National Innovation Foundation - India

# 7TH NATIONAL GRASSROOTS INNOVATION & OUTSTANDING TRADITIONAL KNOWLEDGE AWARDS

*Waiting for the winds to flow*

The Honey Bee Network

# 7th National Grassroots Innovation Awards

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**National Innovation Foundation - India**
Department of Science and Technology, Govt. of India

# Preface

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We are truly proud that so many new innovators, outstanding traditional knowledge holders and creative children are being honoured at the seventh Biennial Grassroots Innovation award function.

We consider it to be a great privilege for us that Honorable President of India, Shri Pranab Mukherjee has not only recognized the creative communities and innovators, but has also provided them an opportunity to showcase their innovations in an exhibition open to common public. When the Head of the State in world's largest democracy honours the creative common people, it gives a clear message to the world that India cares about the grassroots creativity and innovation in this Indian Decade of Innovation.

Thanks to the support from Department of Science and Technology, India is one of the few countries in which grassroots innovations are a part of National Innovation System. Having said that, I must say that we can certainly do better in supporting these creative people, diffusing their ideas, inspiring young children and building value chain around these innovations.

I am happy that so many are joining this grand national endeavor of creating an Innovative India. Private sector is taking increasing interest in scaling up the grassroots innovations. The support from academic institutions is growing and so is the support from other stakeholders. In fact, last year, NIF partnered with around 200 partners from R and D institutions, IP law firms, designers, fabricators etc. Majority of them support innovators at a cost that is much less than the market cost. I applaud this cooperation from different stakeholders. The service oriented approach of the Team NIF today is a major driver, but I must also say

that this grassroots innovation national movement owes so much to the original spirit ignited by the Honey Bee Network.

I warmly congratulate all the awardees, who feature in this award book. I hope that they will continue their efforts to overcome persistent problems facing our country through their innovations. I appreciate the efforts of the tens of thousands of our countrymen and women, who have shared their ideas with us, even if many of them could not be recognized at this function. I compliment scientists and all other stakeholders for partnering with NIF.

It is this unique spirit of 'caring and sharing' that makes our open innovation platform so powerful in reimagining and reinventing India.

## Introduction

Anil K Gupta
Executive Vice Chairperson,
National Innovation Foundation - India
& Professor, Indian Institute of Management
Ahmedabad

In this seventh edition of the Biennial Awards for Grassroots Innovation and Outstanding Traditional knowledge, we have once again found robust evidence of creativity in the country. NIF has continued to rely on the volunteers of Honey Bee Network for reaching out to the masses. One of the most remarkable developments during last year was more than three times escalation in the entries from children. As against 4000 ideas from children in 2011, around 14000 ideas were received in 2012. It is a good sign showing increasing awareness about creative thinking among children. When one looks at the ideas sent by children, one becomes very optimistic about the future. Many of the problems with which our generation learned to live with, our children want them to be solved as early as possible. The challenge really is to support such children through a distributed mentoring programme so that they are able to sustain their imagination and have the confidence of converting their ideas into reality. Under the IGNITE awards given every year by NIF, children are expected to send only ideas, though some of them do develop proof of concept. For all other selected ideas, NIF tries to get the prototype made and also patents filed wherever feasible. The idea is to give a message to children that their imagination for inclusive India matters.

In the seventh biennial competition, entries received during April 2009 - March 2011 have only been included. Out of about 20000 entries from 33 states and union territories, majority were about animal care, human health, agriculture and engineering. Energy and household appliances were the next two major categories. The traditional knowledge practices continue to abound. This year, 54 awards are being given to 64 individuals and the representatives of five village communities. Gujarat tops the list followed by Tamil Nadu, Manipur,

Bihar and then other states. Fortunately, this time there are 13 women and girls [about 20 percent of total individuals], which is higher than ever before. Our hope is that in not too distant a future, the share of women will exceed that of men. Another distinctive feature is the recognition to five communities for their outstanding community knowledge. These communities are from Gujarat, Madhya Pradesh and Manipur. In addition, several innovators from J&K, Assam and Gujarat are being recognized for serial innovations. Partnership awards have been given to intellectual property firms, district administration and academic institutions. Similarly, the media contribution of those who have tried to give visibility to the grassroots innovations have also been recognized.

The lifetime achievement award is being given to Shri Annasab Udgave from Karnataka. He has developed several innovations in the field of farm machinery and energy generation. To test his tidal wave based energy generation unit, he went to Goa coast, 800 km away. He is also a great sculptor and has been invited to Japan in the past. Excelling in so many fields and with a great open heart, he serves his community whole heartedly.

Among the national winners, there are several technologies, which have diffused widely. For instance, the food processing machine, bamboo stripping and incense stick making machines, natural water cooler, improved paddy variety, natural non-stick pan, modified windmill and soil scrapper and loader are a few other examples of technologies that have made a mark in the market place. There are many other herbal medicines or products for agriculture and livestock, which have the potential to diffuse if large scale on-farm trials can be organized. This is one area where NIF has not been able to make a major breakthrough yet. Most districts have Krishi Vigyan Kendra with ample land for such a purpose. The expected synergy is likely to be forged in the years to come.

After becoming a full-fledged institute of DST, NIF resources have been augmented to take up several new initiatives. One of the major goals of the Science, Technology and Innovation Policy unveiled by the Prime Minister during the Science Congress in January 2013 is to create S&T public goods for inclusive development. Grassroots Technological Innovations Acquisition Fund [GTIAF] has been created to pay a nominal amount to the innovators to acquire the IP rights to their innovations so that these can be made available to the society by licensing at no or low cost to

the small entrepreneurs. Rights to seventy technologies were acquired last year. Unless large number of entrepreneurs make available such affordable solutions widely, the real purpose of social development will not be achieved.

In a large number of awarded technologies, the innovators themselves may not be able to commercialise these on a large scale. Involvement of entrepreneurs and companies is most essential to take these ideas forward. NIF invites various industry associations in India and abroad to join hands for creating value chain to develop extremely affordable and sustainable solutions to the problems of the majority.

The cooperation from the academic institutions has been very encouraging and crucial for the validation and value addition in grassroots knowledge. Without such validation, we would not have been able to recognize many herbal technologies this time. The herbal claims for human applications, though large in number, still remain unrecognized because dedicated facilities for adding value to them are still not available. Among many things that scientists have to do, validation of, and value addition in grassroots innovations is only one of the activities. Since the appraisal system of the scientists places far more weightage on publications than on production of socially applicable technologies, the scientists do get pulled in different directions. It is hoped that the institutional R&D system will sooner or later evolve norms in this regard. The societal expectations are increasing and the patience is decreasing.

I hope that numerous collaborators of Honey Bee Network working with NIF in scouting, documentation, dissemination, validation, value addition, design, fabrication and mentoring will continue their cooperation and take the grassroots innovation movement to new heights. Without the voluntary spirit, much of what NIF has achieved could not have been possible.

I wish all the innovators and outstanding traditional knowledge holders a great success in their endeavours to serve the society and make India more inclusive, imaginative and integrated.

**Lifetime achievement**



**National I**



**National II**



**National III**

**Consolation Awards**

**Student Awards**



**Diffusion Award**



**Appreciation**

## A lifetime of creativity

**Annasaheb Bhavu Udgavi**
Belgaum, Karnataka

An enterprising farmer and a prolific innovator, Annasaheb is a 'young man' of seventy eight years. His creativity spans over last few decades, where he came up with a number of useful ideas and implements, some out of need and some simply out of a desire to do something different.

He has a small close knit family and twenty acres of land. The family earns a reasonable income because of their hard work and innovative farming practices. Annasaheb did not go to school, as he had to assist his parents in work. The innovator in him started to surface when he was in late twenties and the urge to innovate has become stronger in last five decades. Over the years, he has had the support of his wife and grandchildren in his long journey of innovations, and this has inspired him in all his endeavors.

The early sixties

Way back in 1960, he made his first innovation, a clock, which ran on drops of water. The second's hand of the clock moved forward when a drop of water fell on it from a dispenser, which had been timed properly. For this innovation, he received an appreciation certificate from the then Prime Minister, Mr. Jawaharlal Nehru, which can still be found adorning a wall in his house.

In 1962, he made a horizontal charkha that was foldable and could fit into a suitcase. He displayed this at Sabarmati Ashram, which improvised on his design, and increased number of *belanis* from three to eight in conventional one, in order to increase the output.

The mid seventies

In mid 1970's, to save his betel vine orchard from acute water scarcity, he fitted PVC pipes used in electrical fittings with perforations made on them using nails. By irrigating each day for one hour, he ran the crops for seven years. This was Annasaheb's innovativeness more than thirty years ago, probably only a few then may have had an idea about drip irrigation, which he had pondered over and developed in his own way.

The eighties

Poor prices of betel leaf made him switch to sugarcane. He believed that the best method to solve the problem of aphids and white flies was a high-pressure water spray. It was then, during 1980s, that he innovated the rotor sprinkler system that could cover a radius of 140 feet. He named it after the goddess Chandra Prabha. Thus was born the Chandra Prabha Rotor sprinkler - the Rain Gun.

The advantages of the Chandraprabha rain gun are manifold. It can irrigate one acre in about one and half hours. Since it has a pipe of three inches and a wide nozzle, even composts such as biogas slurry can be applied to the crop through it. When water is applied with force, pests like aphids and white flies can be washed down. It does not even need additional pipelines because of its ability to cover a radius as much as 140 feet. For this innovation, he was awarded in the First National Grassroots Technological Innovation and Traditional Knowledge Awards of NIF in 2001.

