like to invest and promote the product on long term basis.</p>
<p><b>Contributor Name</b></p> <ul style="list-style-type: none"> <li>• Prof. Dr. Aman Ullah Malik, Director/Project Principal Investigator, Institute of Horticultural Sciences, UAF</li> <li>• Engineer Hamid Ali Meo, CEO, Koldware Industries Pvt. Ltd., Karachi</li> <li>• Dr. Raheel Anwar, Assistant Professor/Co- Principal Investigator, Institute of Horticultural Sciences, UAF</li> <li>• Dr. Anjum Munir, Associate Professor, Food Engineering, UAF</li> <li>• Dr. Muhammad Inam-ur-Raheem, NIFSAT, UAF</li> </ul>	<p><b>Industry:</b></p> <p>Koldware Industries Pvt. Ltd., Karachi</p>

Title of Technology: Portable Water Monitoring System



US made velocity probe fan



Our Thrust measuring device of digital Velocity meter.

**Challenges / Issues**

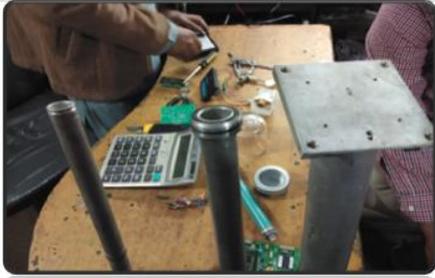
- The continuous flow measurement is important for flood forecasting and equitable water distribution.
- The methods for the measurement of discharge in an open channel are: (1) Structural Instruments; and (2) Analytical method. The former involves the usage of different types of flumes and weirs; which define discharge as a function of flow depth. Nevertheless, these instruments suffer from submergence and maintenance issue \_\_ which limit their use. Moreover, the complicated formula for the execution of discharge can make discharge measurement an impossible task for a layman. On the other hand, analytical method, which is generally considered to be more convenient, of two methods, in application, requires the knowledge of channel area and mean flow velocity.
- The velocity parameter which is mandatory for the measurement of discharge requires the use of expensive scientific instruments (e.g., current meter or flow probe) placed at the precise flow depth for the measurement of mean velocity. However, experience suggests that the placement of instrument at the required depth can be complicated for very deep channels. Moreover, the calibrated propulsion system for the measurement of flow velocity sticks as a result of continuous usage in silt carrying water.

**Interventions/ Technology Brief**

- To address these concerns related to the analytical method, we plan to measure area and velocity parameters through an automatic mechanism that will extend fins across the entire width of the channel (both top & bottom) to execute the channel area \_\_ thus minimizing any constraints related to area measurement.
- The mechanism will further measure the velocity of water by measuring the thrust exerted by water at the desired depth and then converting into velocity through proper calibration.
- The best part is that the entire process will involve the use of automatic mechanism (including sensors) without engaging human element, which will not only decrease the possibility of error but will also be easy to operate and handle at any depth and discharge magnitude.

**Outcomes/ Input**

**Input:** A more convenient and perhaps the most commonly used option to measure the discharge at any desired section of the channel is velocity-area method.



Internal rings of pipes for supporting movement.

The method relates discharge in an open channel as a product function of channel area and velocity.

**Outcomes:**

We aim to develop a discharge measurement mechanism, which upon completion will include:

- A. A mechanism to convert water thrust into velocity;
- B. A mechanism to find the channel dimensions;
- C. Merger of (i) and (ii) to execute the flow rate;
- D. A memory devise to record the time series flow data; and
- E. A transmitter to transmit the recorded data to an online source.

**Way Forward/ Future Strategy**

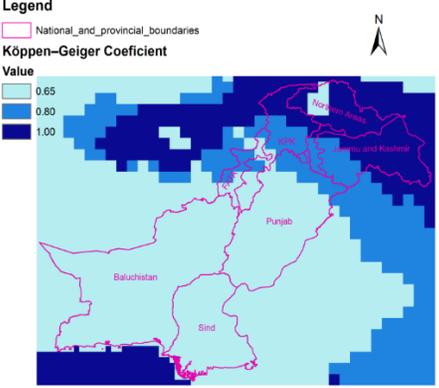
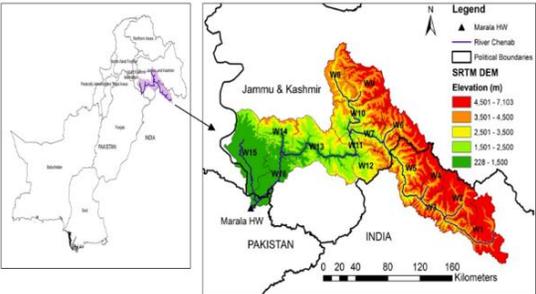
- Laser-scaling on pipes for depth measurement;
- Leveller installation to allow erect insertion in water; and
- Installation of full-scale model of digital velocity meter in Canals to validate its performance.

