

1. **Anti-Hair Loss** (Product Readiness: 2015-16) - **Outcome:** Differentiated anti-hair loss formulations. **Status:** Clinical trial to test the Anti-hair loss formulations (Leave on tonic) completed. Statistically significant improvement compared to baseline in various tested parameters achieved. Clinical tests will be completed by Q3, 2015/16.
2. **Hair Growth** (Product Readiness: 2016-17) - **Outcome:** A novel hair growth formula, preferably with all natural ingredients. **Status:** Proof of Concept 1 (POC1) against Minoxidil benchmark completed and two combinations showing better efficacy than Minoxidil identified. Formulations developed & Clinical trials to initiate in Q3 2015/16.
3. **Skin Anti-Tan** (Product Readiness: Q2, 2015) - **Outcome:** All natural molecules for skin anti-tan to deliver a higher delta L in larger fraction of respondents. **Status:** Clinical trial is completed. Closure statement on the above trial is submitted to business.
4. **Blue light Photoprotection** – (Product Readiness: Q4, 2015) - **Outcome:** Complete protection against UV and Blue light. **Status:** Active is in product format.
5. **Infra-red light Photoprotection** (Product Readiness: Q2, 2015) - **Outcome:** Complete umbrella protection against Infra-red and ultra-violet radiation **Status:** **First Manufacturing Sample (FMS) of product with active *Moringa oleifera* seed extract is expected by July 2015.**
6. **Skin Anti-Aging** (Product Readiness: Q4, 2015) - **Outcome:** Reduction in facial fine lines by 50% over a period of 8 weeks. **Status:** Two prototypes for an efficacious skin anti-aging active combination have been developed. Clinical study is scheduled to start by July'15. *In-vitro* efficacy study for two potential plant stem cell extracts is completed.
7. **Probiotic Deo** (Product Readiness: Q4 2015) - **Outcome:** A natural and skin safe probiotic based Deo. **Status:** Prototype developed, concept testing completed at CIC. Clinical study is scheduled to initiate in July 2015.
8. **Anti-Pollution** (Product Readiness: Q4 2015) - **Outcome:** Unique anti-pollution solutions for skin and hair. **Status:** Unique active combination to repel pollutants from skin identified. Prototype development to be initiated by July 2015.
9. **Pain Relief** (Product Readiness: Q4 2015) - **Outcome:** Differentiated antiseptic cream. **Status:** Actives capable of relieving pain short-listed
10. **Evaluation of novel actives for personal care applications:** Leads identified in the Modified Tobacco Products program are being repurposed for anti-aging, anti-tan, anti-pollution and wound healing applications. A program for encapsulating sensitive actives in personal care area has been initiated.

1. **Diabetes** - **Outcome:** To develop product(s) with active for clinical studies by Q2 of 2015. **Status:** Developed in house biscuits with ITC/49 with acceptable sensorial and in-vitro efficacy. Also developed diabetic powder beverage using ITC/49. Third phase of the report received from National Institute of Nutrition (NIN) on beta cell biology providing stronger support for the mode of action of ITC/49. Ingredient safety clinical study completed. Product clinical study design completed.
2. **Cognition** - **Outcome:** To develop a powder beverage for cognition improvement by Q4, 2015. **Status:** Three variants of beverages outsourced with specific actives. Collaborative in-vivo studies with NIMHANS are being pursued. In-house formulation (powder beverage) is being developed. Clinical trial agreement signed for the study and ready to initiate with either one of the formulations.