The nineties and beyond

In early 1990s, Annasaheb made a foot-operated milking machine using a suction pump.

Apart from his mechanical innovations, he has also been innovating in farming by developing new varieties. He received the state award for the high yielding "Gangavathi-6081" sugarcane variety from the

University of Agricultural Sciences, Dharwad during the year 2001-02.

In 2005, he tried his hands on generating electricity from sea waves. He took his machine to seashore near Ambaghat on the Goa-Maharashtra border and successfully operated his machine by generating enough electricity through sea waves to light up four bulbs of 100 watts each. The machine worked on the principle of compression of air through the force of sea waves and thus using it to move the turbine and to generate electricity.

Annasaheb was involved with sugarcane cultivation. He encountered difficulty in getting farm workers in his area, particularly in peak season when he needed over fifteen people and twenty liters of diesel per acre for sowing and adding manure. The manual methods of operations like planting, applying manure and stubble shaving takes about 30-35 man-days/hectare/day for each operation. He found that the tractor drawn rotovators available in the market would not give the shaving effect on the sugarcane ratoon crop and manual cutting did not give uniform height. Ideally, farmers would like to have a machine that would do multiple operations such as stubble shaving, fertilizer drilling and earthing simultaneously. This would not only save time, cost and effort, by reducing number of passes, but also preserve health of the soil (since too much of tractor movement compacts the soil).

The solution developed by Annasaheb had the advantages of three simultaneous operations for better mulching in sugarcane cultivation. He came up with a multipurpose equipment that can be attached to a 30-40 hp tractor. This machine can simultaneously perform the farm operations like bund forming, seed sowing, manure application and harvesting in sugarcane cultivation. He filed a patent for this innovation and has been using it for many years.

Life beyond innovations

Inspite of age, he remains active doing something or the other. While he is not working Annasaheb likes to spend time with his family especially with his grand children. He is also an outstanding sculptor and specializes in repairing old Buddhist statues.

## The Multipurpose Processing Machine

**Dharamveer Singh Kamboj**
Yamuna Nagar, Haryana

*"Sangharsh hi sabse badi kaamyaabi hai. Agar badhna hai to peeche mud kar nahi dekhna hai."*

(The capacity to struggle itself is a big effort. There is no looking back, if one has to keep on moving forward)"

For Dharamveer Kamboj, an innovator who encountered many hurdles on the road to success, these are not pompous words but a truism by which he lives his life. This multifaceted innovator wears many hats. Best known for his multipurpose processing machine that enables farmers to process various farm products on a domestic level, he also sells *Aloe vera* juice, gel, *amla* juice and other *amla* products and a whole range of herbal products. He also grows medicinal plants in his fields in addition to selling *safed musli seeds* and *Aloe vera* saplings to other farmers.

Born in 1963, Dharamveer was the youngest amongst five siblings. He used to assist his father in farming and running an *aata chakki* (flour mill) and *gur bhatti* (jaggery processing plant). However, it was his mother who played a critical role in inculcating in him a love for nature. He was very close to her and would often help her in plucking and taking care of *Kesuda* flowers, which she used as colours for playing Holi. Already inquisitive by nature, this laid the foundation for his life-long pursuit of learning more about the plants around him.

About this time, a chance encounter further deepened Dharamveer's interest in herbs. In 1980, a holy man visited his village and gave him knowledge of different herbs and Ayurvedic medicines. This interaction made him realize the potential of earning a good living through cultivation of herbs. He also came to know a lot about herbs and their uses while working as a

rickshaw puller in the old city area of Delhi where he used to ferry passengers dealing in herbs.

An innovator at heart, he was the first farmer in the area to cultivate hybrid tomatoes and maintain a record of his produce. In 1990, he developed a battery operated spraying machine using a tape recorder motor. For catching insects, he tried various things including the use of adhesive tape as an insect trap. To maximize returns from his farm, he practiced intercropping by cultivating coriander, bottle gourd and sugarcane. He also developed a special implement to plough the field without disturbing the sugarcane crop. In 1991, he started growing mushrooms under the guidance of the Department of Horticulture.

A Cleaning Machine to Assist Sweepers

In 1995, he observed a sweeper cleaning the platform at the Saharanpur Railway Station in Uttar Pradesh. The philosopher in him reasoned that in the struggle between the pen and the broom, it is the pen that always wins. The pen got upgraded to a typewriter, printing press and then a computer but the broom has remained the same. Observing the drudgery involved in the work, he challenged himself to design a machine that would ease the work of the sweepers. After about a month of design and development, he was ready with a machine that was made using an old auto engine and scrap materials like chain, sprocket, brushes and dustbin. He used air pressure for the pump and fitted it with a water sprayer so that dust could settle down and garbage could be collected in one place from where the machine could pump it into attached dustbins. He took a loan of Rs 8000 for making this machine, going against the wishes of his family. Eventually, the machine became so popular that people from many places started visiting him for demonstrations. In 1997, his interest shifted towards medicinal plants and strawberry.

Genesis of the Multi Purpose Machine

In 2002, a new bank manager was posted in Yamuna Nagar. A forward looking person, he promoted *Aloe vera* farming amongst the villagers. He specifically discussed with Dharamveer the benefits of an *Aloe vera* gel extractor, and the possibility of installing a unit. In December 2004, Dharamveer got the opportunity to visit various *Aloe vera* and *Amla* processing units for various products in Rajasthan along with a group of farmers through the Department of Horticulture, Government of Haryana. He found this a lucrative business but the high plant cost emerged as a barrier. However, instead of backing out, he decided to develop his own machine as he had understood the processing methodology by now. He started working on the development and by April 2006, was ready with the first prototype of the machine, which he used mainly

for juice extraction of *Aloe vera*. He further modified the machine and used it as an essence extraction unit. With the help of this feature and a few more improvements, he could use the machine for processing of several herbs and farm produce.

The Multi Purpose Processing Machine

Multi Purpose Processing machine is a portable machine, which works on a single phase motor and is useful in processing of various fruits, herbs and seeds. It also works as big pressure cooker with temperature control and auto cut-off facility. It also offers condensation mechanism, which helps in extraction of essence and extracts from flowers and medicinal plants.

The machine is a cylindrical container made of food grade stainless steel having an opening (with lid) at the top to feed the herbs and an outlet at the bottom to collect the residue. The machine has an electric motor to drive the central shaft.

The power of the motor varies depending on the capacity of the machine. Gauges for monitoring the temperature and pressure are provided so that they can be controlled for the processing of certain products. The machine is also equipped with an oil jacket outside the main chamber to prevent direct heating of the herbs. Its portability makes it most suitable for farm processing, thereby producing farm fresh products and reducing problems associated with transportation and stocking. The machine is unique because it has the capacity to process a wide variety of products without breaking the seeds of the fruit or vegetable. This machine can be used for processing Aloe vera (making juice, hair gel, face wash, shampoo, hand wash, extract, powder), mango, (chutney, jam), amla (juice, powder, extract, hair oil, candy, sweets laddoo), tulsi, aswagandha, satavar, herbs (juice, extracts), flowers like rose, chameli, lavender etc. (extract and essence).

The machine is available in two models with juice extraction capacity of 50 kg/hr and 150 kg/hr. Dharamveer is also contemplating developing machines with other capacities to diversify his range and attract customers from different segments.


Support and diffusion

Dharamveer has been supported by NIF and GIAN North for value addition and business development activities under the Micro Venture Innovation Fund (MVIF) support. A patent application (367/DEL/2008) was also filed in his name for the technology, for which a Request For Examination (RFE) has been filed. NIF also engaged a designer to improve the machine, who has come up with an improved model with good aesthetics and certain improvements.

Relying more on a positive word-of-mouth of his customers, Dharamveer does not aggressively market his product though he attends various trade fairs. He has sold his machine in many states of the country and also exported one to Kenya. Apart from selling his machine units, he also sells machine based products like *aloe vera* juice, gel, shampoo, cream, *amla* juice, sweets, power and essence which have been developed with the help of this machine. He has given employment to over two dozen women, who make these products. This machine, thus while improving a farmers income by the value addition of his produce, also generates livelihood options for others in the process.

More than 90 machines have been sold by the innovator, with the bulk of sales being in last two years. With sheer hard work and dedication, he has been able to turn around his fortunes from being a rickshaw puller to being a successful innovator entrepreneur with over 4 million rupees of annual turnover.

Recognition

For his innovation of the multipurpose processing machine, NIF gave him the Haryana State award in its Fifth National Biennial Awards function in 2009. Dharamveer had been labeled *'pagal'* (mad) by his family and the community. He says that he looked unkempt as he was too engrossed with his work to

bother about appearances. However, recognition by NIF and winning the award triggered a change in his father who now started calling him *'mehenati'* (hard working). His family and the local community also started respecting him as they see that he has provided employment to the women of his village and helped generate revenue for his village. He also wants to provide similar opportunities to others around him. He has provided good education to his children. His daughter has a MBA and is married while his son is a graduate and works with him. His work has also widely been covered by media, print and electronic alike, the latest being a BBC News story in February 2013. For a man who began as a rickshaw puller, Dharamveer's remarkable achievements inspite of innumerable difficulties show what a person can do by the sheer strength of their will power.