**Contributors Names:**

- i. Dr. Muhammad Uzair Qamar, Assistant Professor, ID, UAF/ Principal Investigator
- ii. Dr. Waqar Ahmed Qureshi, Assistant Professor, UAF/ Co-Principal Investigator

**Industry:**

Sohail Ch. & Company Bull Road Link Brandreth, Lahore

	<p><b>Challenges / Issues</b></p> <ul style="list-style-type: none"> <li>• Pakistan is highly vulnerable to climate change, which is resulting in increased frequency and intensity of extreme rainfall and flood events.</li> <li>• To effectively cope with the challenges of flood management, the climate monitoring and detection of any extreme event is really important.</li> <li>• On-ground climatic stations and rain gauges provide accurate data, but the existing low density rain gauge network in the country is not enough to effectively predict and monitor any flood situation.</li> </ul>
	<p><b>Interventions/ Technology Brief</b></p> <ul style="list-style-type: none"> <li>• Use of satellite rainfall data and forecast may be very beneficial to monitor and predict any extreme rainfall and flood situation.</li> <li>• The proposed Extreme Rainfall and Flood Monitoring System is being developed in following two phases:             <ol style="list-style-type: none"> <li>Initially a satellite rainfall data based web-tool will be developed for Pakistan to provide extreme rainfall alerts in real time.</li> <li>In the next phase, this extreme rainfall and flood monitoring system will be refined by developing hydrologic models for individual river catchments and integrating them with the system.</li> </ol> </li> </ul>
	<p><b>Outcomes/ Input</b></p> <p><b>Input:</b> Basic input in the development of this product is the satellite rainfall data downloaded and integrated with other geographic information using modern GIS and modeling tools.</p> <p><b>Outcomes:</b></p> <ul style="list-style-type: none"> <li>• Availability of a real time extreme rainfall detection web-tool.</li> <li>• Real time rainfall information along with other informative GIS layers to assess the vulnerability and sensitivity of an extreme event.</li> <li>• Near real time prediction of flows for specific river catchments based on hydrologic modeling.</li> <li>• The developed system may help emergency management departments in timely evacuation of masses from flood prone areas and better planning of relief activities.</li> </ul>
	<p><b>Way Forward/ Future Strategy</b></p> <ul style="list-style-type: none"> <li>• This project aims at developing an extreme rainfall and flood monitoring system for Pakistan, which will be beneficial for the farmers having their homes and agricultural crops and commodities in flood prone areas.</li> <li>• The developed web system will also be integrated with mobile SMS service to provide alerts to our</li> </ul>

	<p>premium users through SMS. For this purpose, services of telecommunication companies will be employed.</p> <ul style="list-style-type: none"> <li>• There is a big community of large land holders in the flood prone areas, who will be convinced to be our premium members; and thus, will be provided with regular alerts about any forthcoming flood situation, as well as about the extreme rainfall events to plan their agricultural operations in a befitting manner.</li> </ul>
<p><b>Contributors Names:</b></p> <p>i. Dr. Muhammad Adnan Shahid, Assistant Professor, WMRC, UAF/ Principal Investigator</p> <p>ii. Prof. Dr. Muhammad Arshad, Director WMRC, UAF/ Co-Principal Investigator</p>	<p><b>Industry:</b></p> <p>SK, Developer, Net Cash Pakistan, Moon Plaza Chiniot Bazar , Faisalabad</p>

**Title of Technology:** Enhancing value addition of milk by developing specialized cheese and cheese spread



**Challenges/issues**

- Pakistan is the 5<sup>th</sup> largest country in milk production but only 4% of milk is being used for product development.
- The gap between supply and demand of cheese is getting wider day by day.
- Indigenous production of cheese does not meet the requirement of local consumers.
- There is an increased trend in the import of cheese for last 5 to 6 years due to greater consumption.
- The supply-demand gap of 10-15% offers attractive opportunities for investments in dairy sector. Almost all of the cream cheese available locally is of imported brands (Krafts, Almarai, Emborg). Cheese production and processing can be a very profitable business venture for new and existing investors.

**Project intervention**

- Development of cheese spread on lab scale and finalization of cheese spread formulation for industrial scale and transfer of technology to dairy industry.
- Commercialization and marketing of the cheese spread by working with dairy industries ( Fauji Foods)

**Expected outcomes**

- The most important outcome is the development of cheese spread using local resources and the reduction in the import of cheese thereby, decreasing the strain on our economy.
- Production of cheese spread will result in the decrease in the prices as well as wide availability to the consumers.
- It can also contribute in the alleviation of malnutrition from our country, as it is rich source of micro and macronutrients.