3. **Cardiovascular Health** - **Outcome:** To deliver at least one clinically proven solution with “functional claims” for CVH by Q2, 2015. **Status:** Developed in house powder beverage with ITC/70 with sensorial acceptability and in vitro efficacy. POC-1 studies completed for bucket 2 ingredient, ITC/43. Neat ingredient clinical study (with ITC/70 and ITC/43) and product clinical design initiated with ITC/70.
4. **Obesity** - **Outcome:** To deliver at least one clinically proven solution with “functional claims” for obesity conditions by Q4, 2015. **Status:** Ingredients identified. Collaborative study with National Centre for Cell Sciences initiated. Neat ingredient clinical trial study initiated.
5. **Sensorial and taste**: **Outcome:** To understand sensorial profile and improve taste. **Status:** Completed threshold taste study with Diacon Hospitals and initiated salivary proteomics study in diabetic and obese subjects.
6. **Anti-inflammatory/Immune health** - **Outcome:** Immune health solution with fruit juices. Impact to business: Q3, 2016. **Status:** Ingredient’s effect on immune health and inflammation studied with cell culture experiments. Clinical for safety and efficacy of shortlisted ingredient completed. Organoleptic properties of the fruit juices with the ingredient tested. Product clinical to be initiated in July ‘15.
7. **Anti-inflammatory/Bone health** - **Outcome:** Bone health solutions with multiple formats. Impact to business: Q4, 2017. **Status:** Short-listed ingredient tested in combination with multiple vitamins and minerals. Neat ingredient safety and efficacy study in progress.
8. **Oral Health (Biotics-Probiotics and Actives)** - **Outcome:** A series of products with clinically validated benefits for oral health. Impact to business: Q4, 2015. **Status:** Two Chewing Gum prototypes developed and clinical trial is ongoing.
9. **Gut Health (Biotics-Probiotics and Prebiotics/Actives)** - **Outcome:** Impact to business: 2016. **Status:** Clinical trial with one active combination (ingredient) for bowel function is ongoing.
10. **Low Lactose Milk with GOS (Galacto-Oligo-Saccharide) Enrichment** – **Outcome:** Differentiated Low Lactose milk with added health benefits of GOS. Impact to Business Q4, 2015. **Status:** POC 1 completed.
11. **Synbiotic Lassi for Low GI and Health Benefits** - **Outcome:** Low calorie lassi with probiotic and prebiotics for low GI benefits. Impact to Business 2016. **Status:** POC 1 completed, prototypes developed. Clinical studies to be initiated in Q2 2015.
12. **Vitamin Enrichment (Biotics-Probiotics and Prebiotics)** - **Outcome:** Novel synbiotic combinations for vitamin enrichment. Impact to business: 2016. **Status:** B12 enriched and prebiotic enriched, synbiotic Dahi developed. Batch to batch variation of the Prototype is being evaluated for scale up.
13. **Low Cholesterol Ghee with an active** – **Outcome:** Differentiated Low Cholesterol ghee with an added health benefit of the “active”. Impact to Business 2016. **Status:** POC 1 completed.
14. **Herbal Ghee for Health Benefits** – **Outcome:** Differentiated herbal ghee for health benefits. Impact to Business 2016. **Status:** POC 1 completed.
15. **Whey Based Drink for Health Benefits** – **Outcome:** Whey based drink for health benefits. Impact to Business 2016. **Status:** POC 1 completed.

Agri sciences – ABD/ILTD - Tobacco

1. **Flavour enhancement K326 (To impact business starting 2016)**. **Objective:** Enhance the flavour of tobacco grown in India to match that of tobacco grown in Brazil with no adverse effect on sensorial. **Status:** First year Central Tobacco Research Institute (CTRI) trial has been completed and second year CTRI trial is in progress.
2. **Enhancement of Potassium in lamina - SBCS Region (To impact business starting 2016)**. **Objective:** Enhance Potassium in lamina to 2% from the current levels of 1.5% in SBCS tobacco in line with the benchmark grade from NLS. **Status:** First year CTRI trial has been completed and second year CTRI trial is in progress.

3. **Enhancement of leaf yield >15% in FCV (over CH3), Burley and Oriental (To impact business starting 2017-18).** **Objective:** A variety / Hybrid meeting the target yield increases without any adverse effect on smoke sensorial. **Status:** FCV & Burley mutants recorded yield advantage in preliminary RBD over control & in Oriental multi-location trial for evaluating the yield potential at different locations has been completed.
4. **Enhancement of leaf yield in FCV > 3500 Kg/ha in NLS (To impact business starting 2020).** **Objective:** A variety / Hybrid meeting the target yield increase without any adverse effect on smoke sensorial. **Status:** Six superior hybrids are under evaluation in RBD trails in NLS region for testing yield potential of 3000-3500Kg/ha & similarly four superior selections from RIL's are under evaluation in RBD trials for yield potential of >3500kg/ha.
5. **FCV Variety / hybrid for water limiting conditions of SBCS & SLS region with enhanced yield (>15% over Siri) for sustainable future (To impact business starting 2020).** **Status:** WUE hybrid showed 10-13% yield advantage over the check Siri in RBD trial in both SBCS & SLS regions and MRBD trial for the same is in progress.

Agri sciences - Strategic Capability Building

1. **Tobacco Genome Sequencing (TGS):** Identification of genetic factors (QTLs) controlling the leaf yield traits in tobacco by utilization of whole genome sequence has been strategized. Re-sequencing of the 12 parental lines used for the development of mapping populations and phenotyping of mapping populations is in progress.
2. **Collaboration with NCSU:** Successfully completed the collaborative project on Metabolomics with NCSU. A comprehensive metabolic map has been developed. Identified genes linked to metabolites. Delineated the pathways & network for metabolites & developed the globally bench marked platform for breeding new cultivars.