**Bamboo Stripper cum Splinter**

**Lalbiakzuala Ralte and Lalpiangliana Sailo**
Aizwal, Mizoram

L Ralte (46 years) and L Sailo (49 years), both fabricators, develop customised tools and equipments for their customers. They also undertake research in innovative products. They have developed a bamboo stripper cum splinter, which reduces the drudgery and danger in using knife for making bamboo strips and splints.

An arts graduate, Ralte has his wife and four sons in his family. All his sons are students. Remembering his childhood, Ralte mentions that while he was a good student, his interest primarily lay in drawing and painting, which he is passionate about even today. He wanted to take up a career in visual art but became a fabricator after his graduation.

A mason by profession, Sailo has his wife Lalengsiami, two sons and a daughter in his family. All his children are married and settled. Though he liked mathematics a lot and wanted to study, he could not beyond class 5 due to extremist movement in the area. He has tried his hand at different jobs, carpentry, masonry, fishing and even worked casually worked for electricity department for a while. He has been quite creative as a child as well. At the age of eleven, when there was no electricity in his village, he made a room lighting system using torch bulb and battery. Later he also made a river water operated grinder and husker.

Both Ralte and Sailo came to know each other while being associated with a voluntary organisation CHAN's Vocational Training Centre. The acquaintance went on to become good friendship, given their mutual interests. They both opened their workshop in 2007 and have been together since then. Prior to their coming together, they used to individually work on their innovations and occasionally discuss ideas. Sailo has a number of useful machines to his credit, which include grass cutter, squash vegetable/fodder chopper, chicken dressing

machine, dough kneading machine and bamboo splinter.

How the idea evolved

Association with the voluntary organisation exposed them to a variety of issues and challenges. They also came to know about bamboo and its prospective use. It was then they realised that there was abundant wealth lying as waste in the forests. Meanwhile an entrepreneur approached them with a challenge to develop a machine for slicing and splitting of bamboo for making incense sticks. They started working on the concepts, the brief given to them was to have a machine, which can reduce labour dependence, be of low cost and efficient.

The problems soon started. The first idea was ready but there was no milling or die cutting machine around, so the task had to be outsourced to a far off location. The first attempt resulted in two different machines viz. for slicing the bamboo into strips and for making splints from the strips. In 2007 NEDFi (North Eastern Development and Finance Corporation) supported them for their two machines. Their work continued and one prototype followed other, each with its own design issues. However, they got fifth time lucky when they were able to successfully merge both the functions in one device. This resulted in lowering of cost, increased efficiency and ease of use. This was facilitated by the product development grant by NIF.

The bamboo stripper cum splinter

The device is a handy manual device, which can slice bamboo strips and make splints from the strips, thereby eliminating the risks involved in doing the same using knives.

For using the machine, one needs to load the bamboo piece onto the machine and slide the cutter to and fro using a handle. This results in 1.2 mm thin strips of bamboo. About 50 of these strips are then stacked together and loaded onto the machine vertically. The cutter is again moved to and fro resulting in splints of 1.2 mm thickness. Using this machine, an average person can make about 5000 splints per hour.

While bamboo stripping and incense stick making machines are available (NIF Database: Paresh Panchal, Usman

Shekhani, Manihar Sharma, Uddhab Bharali, Liagi Baht), the advantage with this machine is that it combines both the features together with good efficiency at a reasonable cost. All other machines are a set of two for both the separate processes.

Diffusion

NIF filed a patent (955/KOL/2009) in their name and provided them financial support from its Micro Venture Incubation Fund (MVIF) to commercialise the product, which is gratefully acknowledged by the innovators. As of January 2013, 1850 units of the device have been sold in and around Mizoram and Bangladesh. Further they have an order for another 700 units. NIF is also trying to diffuse these in different pockets of the country where bamboo is available and processed. These machines have been received well and the user feedback has been positive where they have mentioned that they found the device efficient and easy to handle. This machine has a great scope in areas where bamboo is grown and processed both nationally and internationally. It won the 'Best Innovative Bamboo Product" award in 2012 as well. This machine has also been popularised by local news in newspapers and cable channels. Their work has been profiled by a few regional stations of Door Darshan also.

Future plans

Ralte and Sailo are working to upgrade this manual machine to a semi - motorized machine. They are also planning to develop a stove using Jatropha seeds and a Betel nut peeling machine. Commercialization of a chicken dressing machine is also on the cards. Sailo is simultaneously working on three other machines viz. areca nut peeler, tung breaker and dough kneader, for which he has been approached by a noodle maker from Aizawl. Challenged with another problem! Would history repeat itself, only time will tell.

## Bamboo splint making machines

**Pareshbhai Kasturbhai Panchal**
Ahmedabad, Gujarat

Paresh Panchal (42), an innovator and fabricator, has developed a set of two machines *i.e.* bamboo strip and incense stick making machine, which are used to make incense sticks from bamboo pieces. The first machine is used to slice the bamboo pieces of definite size and length. The slices cut are then fed in the stick making machine to produce the sticks. Both the machines are easy to operate & maintain, and most suitable for rural areas.

Bamboo sticks are major raw materials used in the Agarbatti industry. For making incense stick, electricity operated high capacity machines are available, which are suitable for industries but not for rural poor who make strips and sticks using knife. Paresh identified the technology gap and developed an innovative bamboo stripping and incense stick making device, useful for small scale industries.

Due to the untimely demise of his father, Paresh Panchal, being the eldest son, had to shoulder the responsibility of running his family. Presently, Paresh stays with his mother, wife Harshaben, his daughter and son along with his brother and his family. After death of his father, Pareshbhai took over the workshop run by him. Once settled in business he started thinking of doing something different to increase the income of this workshop. He used to make conventional '*firkis*' or thread winders used for kite flying, in his workshop. It occurred to him one day to make a different kind of a thread winder that could reduce drudgery of rewinding thread and make

whole process of kite flying faster and more enjoyable. He came up with a motorized string winder, which is fitted with a battery operated motor and has a spooling mechanism to rewind the thread at high speed. Standard batteries power the electric motor. While he was manufacturing and selling automatic thread winder, he had started his work on the bamboo splint making machines.

Genesis

Paresh Panchal is a serial innovator and his innovative mindset constantly inspires him to undertake experiments, which may result in products that would help augment his income and also provide useful solutions to the people. For making bamboo sticks, generally bamboos are cut and splinted by manual method using knife with bare hands. As a result, labour is expensive and also involves risky methods that would have a high chance of having bruises on the hands. The machines available in the market are suitable only for industrial scale and not suitable for cottage industries or household purpose. He started developing the machine in 2008 and finally by 2011 he developed two separate machines (Strip/Hips/ Sliver making machine and stick making machine) which are both operated manually. The machine set gives good and uniform quality output, is easy to operate and is completely risk-free of any injuries. Each machine can easily be operated by one person. For the first machine, the operator must keep the bamboo of 8 or 9 inch sizes (as per the requirement) in the space provided and perform to and fro motion. This will output in strips of bamboo of uniform shape and size. These strips are then fed into the stick making machine one by one. While feeding, the operator has to perform simple circular movement of the gear and obtain standardized sticks. The machines have a capacity of processing about 30 kg bamboo per day. The blades are made of High Carbon Steel and require grinding only after processing 10,000 kg of bamboo.

The machines are easy to operate, safe and do not require any formal training. They reduce drudgery and are ideally suitable for community livelihood generation purpose. In last two years, he has sold about

200 sets (400 machines) till date and getting regular orders for his machine. Of these, 50 machines have been sold to Village forest Protection and Management Committee (VFPMC) in tribal areas of Rajasthan through District Forest Officer (DFO), Udaipur (Rajasthan). The forests of Udaipur range have an abundance of bamboo. The problems with bamboo were two fold. It was lying useless and sometimes the dried ones acted as fuel in forest fires. Introduction of bamboo processing machines in the villages helped the authorities to a) prevent migration of men folk from villages b) utilize forest produce c) check forest fires and d) provide sustainable livelihood options to the people in village itself. Using a set of these machines, a person can easily earn about 10,000 rupees per month through the sale of incense sticks. It is one of the successful models of enterprise development using grassroots innovation. NIF is trying to get it replicate the model elsewhere as well. To commercialize the innovation at a larger scale, Paresh Panchal also wants to start the batch-wise production so that he can get the advantage of mass manufacturing and also be able to provide quality machine to the customer.

## Breathing Sensor Apparatus to Assist Physically Challenged

**Susant Pattnaik**
Bhubaneswar, Orissa

Susant is an innovator, serial entrepreneur, and motivational speaker. He has at least ten innovations that have made the critical transition from idea to working prototype; set up four companies; featured in MIT's Technology Review; been a guest speaker at IITs – and he's all of 20 years old.

Meet Susant Pattnaik: a boy who counts Dhirubhai Ambani as his role model and effortlessly rattles off his many of his quotations to explain his point-of-view. And like his role model, he combines the ability of have forward-looking ideas with the confidence and passion to make them come true. Sample some of his ideas:

Accident-proof Technology

This prevents 4-wheelers from falling off a mountain or going into a pit. This sensor-based technology gauges presence of a road in front. On encountering a pit or a cliff where there would be no road, the sensors get activated to prevent the vehicle from moving forward (of course the speed of the vehicle would have to be below a critical level). He thought of this idea and developed it when he was in class 10.