**Input**

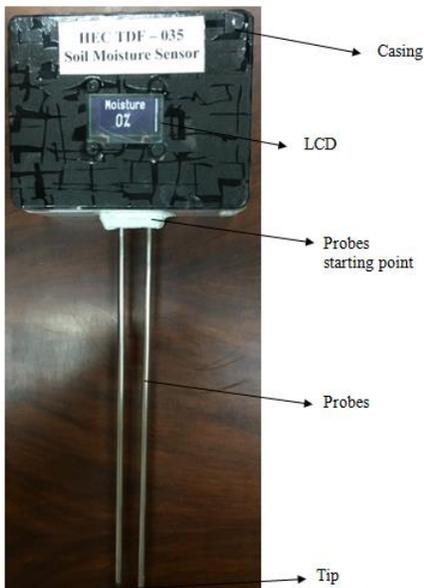
- Our input is the development of various types of cheese spread using indigenous resources according to requirements of local consumers.

**Way Forward/Future Strategy:**

- Provide awareness about the health benefits of the cheese spread and increase its demand using different marketing strategies. Promote production of cheese spread by transfer of technology to the dairy industry of the country.

<p>Contributor Name</p> <ul style="list-style-type: none"><li>• Dr. Aysha Sameen Assistant Professor/PI NIFSAT-UAF</li><li>• Dr. Amna Sahar Assistant Professor/Co-PI NIFSAT-UAF</li></ul>	<p><b>Industry:</b> Fauji Food Ltd, FFBL Tower Upper Mall, Lahore</p>
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## Title of Technology: Android Soil Moisture Meter



### Challenges / Issues

- Prevailing water shortages in the country have compelled all the stakeholders to devise innovative ways for efficiently utilizing the available meager water supplies.
- Pakistan is facing both water scarcity and low water productivity issues and challenges to address these issues are to enhance water availability, as well as conserve water by reducing conveyance water losses and efficiently utilizing the applied irrigation water to the fields.
- An important challenge in this regard is to apply only the required amount of water through precise irrigation scheduling, which can be performed using soil moisture sensors for monitoring real time status of water availability in the root zone.

### Interventions/ Technology Brief

- This invention / disclosure is related to Android application based indigenized two probe soil moisture meter for measuring real time soil moisture conditions in the root zone, which can be a viable option to improve water productivity through precise irrigation applications.
- The electric current (mA) measured in proportion to the soil moisture status in the root zone is converted into digital form using microcontroller (Arduino Nano / ATMEGA328) and volumetric soil moisture content (%) is displayed on LCD within ten seconds after the probes are pushed into the soil.
- At the same time, the reading is also displayed on Android equipped mobile phone. This Android based soil moisture meter has been designed and fabricated locally using steel material for probes and is about ten times cheaper than the imported ones.
- The meter has been tested in the soil pots using gravimetric method and showed results within acceptable range of accuracy of 2%. The said sensor can be a viable tool to monitor real time soil moisture at 150 mm depth in the root zone for promoting precision irrigations to improve water productivity.

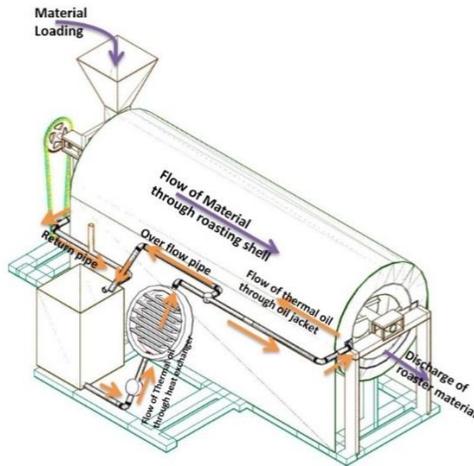
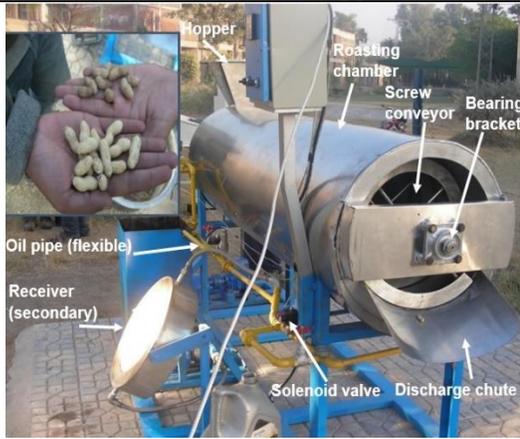
### Outcomes/ Input