Agrisciences: ABD - Wheat

1. **Varietal shift to new geographies - Karnataka, Rajasthan, UP & Eastern India (To impact business starting 2016).** **Objective:** To expand sharbati wheat cultivation to multiple locations beyond traditional areas of Madhya Pradesh with comparable quality and yield levels. **Status:** Introduction of FBD quality approved high yielding varieties leads to increase in area along with substantial improvement in yield for the farmers in ABD's catchment area of Bihar, West Bengal and eastern U.P. Demonstrated the effect of exogenous application of growth regulators on dwarfing sharbati for overcoming the lodging.
2. **Adaptability trials for yield and quality in Wheat (To impact business starting 2017).** **Objective:** Identification of stable high yielding as well as location specific adaptable varieties with desired quality attributes. **Status:** Completed 1st year multi-location field trials with shortlisted 25 varieties across 20 locations covering different agro-climatic regions of the country in collaboration with IARI regional station at Indore. Samples are aggregated from all the locations for quality analysis.
3. **Marker assisted breeding for grain yield and quality improvement in wheat (To impact business starting 2025).** **Objective:** To develop a high yielding variety with desired quality attributes by informed breeding approaches. **Status:** Donor varieties having beneficial alleles for yield and quality were identified by DNA markers. Breeding program to transfer the selected yield and quality traits into desired cultivars has been initiated. Developed

biochemical and molecular methods for quality analysis including standardization of method for Solvent Retention Capacity.

Agrisciences: ABD - Potato

Objectives: Chip Potato: Identification of geography specific variety & agronomy for growing quality chip grade potato in Karnataka, Tamilnadu, Maharashtra and Odisha. **Seed Potato:** Development of a variety specific, targeted nutrition, for higher seed potato yield in Punjab. **Technituber Technology:** Identification of specialty nutrition schedule for sustaining the minituber production.

Status: Chip Potato: Identified potential locations, delivered 7MT chip grade potato to Coimbatore factory for which quality was approved. Precision agronomy trial was designed to develop site & variety specific production practices. **Seed potato:** Adaptive trial is in progress in collaboration with Technico seed team. **Technituber:** Recommended to include Silica in the aeroponic growing medium for improving nutrition use efficiency & minituber yield. Experiment is in progress for developing a speciality nutrition schedule for further enhancement in yield.

Agri sciences: PSPD

1. Eucalyptus:

(a) **To achieve 50% Pulp Yield (at kappa 22, demonstrated at the pulp mill) in Eucalyptus** (To impact business starting 2015). **Status:** The 700 acre plantation of new *E. camaldulensis* selections at Ongole was harvested in 2014 after a growth period of 3.5 years and evaluated in the mill. Lab values yielded 47% PY at kappa value of 17 which is close to 50% at kappa value of 22. Basis this work, a strategy for translation of R&D in to business has been co-created.

(b) **To improve Eucalyptus camaldulensis wood yield by 20% with new clones and Nutrient Management** (To impact business starting 2018). **Status:** Evaluation of 100 new *E. camaldulensis* clones in block planting has been initiated in 2014 at three sites. A strategy for fast-tracking release of new clones with higher wood yield in comparison to existing clones has been co-created by LSTC & PSPD. Joint evaluation of recommended fertilizer dosage (200:100:100 NPK/ha) is taken up at BCM to obtain higher wood yield.

(c) **To select Eucalyptus hybrid clones with good wood and pulp yield traits** (To impact business starting 2018). **Status:** Hybrids with high wood and pulp yield will be identified jointly by LSTC & PSPD from 100 Eucalyptus hybrid clones put up for evaluation in 2014 at multiple locations in comparison to existing clones.

(d) **Genetic Modification of Eucalyptus** for higher wood yield, pulp yield and reduced requirement for pulping chemicals. (To impact business starting 2020). **Status:** Growth-enhancing genes inserted in 1 ITC Eucalyptus clone by FuturaGene and part of the genetically modified plants received at ITC. **In house program** - gene identified, validated, and transformation protocol with efficiency on par with FGN is standardized. Program in parallel track mode.

2. **Casuarina: (Inland adaptability and coppicing ability with 75t/ha of wood yield)** (To impact business starting 2018).