Breathing sensor apparatus for paralyzed people

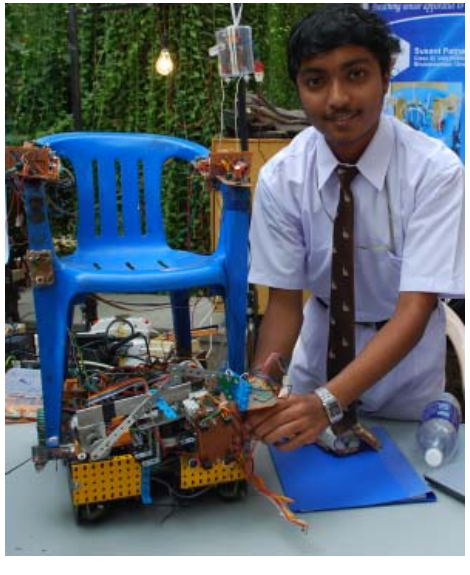
It is wheel chair fitted with a device by which a paralyzed person can do routine things like getting the wheel chair to move forwards, backwards, asking for food or water etc. It is navigated through commands given by changing breathing patterns. "A screen is present on which different tasks come on a regular rolling basis. A task can be selected by breathing on the screen with slight force," Susant clarifies. He thought of this idea as a class 11 student in 2009 and has developed a prototype of this wheelchair. Interestingly, he incorporated his accident-proof technology in this wheelchair to prevent it from falling down the stairs.

Anti-theft Mechanism for Cars

To be safe from the worry of a thief driving away in your car, just install this handy device. Each person gets a unique number on which they get a call any time their car starts. This alerts a person if the car is being started without their knowledge. And to stop the car, they can simply call back on that number. The car can move again only on resetting the system. Susant claims to have implemented it in 50 cars in Bhopal. He shares, "A similar system is available at Rs. 8000 to 20,000 while mine is priced at Rs. 3000 per system. It is low-cost because I have used a different technology."

Low Cost Voice-Operated Electrical and Electronics Appliance

It is system to control electrical appliances through voice commands given over telephone. The kit has programmed circuits connected to home electrical appliances. For switching any device on or off, a call is made to a pre-specified number where it is received by the circuit. Speaking out specific commands will activate the appliance as instructed. "Suppose you say, 'Light on after five minutes', they will switch on accordingly. And if you say 'Fan off after ten minutes', it will switch off exactly after ten minutes," explains Susant.



Super Sense Technology

His current innovation is a 'Super Sense Technology'. It is a circuit-based device attached to the wrist through which one can operate any computer by a slight head or hand movement. No keyboard or mouse is required. He is also working on an advanced model, which comes with a jacket with an in-built computer. Wearing the jacket and the wrist-band does away with the requirement of a computer. Using it, one can type, draw or even access the internet – just like with a regular computer.

Ideas from the Future Inspired from Films

Some of his ideas are so futuristic that they seem a part of a science-fiction film. Not surprisingly, he is a self-confessed film buff who watches "three to four films a week". And while most of the ideas came to him on his own, he shares that the Super Sense Technology was inspired from a scene in the Hindi movie 'Krishh'. It showed a super computer being used in air. Dismissing it as 'unscientific,"

he applied himself to understanding principles of science could be used to make it real.

Currently pursuing a 5-year integrated M.Sc. degree course in Physics from IISER (Indian Institute of Science Education and Research, Bhopal), he finds it unexciting because it's "too normal" (NIF received his ideas while he was a school student). He feels, "There is a huge focus on marks and exams. Students study, but don't learn. I have learned electronics, never studied."

Serial Entrepreneur

He founded the Scientific Innovation Foundation (SIF) in 2011. It is an organization that promotes, generates and documents innovative ideas across the world. He also started Spintrotech India (P) Ltd in 2012. It is a social venture company that develops and markets innovative products. To commercialize his innovations, he has collaborated with Armaan Foundation, Intel, Techpedia, IIT-Gandhinagar etc. He is also supported by NIF. 2012 also saw him setting up a merchandise company, Single Frame Fashions (P) Ltd (Uber Imprints), where people can design their own T-Shirts that will be delivered to them in four working days. An excellent motivational speaker, he also makes himself available to visiting prestigious colleges and corporate houses who invite him as a speaker at their events.

Family Support

Son of a veterinary doctor residing in Bhubaneswar, he has a unique take on parents. He says, "Parents can be like obstacles but only because they want you to be safe." He continues, "My parents would have preferred had I taken the normal path of school, college, degree, job. But I want to follow my dreams and for that, I need to take risk. Of course, they are happy with my achievements."

Hopes for the Future

His next big idea is a body suit with wheels wearing which one can simply "glide on the road at a speed of 40-50 km per hour. It will be battery-operated and will do away with pollution because of vehicles." It's an ambitious dream, but he justifies it by quoting Dhirubhai Ambani: "If you don't build your *dreams*, someone will *hire* you to help build theirs."

## Herbal preparation for controlling stem and fruit borer in paddy and vegetable crops

**Kodarji Kaluji Pagi**
Panchmahals, Gujarat

Inspect pests cause major losses in paddy and other crops. Kodarji Kaluji Pagi (65), an innovative farmer, has developed a herbal formulation to control the stem and fruit borers in various crops.

Kodarji owns about nine acres of inherited land. Most people in his village are agriculturists growing *tuvar* (pulse), *bajra* and *kapas* (cotton). In his fields Kodarji is helped by his two sons and his wife. His third son is a driver. With experience he has developed a lot of knowledge about herbs for use in agriculture and other applications.

To overcome crop damage due to borers, Kodarji has shared a practice where he uses the leaves of a local plant (name withheld due to IP reasons) with neem water and sprays over the crop. This knowledge, as he mentions, has been handed over to him by his late father. With his help, many old farmers of his village and around were met to ascertain whether this knowledge was a common public knowledge there or limited to a select few. It appeared from the discussions that the knowledge about the use of the local plant for fruit and stem borer was not a public knowledge. Some old famers mentioned that while they were not certain but as the plant is native of the area, their forefathers may have used the same for the inquired purpose.

The testing of the formulation was facilitated by NIF SDAU, Dantiwada on Okra crop. The results revealed that there was significant reduction in the larval population (*H. armigera and Earias vittella*) and fruit damage. The formulation was also test in SRISTI Laboratory where it was found to have moderate larvicidal effect against *Spodoptera litura* and *Helicoverpa armigera* larvae under in vitro conditions. In the field, the formulation effectively reduced the fruit and stem borer. Maximum plant damage was recorded in control plots and minimum in the plots treated with the formulation. It was also found to have significant

effect on the growth and yield parameters and maximum yield was recorded in the plots treated with this formulation. It was also found to be effective in controlling the leaf folder of paddy and a reduction of 53% in the leaf folder population as compared to untreated one was observed.

## Herbal medication for promoting poultry health (coccidiosis)

**Smt. Oinam Ibetombi Devi and Smt. Yumnam Ibetombi Devi**
(Community representatives)
Bishnupur, Manipur

Coccidiosis is one of the most common and economically important diseases affecting poultry the world over and is caused by protozoan parasites. The medication for treating poultry ailment coccidiosis is practiced in Heinoubok Awang and Oinam regions of Bishnupur district of Manipur by the Meiteis. Most of them are cultivators and sustain their livelihood through farming activities with paddy being the dominant crop. They cultivate cabbage, cauliflower, tomato etc., for personal consumption and some also for market. The people also rear cattle, piggery and poultry for their livelihood. Backyard poultry rearing adds a rich source of animal protein to their diet and hence is an important secondary occupation of the people.

Some healers of the two areas use a local plant (name withheld due to IP reasons) for treating birds for curing coccidiosis. Smt. Oinam Ibetombi Devi and Smt. Yumnam Ibetombi Devi have been nominated as community representatives by the knowledge holders of the two regions.

An elaborate search of literature did not yield any reference of the usage of the said local herb to treat Coccidiosis. The practice was validated at the Veterinary College and Research Institute (VCRI), TNUVAS, Namakkal to verify the innovators' claims. The validation tests showed better anticoccidial efficacy in comparison to the untreated birds and the standard drug Salinomycin (in terms of minimizing intestinal lesion). A significant reduction in faecal oocyst output was also observed with significant mean body weight gain in treated group.

## Natural Water Cooler, auto air kick pump and others

**Arvindbhai**
**Ranchodbhai Patel**
Ahmedabad, Gujarat

An accomplished technician and fabricator, Arvindbhai Patel (57 years) is a persistent innovator who has never learnt to give up. With his keen mind, he has developed many innovative products such as Natural Water Cooler, Auto Air Kick Pump, Auto Compression Sprayer and Innovative tongs.

For the past twenty years, Arvindbhai has devoted himself to the expression of his creative genius, undeterred by economic hardship and lack of support. He was born in the village Vanch, 10 km from Ahmedabad, in 1955. His family practiced agriculture, but Arvindbhai's mind could not be satisfied with this. He wanted to do something different. A long period of struggle and economic hardship followed but he remained undeterred. And today Arvindbhai probably has the maximum number of technology licensing for several of his innovations among all the grassroots innovators.

Youngest among six siblings, he could study only up to class tenth. With nobody else educated in his family, Arvindbhai only had his motivation to pursue his studies. After completing school, he tried to enroll in a commerce course. However, as the medium of education was English, he couldn't cope with it and had to discontinue. Later he joined an automobile garage and learnt practical skills of auto repairs for two years.