- Initially in phase-I, soil moisture sensors from brass, copper and steel were manufactured, calibrated and validated using gravimetric method.
- Later on, these sensors were further refined in phase-II, and two probe steel soil moisture meter was developed, which was able to display soil moisture status in the root zone at the contact depth.
- This soil moisture meter was also calibrated, and validated. In third phase, soil moisture meter was

	<p>coupled with Android App to further make its operation easy and quick. The latest version is equipped with two steel probes of 203 mm length, and LCD (33 x 33 mm) for displaying soil moisture data and linked with Android App on mobile phone for easy data collection.</p> <p><b>Way Forward/ Future Strategy</b></p> <ul style="list-style-type: none"> <li>• The development of Android soil moisture meter is a need based technology, and is a kind of pre-requisite for applying precision irrigations scheduling.</li> <li>• The Directorate of OFWM has imported soil moisture meter, which are seven times expansive than the locally developed Android soil moisture meter.</li> <li>• Therefore, there is promising potential for commercialization of the product.</li> <li>• We plan to work with all the institutions dealing with water management such as Directorate of OFWM (Punjab), Lahore, PCRWR, NARC, IWASRI, IWMI, research institutions and universities for creating awareness as well as adaptation of the technology, which will have significant impact on the water usage in the agriculture sector for growing crops as sensor based precision irrigation scheduling can save water by 30 to 40%.</li> </ul>
<p><b>Contributors Names:-</b></p> <ul style="list-style-type: none"> <li>• Prof. Dr. Allah Bakhsh, Dean Faculty of Agri. Eng. &amp; Technology, UAF/ Principal Investigator.</li> <li>• Dr. Muhammad Adnan Shahid, Assistant Professor, WMRC, UAF/ Co-Principal Investigator</li> <li>• Engr. Usman Iqbal, Ph.D. Student/ Project Research Associate</li> </ul>	<p><b>Industry:</b> SMARTAN SOLVER,</p>

**Title of Technology:**

**Solar Continuous Roaster (SCR)**



**Challenges/Issues**

- It is difficult to maintain controlled roasting conditions
- Possess contamination by dirt, garbage and environmental pollution
- Un-hygienic process conditions occur during conventional roasting
- Transportation losses due to unavailability of on-farm processing facility
- Value losses due to delay in processing after harvesting

**Technology Brief:**

The system includes a Scheffler fixed focus concentrator (10 m<sup>2</sup> surface area), a dehydration system which comprises of a feeding hopper, discharge chute and a separator for separating of roasted material and heating medium. The receiver is faced towards the primary heating system and thermal oil conveying mechanism (a gear pump powered by ¼ hp motor) is equipped with heat exchanger (diameter 350 mm and wall thickness of 16 mm) with casted ribs in zigzag manner. Then the feeding into the roasting drum (2000 mm length, 450 mm inner diameter and 6 mm wall thickness) is done with a triangular shape hopper. The roasting drum is made of food grade stainless steel material. A ribbon type screw conveyor is designed inside the chamber to convey the material from feeding side to discharge side.

**Outcomes/input**

- Various agricultural commodities can be processed timely at farm level like roasting of ground nuts, peanuts, coffee and drying of seeds/grains to preserve them from spoilage.
- This technology can facilitate farming community by on-farm processing for the value addition of agricultural products.
- It is a sustainable technology with a payback period of 10500 working hours (4 years and 7 months) beyond which the roasting process will be much less than the conventional roasting system.

**Way forward/Future Strategy**

- I believe that value addition is the way forward.
- This newly developed solar based processing unit is the way forward if we want to save our surplus.
- An advertisement plan would be the best way forward for technology dissemination.

**Contributor Name:**

Dr. Anjum Munir, Department of Energy Systems Engineering, UAF I.

**Industry: -**

PAMICO Pvt. Ltd. Faisalabad

## Titles of Technology: Multi Nutrient Liquid Fertilizer



Fertilizer making machine installed at WMRC, UAF



Acid metering pump of fertilizer machine



Acid storage tanks



Multi-nutrient liquid fertilizer

### Challenges

- Unavailability of cheap fertilizer machines in local market for manufacturing of fertilizer products.
- Limited use of fertigation under drip irrigation system, causing low crop productivity, due to improper fertilizer materials and expensive water soluble fertilizers.
- Unavailability of low cost indigenous fertilizers for use in drip irrigation.