Status: (a) A total of 100 clones are short-listed for adaptability and coppicing of which top 20 clones will be multiplied for business translation (b) A new management package for inducing coppicing ability has also been developed in Casuarina, which is being demonstrated to PSPD. (c) Two kg high quality seeds have been delivered to business and plans are in place to continuously provide improved, quality seeds each year.

3. **Corymbia: Development of high pulp yielding (52%) varieties (2021) with commercially deployable rooting efficiency**

Status: (a) A total of 115 families of three Corymbia species are being evaluated at multi locations. (b) More than 1000 interspecific hybrids of 23 combinations have been developed and being evaluated. (c) The hybrids have shown more than 40% rooting in nursery.

4. **Subabul: Low Seeding & high yielding Subabul clones (2017)**

Objective: Develop a protocol to achieve >50% rooting and uniform root distribution to enhance wood yield and reduce lodging in clones. **Status:** 70 new clones are under evaluation to identify high yielding clones for catchment area. A new nursery management technique has been developed to address the problem of low rooting and lodging due to poor root distribution. Lateral shoots produced in nursery mother plants give more than 80% rooting and uniform root distribution.

5. **Strategic Capability Building: Field station for tree breeding and conservation.**

Objective: (a) To conserve *in-situ* natural germplasm of Eucalyptus, Casuarina and Corymbia imported from CSIRO, Australia. (b) Establish Seed orchards of Eucalyptus and Casuarina for quality seed production. (c) Assemble outstanding trees selected from field trials in different locations as grafts for controlled hybridization and breeding. **Status:** Pedigreed Eucalyptus hybrids from good combining parents were developed and evaluated at Bhadrachalam, Ongole and W. Godavari from which more than 100 superior hybrids were cloned for evaluation. Improved seed from E. camaldulensis and Casuarina junghuhniana seed orchards was supplied to PSPD for distribution to farmers.

6. **Sustainable crop protection strategies for major pulp wood species**

Objective: To evaluate gall infestation and susceptibility in Eucalyptus clones. **Status:** All popular ITC clones are being chemotyped for gall wasp susceptibility. A novel artificial blend comprising semiochemicals at a critical concentration is being developed to attract *Leptocybe invasa* that can be used as an alternate oviposition site. The critical blends will be productized for developing prototype devices such as Lepto-lure, Kairo-Vap and Kairo-lept. These devices will give the critical olfactory/chemosensory clues to *Leptocybe* females and mislead/deceit the wasps from ovipositing on to the eucalyptus host in the clonal nursery ensuring pest free planting material.

VAA: ABD- Soybean & MAPE

1. **Soy Protein Isolates:**

(a) **Multiplication of selected high protein and high oil soybean varieties:** (To impact business starting 2015).

Objective: To assess the yield potential of soybean varieties that offer differentiating properties like high protein, oil content (amenable for immediate value capture), KTI free and high oleic acid (value capture in medium term).

Status: Demonstrated first level certification (IC-1) process with 102 farmers in Maharashtra for organic soybean production. Seed multiplication of two specialty soybean lines, NRC 102 & IC 210 for its large scale evaluation & aggregation completed in MP. Exploring the possibility of commercialization of vegetable soybean production in association with AVRDC is in progress.

(b) Production of Soy Protein Isolates (SPIs): (To impact business starting 2018).

Objective: To assess the possibilities of making Soy Protein Isolates (SPIs) from Indian soy flakes/grits.

Status: Successfully completed the “Pilot Production” of Soy Protein Isolates (SPIs) from Indian Food Grade soy flakes/grits at Germany and Denmark facility of the selected vendor i.e., GEA, Niro, Denmark,

(c) To develop SPIs based “ITC Protein Powder”: (To impact business starting 2018).

Objective: To assess the possibilities of making “ITC Protein Powder” better than the market leaders.

Status: Prototype of “ITC-Protein Powder” was prepared using the Pilot Trial generated SPIs. On sensory evaluation and dispersibility front this product was found to be better than the two leading market products.

Earlier, three prototypes of “ITC-Protein Powders” were developed in collaboration with Solae, Dupont (Dupont’s SPIs) and sensory profile was improvised v/s the two leading market products after our feedback, each time.

2. Medicinal & Aromatic Plants Extracts (MAPE)

(a) Land acquisition for captive/precision farming of MAPs: (To impact business starting 2018).

Objective: To initiate, explore, and acquire land for captive/precision farming of selected MAPs.