In 1980, he traveled to Saudi Arabia, where he worked for a few years and returned back to settle down in his native village. He lived there till 1993 and thereafter moved to Ahmedabad. Arvind's wife Jaishree is a schoolteacher who holds a Masters in Arts and a Bachelor's in Education. Their son is a mechanical engineer while daughter is a physiotherapist. Both his children have been instrumental in triggering ideas in him for new innovations. Initially, his wife considered him to be over enthusiastic and asked him to

concentrate on a steady job and leave alone, the work on innovations as it did not earn him regular money. But her views changed once the products were widely used and he started getting widespread recognition.

Arvindbhai's innovations are in diverse fields. However, the ones in the non-conventional energy sector have been more widely appreciated. These include a water cooler, low cost solar water heater, auto air-kick pump, and innovative application of the windmill, amongst others.

'Natural' Water cooler

The idea of the water cooler came to Arvindbhai when once he was running a fever. His wife repeatedly applied cold packs to his forehead to keep the temperature in check. This gave him an idea to use the same principle to develop a water cooler, which would not require electricity. In his natural water cooler, water is passed through copper coils covered with cotton cloth, which is continuously being moistened by a dripper. Evaporation of water from the cloth wrapped on the coil cools the water inside. He has obtained a patent for this cooler, which was facilitated by SRISTI/GIAN West. He was also supported under the Micro Venture Innovation Fund (MVIF) scheme of NIF for commercialisation of this technology. GIAN West also facilitated the technology transfer of this cooler to entrepreneurs.

The cooler is useful for supplying cool drinking water in hot summer, particularly in areas where electricity is absent or erratic. It is suitable for schools, banks, hospitals, bus and railway stations and similar such places. Initially, Arvindbhai manufactured his water cooler in three different capacities of 5, 10 and 20 litres. But now he is only manufacturing 100 and 150 litres capacity coolers. About 600 units of different capacities have been sold so far and are in use. Using the same concept, he has also been trying to develop a cold storage for vegetables.

Auto Compression Sprayer

In case of conventional sprayers, spraying is done by continuous pumping by hand, which is tedious and tiring. Shortage of labour is also a big problem as spraying has to be done at a particular time, failing which the pest attacks can be a serious problem.

Arvindbhai Patel has modified a knapsack sprayer into an auto compression pesticide sprayer. He realised that the jerks produced during walking could be utilized for the oscillation of the piston in a cylinder. So he used a spring and additional weight to magnify these jerks to generate requisite pressure in the tank to spray the pesticide. This device thus works on the concept of dead–weight oscillation, which causes the reciprocation of the piston and results in spraying action. While the technology holds great promise, effort is on to optimize the spring size and material vis-à-vis the dead weight keeping in mind the pumping efficiency.

Auto Air-Kick Pump

This innovation is a low cost, portable, compact aid to inflate tyre tubes/punctures of any vehicle, particularly two-wheelers, having kick start or auto start mechanism. One can fix the problem on the spot so that the vehicle can reach the nearby gas station or repair shop.

This device converts the compressor of two-wheeler into an air pump. A pinch of polymer granules is also inserted in the tube to seal the leakage. The user can kick and fill air in the tube. This may last for a few kilometers to reach a puncture repairing shop. An entrepreneur from Mumbai had taken non-exclusive license for this technology and sold more than 2500 pieces, mainly in North Eastern India. Arvinbhai later modified his technology suitably to adapt it for four wheelers as well.

Suraksha Tong

In everyday life, one has to deal with hot plates and vessels regularly, mostly in kitchen. Tongs are the commonly used gadgets used for holding hot or heavy utensils, which is inevitable in any kitchen, laboratory, and mechanical workshop. Tongs available in the market are often clumsy and unsatisfactory for the user. In most of the cases, they are unreliable and cause accidents.

Arvindbhai keenly watched the functioning of the common household tongs and discussed the problems with users. Using the feedback obtained, he designed a tong made of stainless steel pipe having length adjustment facility to fit vessels with different diameters. Spring mechanism is provided for length adjustment facility. End of each

shafts are connected with semi-circular arc type plate and handle grip to hold edge of the utensil, which ensures safe lifting and usage. A set of two tongs can easily hold 10–15 kg weight.

Other efforts

Arvindbhai developed a fascination for solar energy, which drove him to fabricate a 50-litre solar water heater in 1985. He used HDPE/PVC for the storage tank and straw of bajra (pearl millet) for insulation. Between 1985 and 1990, he made eight different models for trying out different materials and correcting the flaws or deficiencies he came across until he was fully satisfied.

The idea of harnessing wind power struck Arvindbhai sometime in 1996 when he was looking at clothes drying in the wind. He used a curtain, a rod and an air pump to fashion a rough model of a wind tunnel. After several experiments and fabricating different models, he came out with a horizontal 'Low Air Thrust Multi-curtain System'. The device, Arvindbhai visualises, can be beneficially used for pumping water, heating water, inflating tyres, drip irrigation and even for running a grinder/juicer.

Normally, while one person flies a kite, another person holds the reel, allowing it to unroll as per requirement. Once during the kite festival, his daughter refused to hold the reel for her brother who was flying the kite. To settle the children's quarrel, he designed a new reel holder to wind the kite thread. With this new holder, a person can fly a kite without an assistant to hold the reel.

Arvindbhai is a man driven with passion to strive continuously to deliver something new and better for the society. Despite several setbacks, resistance from the family and financial constraints, he has been single mindedly pursuing his passion, which at many times, is quite inspiring for other people. His mind is continuously buzzing with new ideas and eyes are always on the lookout for problems, which he can engage his mind with.

**Tractor operated reaper windrower with reel**

**Bhagwan Singh Dangi**
Vidisha, Madhya Pradesh
Scout: CIAE, Bhopal

*"Khet main sabse jyada samasya kataai mein aati hai. Baaki sabhi kam ke liye machine hain, kaatai ke harvester bade kisan hi kharid sakte hain; isliye mujhe chhote kisano ke liye reaper market mein lana hai"*

*(In the field, maximum problems are faced during harvesting. For everything else, there are machines. But present harvesters can only be purchased by big farmers. I want to market a reaper meant for small farmers.)*

It was this ambition that drove Bhagwan Singh Dangi, a farmer from a small village in Madhya Pradesh, to develop such a machine. His reaper windrower is machine which cuts the crop and windrows (a row of cut hay/small grain crop) it in the centre.

55-year-old Bhagwan Singh was born in a farmer's family. Even as a child, Bhagwan Singh was fascinated by machines. "I could sit for hours watching repairmen when they came to our house to fix farm machineries," he confides. As he grew a little older, he would pick up any wrist watch lying around the house and open it up to study what was inside.

Although his brothers are graduates, Bhagwan Singh was more interested in agriculture. In 1973, he quit school after class 12 to help his family with farming. He also followed up on his love of machineries and started tinkering with farm implements by way of building and repairing them.

First Success: A front mounted blade for tractors

Farming in his village was challenging. One of the first difficulties he faced was an uneven field dotted with pits. So he developed a front-mounted blade for tractors for land leveling and bunding. "I made this blade way back in 1982 but I still use it on my farm. Others have copied me but I am happy that my region now has many people adept at adding this farm implement to tractors," he shares proudly. His next

innovation, made in 1995, was a rubber accessory for increasing the discharge of bore-wells by over 40 per cent.

He continued mending small gadgets and farm implements for years before developing his reaper windrower.

Genesis of the innovation

Soybean is a major crop in his village. Labour shortage during peak harvesting season is a big problem. Trying to find a solution, Bhagwan Singh explored the market for machines that would harvest quickly and with minimal grain loss. He needed a machine to execute two main functions- reaping and windrowing. Reaping involves cutting the crops systematically while windrowing is laying the cut stalks in windrows for easy bundling and post harvesting processes.

Some of the machines he came across were self-propelled reapers placing the harvested crop on one side of the machine, which lead to high shattering losses. Moreover, large portions of the stalks were left in the fields, which required manual clearance before the next run. This arrangement was not feasible for small fields with frequent turns as it damaged the standing crop. The reaped crop was carried all along the row, which was dropped only at the turns. This created an unnecessary load on the engine and hence added to fuel consumption.

Unable to find a machine appropriate for his small-sized farm, he then thought about making one of his own. He conceptualized building a light, agile vehicle with a front mounted hexagonal rotating reel with mechanism for cutting and dropping the crops.

His first prototype was ready in 2001. Inspired, he decided to start his own workshop where he could give shape to his imagination and creativity. He took a loan against his property and opened the workshop in 2004. All this while he continuously worked on the design and improved his idea. The modified self propelled machine had a 18 hp engine prime mover

instead of the earlier 2 hp one and a centrally placed reaping windrowing machine. It took him over a year and 10 lakh rupees to develop, test and modify the individual components and assemblies.

Considering its applications, NIF facilitated its value addition by developing it as attachment for tractor at CSIR- CMERI Durgapur under the NIF-CSIR cooperation. With this support, Bhagwan Singh has been able to develop the reaper windrower as an attachment that can be mounted in the front of a tractor, which seems to have a huge potential.

The tractor operated reaper windrower

This is a front mounted attachment for tractor. It has three different units namely, reel unit for pushing the standing crop towards the cutter bar, cutting unit, which consists of cutter bar, and gathering unit to windrow the crop at centre of the machine thus making it easy to handle/transport to the threshing floor. It reduces manpower requirement and the drudgery involved in the harvesting process.

A design modification in windrower unit does away with the problem of shattering loss, or breakage of grains, in the subsequent turn as the tyres do not run over the harvested crop.