### Technology Brief

1. Making of liquid fertilizer using improper machinery and without standard safety measures is very dangerous and can cause serious accidents. The proper fertilizer machines of imported brands are expensive because these machines are not available in local market. To promote the use of liquid fertilizer, there is need to manufacture these fertilizers on large scale by local investors by using cheap fertilizer machines. To address this problem, a low cost indigenous liquid fertilizer machine has been developed to reduce the cost of fertilizer unit for encouragement of local investors to purchase fertilizer machinery for production of liquid fertilizer. This fertilizer machine is simple in structure and save energy and labor. The solid raw material is fed directly from funnel of the reactor. The precise and calculated amount of acid and liquid raw material is fed through Acid transfer pump. The chemical reactions are performed during mixing of raw material inside the reactor under controlled temperature and pressure. The temperature can continuously be monitored at control panel and cooling mechanism is used to maintain standard temperature inside the reactor. The agitator speed can also be changed as per chemical used in fertilizer recipe. The fertilizer is collected from Drain valve for packing into cans to sale in market.
2. The multi-nutrient liquid fertilizer relates to fertilizer compositions in which macro and micro nutrients are incorporated in fully mixed form. Fertilizer compositions applied to the soil to assist plant growth are often wasted to a considerable and costly extent due to fixing in soil and later on its leaching by rain or surface water directly through the soil without being able to be absorbed by the plant roots. This problem is especially prevalent with un-soluble fertilizer compounds used particularly in agricultural fields. It is an object of this invention to provide readily available fertilizer materials that contain all essential nutrients for



Farmer day



Brochures of project technologies

plant growth. This invention “Multi-nutrient liquid fertilizer” contains sufficient amount of Nitrogen (N), Phosphorus pentoxide (P<sub>2</sub>O<sub>5</sub>), Potassium oxide (K<sub>2</sub>O), Calcium oxide (CaO), Magnesium oxide (MgO), Sulphate (SO<sub>4</sub>), Zinc (Zn), Copper (Cu), Ferrous (Fe), Manganese (Mn), Boron (B), Chloride (Cl) and Molybdenum (Mo) in proper composition/fraction for efficient plant growth.

**Out comes/Input**

- Development of Indigenous low cost fertilizer making machine.
- Development of multi-nutrient liquid fertilizer for use in drip irrigation system and hydroponic farming.
- Development of management schemes for production of high value crops.
- Commercialization of developed technologies in collaboration with partner industry through farmer meetings, exhibitions, farmer days etc.
- Development of dissemination material including documentaries, brochures etc.

**Way forward/Future Strategy**

- Commercialization of developed technologies on large scale, developed under the project.
- Work on efficient and precise applications of fertilizers in field for reduction in production cost.

**Contributor Name:**

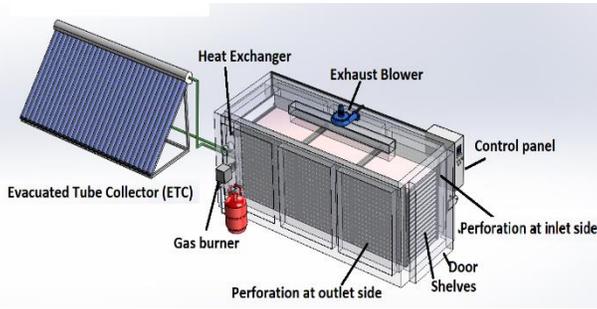
1. Dr. Junaid Nawaz Ch, Research Officer/Project PI, WMRC, UAF.
2. Dr. Syed Hamid Hussain Shah, Assistant Professor, Department of I&D, UAF.

**Industry:**

DAIM Fertilizers and Chemicals Fsd.

Title of Technology:

Solar Drying Cabinet



**Challenges/Issues**

Mechanized and Hygienic Drying Process, Drying Heterogeneity, High heating (energy) cost, Food Security, Processing Capacity

**Technology Brief:**

- Capacity: 200-250 kg/batch
- Drying area: 280 ft<sup>2</sup> (45 W×51H×137L in inches)
- Heating source: Hybrid (Solar and gas)
- Mode of operation: Auto controlled (single or dual mode of heating)
- VFD based inlet and exhaust blowers
- No. of trolleys and trays: 03 and 45 (15 trays per trolley)
- Multi-crop handling (processing)
- Drying time increased on solar mode of heating= 20-25% compared to gas based mode of operation

**Outcomes/input**

- Heating cost can be reduced up to 30-40% (under day time solar based and night time gas based mode of operations.
- 27-30 electric unit consumed in 20 hrs drying cycle which can be saved using PV system

**Way forward/Future Strategy**

- I believe that value addition is the way forward.
- This new developed solar based perishables processing unit is the way forward if we want to save our surplus.
- An advertisement plan would be the best way forward for technology dissemination.