Status: Acquired 87 acre of land at Madhya Pradesh and acquisition of 23 acres is in progress. Efforts are being made to acquire 50 acre land for “MAP captive farming” in Uttarakhand for captive farming of MAPs needing temperate climatic conditions.

Land capability classification & micro-zone grouping based on soil profile & crop specific requirements for acquired land is completed.

(b) Assessment of market of selected MAPs: (To impact business starting 2018).

Objective: To explore and understand markets for nine selected MAPs.

Status: Value chain analysis for nine selected MAPs is being pursued.

(c) To develop Dietary Supplements (DS): (To impact business starting 2019).

Objective: To develop ‘dietary supplements’ to capture higher value from MAPs grown through precision farming.

Status: Developed two prototypes of “Dietary Supplements” viz., ImmuniMax for immunity enhancement and PragyMax for memory and cognition enhancement from selected MAPs for “captive/precision farming”, showcasing the capabilities of creating “dietary supplement” business at a later date.

3. Dairy

Objective: To develop a “sustainable milk supply chain” to supply quality milk at competitive cost for ITC’s Dairy business via animal husbandry practices.

Status: As a part of animal husbandry initiative, providing nutritive fodder for enhanced milk production, imported & successfully established indigenous cultivation of **Rhodes grass** (high protein content forage) from Australia.

Paper & Material Sciences: PSPD, ESPB, PPB & CBSC

- 1. Pulp Yield Improvement:** Team (LSTC+PSPD) **Objective:** 2-3% increase in pulp yield, and hence, reduced wood usage, using superior penetrating agents and/or redox chemicals. **Schedule:** Bulk trials – Q4 2015. **Status:** Lab trials completed.
- 2. Augmenting Bulk and Stiffness of Paper and Paperboard:** Team (LSTC+PSPD) **Objective:** Improve ITC paperboard and paper bulk and stiffness property by 10% from current levels. **Schedule:** Bulk trials – Q4 2015. **Status:** Lab trials completed. Piloting is in progress.
- 3. Reconstituted Tobacco (RECON):** Team (LSTC+PSPD+CBSC) **Objective:** Lab scale demonstration of RECON Tobacco hand sheet making and chemicals add-back. To produce RECON sheets with characteristics equivalent to presently used mill scale SWM samples. **Schedule:** Piloting and Bulk concept readiness – Q1 2016. **Status:** Lab trials completed and desired product quality achieved.
- 4. Fire Safe Cigarette (FSC):** Team: (LSTC+PSPD+PPB+CBSC) **Objective:** Mill scale production concept readiness of in-house developed Low/Reduced ignition propensity (LIP/RIP) technology cigarette paper for FSC cigarette. **Schedule:** Concept readiness by Q3/2015. **Status:** In progress - FSC with improved sensorial manufactured & testing.
- 5. Alternative Wood Species:** Team (LSTC+ESPB) **Objective:** Develop optimized formulation and establish natural bio-based wax and dye impregnation treatment of multiple wood species used in pencil making. **Schedule:** Bulk scale implementation – Q3 2015. **Status:** Bulk scale implementation in progress.
- 6. Hot Foil Stamping (Pencils):** Team (LSTC+ESPB) **Objective:** Develop hot foil stamping for ring design in pencils. **Schedule:** Bulk scale implementation – Q3 2015. **Status:** Pilot testing validated. Equipment purchased. Installation and validation are in progress.
- 7. Novel Inks for New Notebook Designs:** Team (LSTC+ESPB) **Objective:** Develop new notebook cover design based on novel inks, such as, anti-counterfeit, glow in the dark, photochromic and graphite activated. **Schedule:** Bulk scale implementation – Q3 2015. **Status:** Under market study.
- 8. Tarnishing:** Team (LSTC+PPB+CBSC) **Objective:** Study root cause/mechanism of blackening of gold print in cigarette board; solution for elimination of tarnishing. **Schedule:** Bulk scale implementation – Q4, 2015. **Status:** In progress – Semi bulk trials with anti-oxidants addition to ink & testing.
- 9. Barrier Coatings:** Team (LSTC+PPB) **Objective:** Incorporation of barrier (Oxygen & water vapour) layer on multiple substrates through solution based coating. **Schedule:** Bulk trials – Q4, 2015. **Status:** Oxygen barrier achieved with Polyvinyl alcohol based coating. Moisture barrier – lab trials in progress.

Intellectual Property

We have accelerated to secure 358 patents (filed) & 75 design registrations. Some of these patents (although a very few in number) are International patents.

Notable mention is that we have been able to secure intellectual properties from businesses as well.