The machine requires only one person to drive the unit and two persons at the rear to collect the produce. Apart from soybean, it can be used to harvest wheat, paddy and pulses. It is capable of working in small fields, taking sharp turns and not damaging the standing crops.

In conventional reaper units, the harvested crop is dropped perpendicular to the travel of the prime mover causing a lot of grain loss. The novelty of the innovation lies in the design and spatial arrangement of the windrowing attachment, which achieves minimal grain loss. The gathered crop drops in line between the tyres in a neat row for collection and facilitates the next parallel run.

As per tests at CIAE Bhopal in soybean crop, the machine demonstrated a field capacity of 0.35 ha per hour (at forward speed of 1.93 - 2.10 kmph). The total harvesting losses were reported to be 3.37%, including 2.33% pre-harvesting losses (i.e. losses while harvesting was done with this machine were 1.04%) and uncut loss were zero.

The innovation has featured in national media including Start TV, Yojana and The Hindu and has also received local media coverage. This has resulted in over 150 enquiries from various districts. A patent was filed by NIF in the name of innovator in 2011 (677/MUM/2011)

Future Dreams

"I dream of the day when my reaper unit would be used by marginal farmers across the country. My family was apprehensive while I was working on it because of the money involved. But they never discouraged me," he says. He accepts that his wife Radha was his staunchest supporter. "She never doubted me. She has just studied till class 8 and was not even sure of what I was doing. But she never told me that I am wasting my time with this innovation," he states in a voice full of pride.

All his children are graduates. "Now, I want to create an enterprise based on my innovation, which my children can take forward," he mentions. Farmers in the area have seen this implement in use and are asking him for it. However, financing is a problem because they do not have the money to pay for it in cash and there are no options of bank loans etc.

He feels farming practices need to change for better growth. "*Aaj kheti karne ka dhang achcha nahi hai, hame tarakki karne ke liye kheti karne ka tareeka badalna padega,*" he believes. And he wants to contribute to the change by way of developing new farm implements, agricultural practices and seed varieties.

## Improved variety of carrot (Laxmangarh Selection)

**Smt. Santosh Pachar**
Sikar, Rajasthan

Scout: Sundaram Verma

Smt. Santosh Pachar (40) is an innovative farmer of her village and has developed a vermilion coloured long length carrot variety, sweet in taste and with low percentage of forked roots.

Practicing organic farming, Santosh Pachar and her husband, are well known in the village both for their farming skills and helpful nature. Both studied till class eight only but have ensured proper education for their daughter who completed her master's in education and son, who is going to college. Santosh developed interest in farming while helping her family during her school holidays and from hobby it became a full-time occupation after marriage. She has five acres of agricultural land where she has been cultivating crops like wheat, methi, onion carrot, garlic, coriander, pomegranate, papaya etc. She considers herself lucky to have the support of her husband and other family members in all her on-field experiments. Practicing organic farming herself, she also leads a self help group, working to promote organic cultivation practices in the village.

Genesis

Sixteen years back, Santosh Pachar had collected some carrots for consumption from a farmer, Mahaveer, belonging to the Akwa village in the Laxmangadh tehsil. The carrot was very good in appearance and there were very less number of forked root. She adopted the root-to-seed method of planting at her farm to produce seeds of the above carrot. The criteria of selection of carrot for seed production were long root-length, sweetness, "Sinduri"/vermilion color and softness. She collected the seeds from the first year plants and sowed it again in small field and adapted same selection method continuously for 4 to 5 years, which stabilized the desirable characters. She also used neem oil for controlling insect-pest and disease.

The improved carrot variety

The carrot variety has been developed by Smt Pachar adopting the root-to-seed method of planting. The criteria of selection of carrots for seed production were long root-length, sweetness, vermilion color and softness. The variety is well adapted to high temperature. The length of carrot is up to 1.5 ft with the percentage of forked roots being quite low. This variety is resistant to disease and insect pest attack and takes about 2.5-3 months to be ready. It is less hairy and yields almost 630qt/ha. It is sweet in taste and fetches high market price due to its quality.

Santosh has also experimented with the seed sowing method. The seeds are stored in cotton bag. Two kg/bigha seeds are taken for sowing. Prior to sowing the seeds are scarified by rubbing them with palm. After scarification, seeds are treated with sesame oil and then sown in pre-prepared plots (size 15 x 20 ft) on rows. After sowing the fields are irrigated heavily with sprinkler to maintain the high soil moisture. Light irrigation should be given upto one month using sprinklers. After one month normal irrigation process is followed. Weeding is carried out at an interval of 15-20 days after sowing and thinning practice is adopted for maintaining spacing.

After three months, the colour of the carrot leaves changes to light yellowish, which is an indication of crop maturity. This implies that carrots are ready for uprooting, after which they are cleaned, washed, packaged and marketed.

The enterprising lady

Santosh has an innate learning capability and consciously makes an attempt to learn from others' experiences and share her own. Having distributed seeds of her variety, she has also taught farmers the practices she followed. She has attended several meetings at KVKs, gram panchayat

and regional farmers' meet where among other things, her innovation has also been discussed. She even invites farmers to her field to see her work. She has been acknowledged for her efforts and has received some recognition. She is grateful to her family and others for all the support they have provided to her. While the urge to do something new was the main cause for her innovation, demand from the market was the driver for continuous improvement.

Santosh wishes to experiment further to improve the variety and also come up with certain other innovations. She is also on the lookout for some financial support to help her scale up her experimentation efforts. Exhorting fellow farmers to undertake field experiments themselves, she exclaims, "*tum sab aage bado, hum tumhare sath hain*" (all of you move ahead in your work, we are there to support you).


## Herbal formulation for treating Coccidiosis in birds

**Sudhakarbhai Gauli and Jeevalbhai Gauli**
Dang, Gujarat
Scout: Pravinkumar Vankar and Pravin Rohit

Coccidiosis is one of the most common and economically important diseases affecting poultry the world over and is caused by protozoan parasites. Sudhakarbhai (50) and Jeevalbhai (58), two herbal healers from Dang have developed herbal formulation to address this problem. Both of them were identified during a Shodh yatra in their region in the year 2000 and have been associated since them.

Vanki is a small tribal village, where Sudhakarbhai (50), a traditional herbal healer lives with his family of six. He has very good knowledge of therapies for various livestock ailments and is helped by his wife in preparing various herbal formulations. Other members in his family include his eldest son who works as a wireman, younger one who looks after their 11 acres of ancestral land in Maharashtra, his youngest son looks after farming in Vanki itself and his daughter who is married. He has around six acres of land where he cultivates *Nagli*, Paddy, Pigeon pea and groundnut. He also has some cattle head to take care of. He is quite famous for his herbal treatments in the area and is easily approachable. He even has visitors from nearby Surat district.

His family traditionally has been involved in administering herbal medicines for curing various livestock ailments and he learnt the same through the elders. Realising the importance of this knowledge he made extra efforts to imbibe the maximum from his elders. Sudhakarbhai gives herbal medicines for poultry ailments, bloat in animals and diabetes in human.

Eldest among seven siblings Jeevalbhai was born and brought up in his mother's village- Maharajchond, Dangs as his father was a *ghar-jamai* (husband who stays with his parent in law). He has seven members in his family- his wife, two sons, their wives and a grandchild. He owns 16 hectare of land, and some cattle head. Apart from working in his fields he also

sometimes works as a casual labourer, getting rice and other food items in return of the labour. Sometimes, he also works in different rural government projects for earning money.

His village Kosambiya has around 300 families, most of which indulge in agricultural activities for their sustenance and grow paddy, *verai*, *tuvar*, maize etc. The main source of water is the river Khapri. The village is surrounded by dense forest and natural sub-tropical deciduous vegetation. Sometimes the villagers also work as migrant labourers in sugarcane and grape farms in the plains of Gujarat and Maharashtra. With only two *bhagats* (traditional healers) and trained *dais* (midwife), primary health facilities are negligible in the village.

The problem

In coccidiosis, the parasite (commonly protozoa of *Eimeria* species) develops and multiplies in the epithelial cells of the intestine, causing damage to the host's intestine resulting in mortality. Chicks pick up the infection from unhygienic and infected premises. These may have been contaminated previously by other young infected birds or by adult birds that have recovered from the condition. Chemotherapeutic treatments are most usually retorted to for addressing this problem. But with the emergence of drug resistant strains, the problem is getting compounded.

These two herbal healers from a backward district of Gujarat have developed herbal formulations for treating Coccidiosis in poultry and also to increase immunity in them. An elaborate search of literature did not yield any reference of the usage of the said local herb to treat Coccidiosis and accordingly a patent (2387/MUM/2007) was filed in their name for the practice. The practice was validated at the Veterinary College and Research Institute (VCRI), TNUVAS, Namakkal to verify the innovators' claims.

The formulation was evaluated by Matrix Biosciences Pvt. Ltd., Hyderabad. The results were highly promising and the technology was licensed as "Coccicure" to Matrix Biosciences.

## Manual walnut peeler, walnut cracker, tree cum pole climber

**Mushtaq Ahmad Dar**
Anantnag, Jammu & Kashmir

What separates Mushtaq Ahmad Dar (32), a serial innovator from Anantnag, from others is his sensitivity and a keen eye to spot problems. He has come up with a number of practical technological solutions to persistent problems, people had been facing for long. These include the walnut peeler, walnut cracker and the tree cum pole climber among other of his ideas.