**Contributor Name:**

- II. Dr. Waseem Amjad
- III. Dr. Anjum Munir  
Department of Energy Systems  
Engineering, UAF

**Industrial Partner**

PAMICO Technologies, Faisalabad

	<p><b>Challenge/Issues</b></p> <ul style="list-style-type: none"> <li>• Livestock sector is facing a great threat of parasitism which ultimately badly affects the production of animals mainly in terms of reducing weight gain and milk production.</li> <li>• This is very hard to control this problem by using the chemical drugs because of development of drug resistance with additional disadvantage of drug residues issues.</li> </ul>
	<ul style="list-style-type: none"> <li>• This product is developed by indigenous herbs having medicinal properties especially having ability to reduce the worm burden along with having positive effects on live weight gain and production performances.</li> <li>• This product is multi-mode and has no harmful metabolic residues. For that reason this is an eco-friendly product having no negative impact on public health.</li> <li>• This is a palatable mixture which improves digestibility so that feed intake is also enhanced having a number of associated effects.</li> </ul>
<p><b>Contributor Name:</b></p> <ol style="list-style-type: none"> <li>1. Dr. Rao Zahid Abbas (PI)</li> <li>2. Dr. Muhammad Sharif (Co-PI)</li> <li>3. Zohaib Saeed (Ph.D student in project)</li> </ol>	<p><b>Outcomes:</b></p> <ul style="list-style-type: none"> <li>• Introduction of herbal dewormer in the market, Veterinarians and farming community</li> <li>• Organic farming Feasible</li> <li>• Eco-Friendly product in hand</li> <li>• Indigenous industry flourished</li> </ul>
	<p><b>Way Forward</b></p> <ul style="list-style-type: none"> <li>• In continuation of this project in future we will increase publicity of this project up to national level.</li> <li>• we will market this product in all the Provinces. Vast extension program about farmer awareness and benefits of product would be done in next year.</li> </ul>
	<p><b>Industry :</b></p> <p>Stomach Powder Manufacturing Unit Al-Sheikh herbal Product, Gojra</p>

**Title of Technology:** Golden Nuggets: Animals Feeds from Citrus Pulp Waste



**Challenge/Issues**

- Animals are generally fed fodders and crop residues which fulfill their maintenance requirements.
- However, less nutrients are available for diverse biosynthetic activities for productivity. To meet the productive requirements of nutrients, concentrate feeding is frequently practiced. However, due to ever increasing prices of ingredients, concentrate feeding seems difficult.
- It makes the livestock enterprises uneconomical, thus interfering with exploitation of optimum genetic potential of the animal, resulting in poor performance.
- This problem can be overcome with the use of agro-industrial byproducts which are good source of energy and protein.

**Inventions/Technology Brief**

- Different agro-industrial by-products especially fruit wastes can be as an energy source for feeding livestock.
- Citrus pulp is an important by-product obtained after extraction of juice from the citrus fruit.
- A large quantity of pulp is being produced in Pakistan which is not commonly fed to animals.
- It causes disposal problems as well as environmental pollution. Citrus pulp consists of peels, inside residue and culled fruits. It can be used as a substitute of cereal grains in the diet of ruminants. Small quantity of fresh citrus pulp is being used successfully in animal feed in areas situated near the citrus juice processing units.
- It has excellent profile and can be used round the year in animal feed if conserved properly.
- The project is planned to conserve it through drying and ensure its availability for animal feeding. Citrus pulp will be dried mechanically.
- For this purpose, fresh citrus pulp will be treated with calcium oxide and then passed through press to remove the extra water. Afterwards, Dehydration will be carried through dryer. The air velocity and temperature combination will be optimized to reduce the burning and nutrient losses.
- After preparation of the product, certain treatments will be done to improve the nutritional worth of the product.
- The dried citrus pulp will be packed in polythene bags and stored at room temperature before further analysis or usage.
- The samples will be taken and analyzed for dry matter and crude protein, neutral detergent fiber and acid detergent fiber.
- Citrus pulp will be marketed to the feed mills and common farmers for utilization in animal feed that will assist in cost effective feed formulation.



**Outcomes/Input**

- Project objectives have been fully achieved. Industrial partner has planned to expand the business on commercial basis by investing more money as also given in agreement between him and university.
- He will be responsible to provide required infrastructure (office, building for machinery and staff) and shall be responsible for the maintenance of machinery and running / operation of machinery at its maximum level.
- The partner will bear the expenses/cost of the production and marketing of the final product (Dried citrus pulp) i.e. labor charges, electricity charges, gas charges, diesel charges, raw material cost, packing cost, transportation and marketing expenses as running cost for industrial operation of the production unit. He shall be responsible to keep the financial record shall facilitate the University students for internship and research.

**Way Forward/Future Strategy**

- Agreement is signed with the industrial partner for the further execution of the project. The involvement of industrial partner with the institute for next 5 years is itself a breakthrough and indication of the success of the project regarding citrus pulp processing (Golden Nuggets) and its commercialization.

**Contributor Name:-**

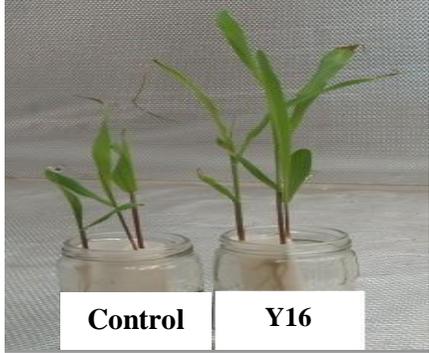
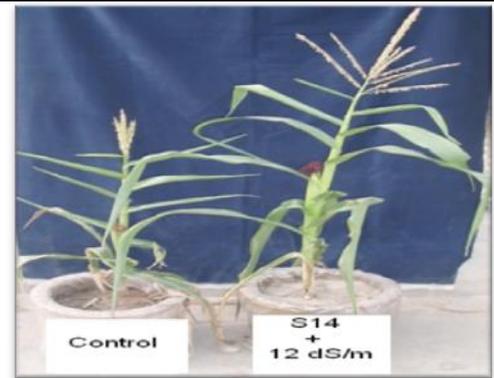
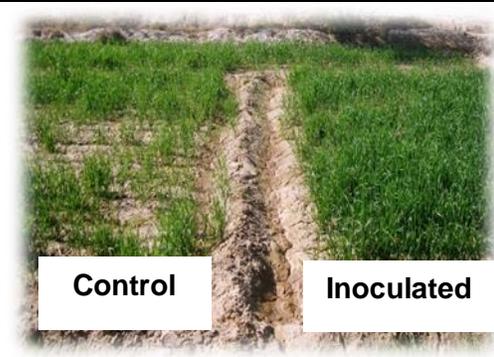
- i. Dr. Muhammad Sharif
  - ii. Dr. Fawwad Ahmad
  - iii. iv. Muhammad Hammad Zafar
- Institute of Animal and Dairy Sciences, UAF

**Industry:**

Ghazi Agropoulive Industries, Faisalabad

	<p><b>Challenges/Issues:</b></p> <ul style="list-style-type: none"> <li>• In Pakistan wheat production decreases 24% annually by weeds which costs the national economy almost Rs. 37.9 billion. To control weeds in Pakistan farmers mostly follow physical and chemical practices.</li> <li>• Physical control is expensive, labour intensive, and causes soil compaction while overuse of chemical herbicides is polluting our environment and creating herbicide resistance.</li> <li>• It is now dire need to adopt cost effective and ecosystem friendly approaches for better crop production. This would be helpful for the economy of Pakistan by reducing the import bill and will ultimately secure the farmers capital by minimizing economic loss due to weeds.</li> </ul>
	<p><b>Interventions/Technology Brief:</b></p> <ul style="list-style-type: none"> <li>• Presently, all over the world, researchers are putting up great emphasis on the utilization of biological agents.</li> <li>• Allelopathic bacteria provide an opportunity to be developed as a bioherbicide. Allelopathic microorganisms suppress the growth of their host weed through multiple mechanisms.</li> <li>• AB perform dual function in the rhizosphere of plants; they not only suppress the germination and growth of weeds but also promote the growth of plants through different plant growth promoting mechanisms. Such technology offers a novel opportunity for the development of a bioherbicide.</li> </ul>
	<p><b>Outcomes/Input:</b></p> <ul style="list-style-type: none"> <li>• Promising strains of allelopathic bacteria were tested for weeds growth reduction and plant growth promotion to develop a microbial consortium for use as bioherbicide in wheat.</li> <li>• The consortium was applied alone and in integration with reduced doses of chemical herbicides. By adopting different application methods, a series of experiments were performed under axenic and natural field conditions which have given very promising results.</li> <li>• So, the allelopathic bacteria have the potential to suppress weeds of wheat and can help the farmer by applying reduced doses of chemical herbicides.</li> </ul>
	<p><b>Way Forward/Future Strategy:</b></p> <ul style="list-style-type: none"> <li>• Different methods were adopted for the application of allelopathic bacteria.</li> <li>• The bacterial strains under study will be used for suppressing weeds growth and Jaffer Brothers (Private) Limited (JBL) is committed to commercialize this bioherbicide in a TDF project of HEC.</li> </ul>
<p><b>Contributors:</b>          Prof. Dr. Zahir Ahmad Zahir          Dr. Muhammad Naveed          Institute of Soil &amp; Environmental Sciences, University of Agriculture, Faisalabad</p>	<p><b>Industry:</b>          Jaffer Brother Pvt Ltd City Tower Shahra Faisal, Karachi</p>

Title of Technology: Biofertilizer for Wheat and Maize Production from Salt Affected Soils