Mushtaq, the second eldest among four brothers, has always been quiet and shy by nature. When he is not working on his innovations, he likes to spend time in his orchard and help his brothers. As a child he loved making small wooden toys and decorate the house with them. Once in eighth standard, he made an electro-mechanical sculpture of Gandhiji working on a *Charkha*, which was displayed during the National Science Day celebrations at Anantnag. For the same, he got an award of Rs. 1000 by a voluntary organization, which he used to buy materials for his innovations.

Mushtaq lost his father at the age of eighteen, when he was studying in 10th standard. Since the financial condition of the family was not good, he discontinued his studies and joined his brother in the family business of walnuts. NIF has recently set up a community workshop at Mushtaq's place, which has been facilitated by the GIAN Cell J&K at Kashmir University, Srinagar. The idea is to provide a platform to other innovators to prototype their ideas, brainstorm with each other and also seek advice of Mushtaq, who thus assumes a mentorship role also.

### The turning point

In 2005, Mushtaq's friend Zahoor, who had been in touch with NIF for some time, brought him along to NIF's Third National Biennial Grassroots Technological and Outstanding Traditional Knowledge Awards at Ahmedabad. Mushtaq was fascinated after meeting the award winners from different parts of the country, who

had succeeded in solving various problems on their own and through persistent hard work. It surprised him that these people could come up with so many things despite not having received any formal training. The seeds of unrest had been sown. His mind started ticking even before he started his journey back home.

## Walnut Peeling Machine

Conventionally walnut peeling is a labour intensive task involving a lot of drudgery. In this process, walnuts are kept under grass for four to five days when they start ripening. They are then peeled individually using a wooden rod. This process takes much time and is tedious. Also, the chemical that oozes from the walnut stains hands and clothes. The walnut peeler developed by Mushtaq solves these problems. It is a manually operated device for peeling green walnuts using which one can peel 70-80 kg green walnuts per hour.

Mushtaq mentions that as a child he had been observing the problems associated with the manual peeling of green walnuts. However, the idea to make the machine struck him recently. Then it only took him about a few months and an investment of few thousands to develop the machine. It is surprising that while the problem seemed so genuine, no solution existed in the market till now. Those available abroad are electricity operated, high capacity costlier versions. A local entrepreneur identified by GIAN Cell J&K has taken the initiative to take this innovation forward in the market. Starting only sometime back, he has been able to sell a few units, giving twenty per cent royalty to Mushtaq. The user feedback has been positive. Given the potential of the machine, NIF filed patent application (683/DEL/2011) in the name of innovator for the same. Mushtaq is also experimenting to see if this machine can be used for other applications as well.

## Walnut Cracker

Cracking walnuts manually is a plodding and tedious job with low output (maximum 10 kg/h). Mushtaq thought of developing a machine that could mechanize this process relieving a person of his drudgery of doing it manually for hours. He discussed this with his friend Naseerul Haq who encouraged him and

saying that if he was able to come up with such a machine, it would be wonderful for all those involved in this work. Motivated, he started working on various designs and finalized one in almost ten days. Then he started making the prototype, which took him about a month and an investment of Rs 3000 to develop.

The walnut cracking machine can process dry walnuts of various sizes, shapes and hardness and crack them open without damaging the fruit inside. The machine can process around 80 kg of walnut per hour and 20 kg of almond per hour. The efficiency of the machine calculated using nylon and aluminum rollers came to be 79.5 per cent and 75.2 per cent respectively.

The innovativeness of the device lies in its minimalist yet versatile design, with a smart set of drives, the use of two grooved rollers, which can be set to handle the various sizes, shapes and rigidities of walnuts and facilitate peeling of green fruit. The roller design and arrangement has also been customized. They have been provided with grooves in specific geometries, which grip the nuts securely when passing through the rollers. NIF filed a patent (2347/DEL/2006)for the machine in Mushtaq's name and facilitated its the incubation at GIAN J&K in Kashmir University, Srinagar. It also engaged designers to work on increasing efficicency and imoroving designs and aesthetics of the machine. Mushtaq also developed a variant of this to be used for cracking almond as well.

The tree cum pole climber

It is a small portable device that makes climbing trees/poles simple and easy. What is remarkable about this innovation is that it uses body weight to lock the climbing steps and is very light, low cost and easy to maintain.

In November 2006, he started designing the tree climber believing that the cold and snowy winters would give him ample time to ponder over the design and complete the work. It took him six days and Rs 100 to come up with a small wooden climber that used a barbwire to wrap around the tree. Not satisfied with the design, the use of wire and wood he again started work and redid the climber using iron frame and canvas belt.

Once while moving around in snow, he saw two electricity department workers carrying a ladder on their shoulders. They took it off near an electricity pole and while one worker held on to it, the other climbed

it to reach the street lamp. This made him think to possibly use this climber to ascend poles also.

The tree climbing device consists of a pair of supporting frames for each foot; Velcro based straps for anchoring the foot to each frame, a sturdy strap with locking system to fix around the tree and a flexible safety belt that can be wrapped around the body and the tree. A patent (1230/DEL/2007) was filed for the climber and the technology licensed to a Ahmedabad based entrepreneur who further improved the device in consultation with Mushtaq.

Other ideas

Mushtaq has also come up with a number of other useful ideas and innovations. He has designed a device to restrict nicotine inhalation for smokers, a modified bike with rain protector cover, magnetic leveler for fields, manual electricity generator, handy fruit plucker and a seed broadcasting machine apart from developing a model for demonstration of lunar/solar eclipses. In 2008 he developed an almond cracking machine, which helps to reduce the drudgery involved in cracking almonds manually and prevent fingers from being hurt. He also designed a washing machine specially for washing heavy materials like carpets, curtains, mats etc.

For his creativity, Mushtaq has received quite a bit of appreciation and recognition from organizations, individuals and the media alike. He won J&K State Award in NIF's Fifth National Awards 2009, participated in Inventors of India workshop at IIM Ahmedabad in 2008 and in the Innovations Exhibition in the President House in 2010. He now wishes to become an entrepreneur, manufacture all his useful machines and sell them under a single brand. Mushtaq advices other young innovators in the country and has this to say to them, "Believe in yourself, be confident, accept assistance from wherever it comes and ease the hardship of humanity".

## Double shuttle loom

**Ngangom Nabakumar Singh**
Bishnupur, Manipur

Noticing the problems in traditional shuttle loom, Nabakumar (42 years) thought of improving it to enhance productivity and reduce labour. His 'double shuttle loom' works on the same principle as that of any other standard manual shuttle loom but is wider with the provision for two sets of warp rolls resulting in double output in a given time.

Nabakumar Singh, a driver and a carpenter, was born in a farmer's family. Poverty did not allow him to study beyond class third. Though he dropped out from school quite early, he has clear memories of school life even now. He was a top ranker, the monitor of his class and wanted to become a professional footballer. He started helping his father in his paddy field but kept on continuously thinking ways to support the family financially. After a few years, he took up driving as the profession and became the driver of a local doctor. He also drove trucks and during rainy season worked as carpenter making furniture. Presently, Nabakumar is fully engaged in the constructing double shuttle loom and its accessories. His wife is involved in weaving of traditional clothes using his double shuttle loom.

### Genesis of the innovation

Being a truck driver, Nabakumar many times had to be away from home for weeks all together. His mother remained unhappy and worried all this while. She forced him to quit and take up other local engagements after his marriage. His wife had brought a traditional loom with her and he had also been looking for options for work. Given his modest carpentry experience, he thought of improving the old shuttle loom to enhance productivity and also to reduce labour intensity. But he soon realised that looms were different than what he had made earlier. He started looking for a teacher who could teach him the nitty-gritty of shuttle loom making. Elders from the village advised him to consult Asem Ibopisak Singh from a nearby village who was

an expert in loom construction. Ibopisak mentored him for many years. Thereafter, he started working on his innovation of double shuttle loom, popularly known as 'Panthoibi Loom'. It again took a couple of years of trial and error but he finally got the combination right in 2008.

In Nabakumar words, it has been a journey of unpredictable need. He went through all possible struggles in life while developing the device. His major challenge while developing the double shuttle loom was in regard to the movement and synchronization of two shuttles. He had sleepless nights during development of the loom and even had quarrelled with his wife that he could not operate double shuttle loom. But he was adamant to see his innovation operational. He shares that his wife really supported him at all stages of innovation. His mentor, Asem Ibopisak Singh, supported him with prompt guidance all throughout. He was also supported financially at times by the owner of the truck he drove, Jonathan. Once, happy with his loyal service, Jonathan gifted him truck full load of wood for his loom experimentation. It was then when his work really picked up.

The Double Shuttle Loom

The innovation is a modified loom, which is only slightly bigger in shape due to the incorporation of the second shuttle. The technical details remain more or less the same with the existing shuttle loom models.

In the conventional shuttle looms a shuttle passes from one side to the other of the warp shade, running on the warp beam. A small rob/string is used to pull the shuttle from side to side. A horse shoe shape slider, commonly made of hard leather, fixed on the end arms of warp beam, pushes the shuttle to and fro from one end to the other. In the double shuttle loom, there is a common horse shoe in the middle. When the first shuttle strikes from one end, the middle horse-shoe strikes the second shuttle in the same direction. Therefore, both the shuttles move in the same direction

simultaneously and the middle horse-shoe strikes one shuttle at a time. Many ball bearings have also been added to the new machine. Therefore weaving on the double shuttle loom has become easier than any other single shuttle loom.