	<p><b>Challenges/Issues:</b></p> <ul style="list-style-type: none"> <li>Salinity is one of the most crucial constraints limiting agricultural productions around the world, including Pakistan. Pakistan has 22 million ha arable land out of which 6.67 million ha is affected by salinity.</li> <li>Pakistan is losing about 40,000 ha land annually due to salinity.</li> <li>However, utilization of such salt-affected soils is also crucial to feed the ever-increasing population of the country. Under the circumstances, it is becoming necessary to utilize sustainable techniques for inducing salt tolerance in plants better adapted to stress.</li> </ul>
	<p><b>Interventions/Technology Brief:</b></p> <ul style="list-style-type: none"> <li>It has already been observed that higher ethylene concentration under salinity is harmful for plant growth. Rhizobacteria containing ACC-deaminase can decrease ethylene concentration in plants and also reduce the degree of root inhibition.</li> <li>These strains protect the wheat and maize by alleviating salinity stress and improves plant health through several traits like reduction of salinity-induced ethylene by ACC-deaminase activity, increasing <math>K^+/Na^+</math> ratio, improving water relations of plants and production of exopolysaccharides which chelate with <math>Na^+</math> and thus reduce its uptake from salt affected soils.</li> </ul>
	<p><b>Outcomes/Input:</b></p> <ul style="list-style-type: none"> <li>The competency of these strains to promote growth and yield of wheat and maize has been established by conducting series of pot and field trials under salt affected conditions.</li> <li>These strains have been used to develop biofertilizer containing a bacterial consortium for sustainable production of wheat and maize from salt affected soils.</li> </ul>
	<p><b>Way Forward/Future Strategy:</b></p> <ul style="list-style-type: none"> <li>The biofertilizer has been extensively evaluated on farmers' fields in different projects and now M/S Jaffer Agro services (Pvt) Ltd. Has consented to commercialize the product in a TDF project.</li> </ul>
<p><b>Contributors:</b>          Prof. Dr. Zahir Ahmad Zahir          Dr. M. Javed Akhter          Dr. Naeem Asghar          Dr. Muhammad Naveed          Institute of Soil &amp; Environmental Sciences,          University of Agriculture, Faisalabad</p>	<p><b>Industry:</b>          Jaffer Brother Pvt Ltd City Tower Shakra+Faisal, Karachi</p>

Title of Technology:

Bio-fertilizer for Legumes and Cereal

	<p><b>Challenges/Issues:</b></p> <ul style="list-style-type: none"> <li>• Legumes are economically important and third largest plant family. Protein is an essential component of human diet. Pulses have a crucial role in human diet due to its vegetable protein.</li> <li>• It is called “meat for poor”. The reasons behind the low production of pluses in Pakistan are cultivation of pluses in marginal and rain fed areas, low yield potential of varieties, absence of sound seed program, stresses of rain fed conditions, inadequate plant stand, poor agronomic practices, damage from diseases, insects and pests, socio-economic conditions, poor nodulation and growth which ultimately leads towards low yield.</li> </ul>
	<p><b>Interventions/Technology Brief:</b></p> <ul style="list-style-type: none"> <li>• Rhizogold a multi-strain biofertilizer developed from different bacteria containing ACC-deaminase. This is the only biofertilizer in Pakistan which has been developed by the use of multi-strains of bacteria containing ACC-deaminase.</li> <li>• These strains have been isolated from specific legumes, characterized and identified in the Soil Microbiology and Biochemistry Lab, Institute of Soil and Environmental Sciences, University of Agriculture Faisalabad.</li> </ul>
	<p><b>Outcomes/Input:</b></p> <ul style="list-style-type: none"> <li>• The competency of the Rhizogold has been established by conducting field trials at various locations in the Punjab.</li> <li>• Rhizogold improves the growth, nodulation and yield of legumes through several traits like reduction of ethylene by ACC-deaminase activity, phosphate solubilization, root colonization, hormone production and pathogen suppression.</li> </ul>
	<p><b>Way Forward/Future Strategy:</b></p> <ul style="list-style-type: none"> <li>• Rhizogold increases the yield of its respective legume up to 20-25% even on marginal lands.</li> <li>• This may also reduce the use of chemical fertilizers and this significantly save the farmer’s input expenses.</li> </ul>
<p><b>Contributors:</b>          Prof. Dr. Zahir Ahmad Zahir          Dr. M. Javed Akhter          Dr. Hafiz Naeem Asghar          Dr. Muhammad Naveed          Institute of Soil &amp; Environmental Sciences,          University of Agriculture, Faisalabad</p>	<p><b>Industry:</b>          Jaffer Brother Pvt Ltd City Tower Shahra Faisal, Karachi</p>