Apart from the double shuttle loom, he also developed certain accessories to further ease work on the double shuttle loom.

Warp Winding Drum for Double Shuttle Loom ( *Khangjeng drum*)

Nabakumar developed this double warp winding machine to accommodate two warp rolls simultaneously. It works in the same principle of any other warp winder. There is no extra effort required and the improved rolling mechanism with ball bearings makes the machine very light to rotate.

Double Bobbin Spinning Charkha (*Silheima Tareng*)
This charkha was developed to facilitate spinning of bobbins for his double shuttle loom. The device follows the same principle of any other shuttle loom except that it spins two bobbins simultaneously. With the same amount of labour input and time, one gets double the output. NIF has provided financial assistance to develop the product further.

Advantages

The double shuttle loom is probably the only treadle operated shuttle loom with double shuttles. Because of the double shuttles, the output is double than any other normal loom as it weaves two fabrics at a time, with marginal increase in cost. More over, this loom reduces the time consumption and needs fewer efforts for weaving as well. Another advantage is that the machine can accommodate other advanced machineries like jacquard machine or "Chanakee" to enhance productivity level in design fabrics. If these devices are incorporated, then the earnings would go up many folds. As it is operated like any other traditional loom, it does not require any special training. If well diffused, his machine has the promise of a secured livelihood for many.

Nabakumar has sold a few units of the double shuttle loom recently. A woman group has also purchased some looms from him, the feedback of which has been quite promising. The Directorate of Commerce and Industries, Government of Manipur has also purchased ten pieces of looms. NIF has also filed a patent application in the name of innovator (203/ KOL/2011). Nabakumar was also invited by NIF to participate in the innovation exhibition in 2011 at Rashtrapati Bhawan Delhi where the machine received wide attention.

Nabakumar dreams to have his own enterprise out of his innovation. He has the following to say to his fellow innovators, "let's make our land a prosperous one by inventing new things".

## Chinnar 20 – an improved paddy variety

**Smt Ariyammal and Smt Pushpam**
Ramnad, Tamil Nadu

Scout: SEVA

Ariyammal, her husband (late Chinnar) and Pushpam developed Chinnar 20 variety using selection method from ADT-46 paddy variety. This variety is a short duration variety well suited for rain-fed and wetland cultivation. The variety is drought tolerant and high yielding.

Chinnar (55 years, demise in 2009) was a marginal dalit farmer owning about an acre of wet land. His land is now taken care by his widow, Ariyammal and their son. Pushpam is also an illiterate dalit farmer owning five acres of wetland. She has been cultivating *chinnar* paddy variety for the last 5 years. Their place is inhabited by about 100 dalit families who are mainly agricultural laborers and marginal farmers. The farming is entirely dependent on rain and tank water. As agriculture is on the vagaries of monsoon many families especially men migrate to nearby Kerala to work as plantation laborers during off season.

During 2004, Chinnar and Pushpam had cultivated ADT (Aduthurai) - 46 variety developed by Tamil Nadu Agriculture Department. Pushpam had sown the seeds in her field as direct sowing crop. At the time of weeding Pushpam found a paddy plant different in color and marked that plant. Chinnar, who had his farm next to hers, collected the seeds from that plant separately and raised it in the corner of his field. This plant was completely purple in color with good tillering with the grains being elongated and fine. With the help of Ariyammal, in the subsequent year he cultivated his entire land and obtained relatively more yield of paddy as compared with the other local varieties viz. ADT-45, 43 etc. Adopting selection method for production of seeds, they checked the stability of characters for five years.

The Chinnar paddy variety

This variety is a short duration variety well suited for rain-fed and wetland cultivation. It is also drought tolerant and high yielding. The plants have purple pigmented leaves and culm hence weed removal is easy. The grains are fine and long with good cooking quality.

The variety is suitable for direct sowing as well as for transplanting. The yield of the variety is about 2700-3000 kg/ acre. The color of the plant is very attractive to the farmers. Seeing the yield of the variety, elongated and fine grain and less incidence of pest and disease attacks has attracted many farmers to cultivate this new variety. The fertilizer requirement is also lesser as compared to other locally grown varieties. The farmers get Rs 100 extra payment per bag of paddy seeds from local traders due to its quality. This improved variety is now being cultivated by about 150 farmers in more than 300 acres of land in the villages in Ramanathapuram district and even in neighboring Sivaganga & Pudukottai districts. The seeds of the variety are now being preserved by Ariyammal and Pushpam.

## *Pachaikkai* – Improved Cardamom Variety

**L. Ramaiah & R. Murugan**
Theni, Tamil Nadu
Scout:: SEVA

Ramiah (70) has developed an improved drought tolerant and high yielding cardamom variety with exceptionally green and bold capsules. His son Murugan has been propagating the same.

Ramaih has eleven acres of plantation estate near his place, which is a hamlet in Megamalai hills of Western Ghats. The place is an ideal location for cardamom cultivation with elevation ranging between 750 - 1200 meters above mean sea level. Most of the inhabitants are marginal cardamom and coffee farmers. The Malabar variety of cardamom is predominantly cultivated in this area. Ramiah, who has studied upto class fifth, belongs to a scheduled caste. He developed the improved cardamom variety with the help of his son Murugan, who maintains the estate now.

Development of the variety

In 1986 Ramaiah wanted to establish a cardamom plantation in his three acres of land and started by growing local Malabar variety in a limited area. After few years he started harvesting cardamom pods from his garden. He and his son Murugan observed that a few plants had large sized pods with bright green color. He then expanded his plantation using the seeds from the newly identified clump. He observed parameters such as growth rate of the plant, disease resistance and yield, and found that they were superior as compared to other local varieties such as 'Nallajni' and 'Malabar'. Also the green colour of capsule did not fade out even after a year. The family members called it *Pachakkai* (green coloured capsule). Later they purchased land and extended the plantation to over another 8 acres by planting with seedlings raised from seeds of this clump of *Pachakkai*.

Ramaiah digs pits of 2 ½′ x 2 ½′ x 2′ size and fills with top soil, compost and lime after mixing them together before planting the cardamom seedlings. He manures the seedlings once in a year during the rainy season

by using neem seed powder and compost. The plants come to yield about two and a half year onwards and maximum yield starts third or fourth year onwards.

The Improved Cardamom Variety

This is a high yielding (2000kg/ha (dry)) variety with exceptionally bright green coloured bold capsules, which have more seeds than other varieties. This variety is also drought tolerant and most suitable for lower elevation areas of Tamil Nadu. Owing to the color and bold capsules this variety is much sought after by the traders. It fetches a premium price of Rs 100-150 per kg over the normal cardamom price.

The Spices Board has recorded the salient features of this improved cardamom variety. and awarded him a shield for best performing cardamom planter in the region in 1999. Over the last 8 years, many neighboring farmers have gradually adopted this new variety. Many farmers from Kerala and Karnataka have also obtained seeds material from him.

## Herbal medication for treating bloat in animals

**Yashodaben Shriram Chaudhari, Yashwantbhai Gauli and Sudhakarbhai Gauli**
Dang, Gujarat

Bloat is the buildup of gas in the rumen of cattle. It is produced as a part of the normal digestive process and is released by belching. However, it may become discomforting and sometimes life threatening for animals. Yashodaben (42), Yashwantbhai (61) and Sudhakarbhai (50) hare traditional herbal healers who administer herbal medicines for bloat.

Yashodaben Shriram Chaudhari studied till class tenth and got married at the age of seventeen. Earlier she had to move around in Gujarat with her husband, in connection with work. However, now her husband practices greenhouse cultivation. He also provides his services in the implementation of various government-funded social schemes where Yashodben also joins. She has also been the *Sarpanch* or village-head. Their family has also been engaged in poultry and animal husbandry. In the best possible way, they look after their domestic animals and try to ensure that they are well-fed and remain free from all ailments. Yashodaben learnt many herbal practices from her parents including one for treating bloat in animals.

Vanki is a small tribal village, where Sudhakarbhai (50), a traditional herbal healer lives with his family of six. He has very good knowledge of therapies for various livestock ailments and is helped by his wife in preparing various herbal formulations. Other members in his family include his eldest son who works as a wireman, younger one who looks after their 11 acres of ancestral land in Maharashtra, his youngest son looks after farming in Vanki itself and his daughter who is married. He has around six acres of land where he cultivates Nagli, Paddy, Pigeon pea and groundnut. He also has some cattle head to take care of. He is quite famous for his herbal treatments in the area and is easily approachable. He even has visitors from nearby Surat district.

His family traditionally has been involved in administering herbal medicines for curing various livestock ailments and he learnt the same through the elders. Realising the importance of this knowledge he made extra efforts to imbibe the maximum from his elders. Sudhakarbhai gives herbal medicines for poultry ailments, bloat in animals and diabetes in human.

Yashwantbhai Gouli is a friend of Sudhakarbhai and visits him quite often. He greatly admires the work of Kauchabhai (Sudhakarbhai's father) and keenly observes him. To learn more about various herbs and their uses, he often volunteers to help in the preparation of formulations. With time, he has been able to grasp much and establish himself as a herbal healer as well.

In Vanki, Sudhakarbhai and Yashwantbhai are widely acclaimed as experts in ailments related to human beings, animals and poultry. They make the herbal formulations at home, to administer them to the patients who visit them as and when required.

The problem

Ruminants have an active population of micro-organisms in their fore stomach, which help in digestion especially of fibers. During the process of digestion, these micro-organisms produce large quantities of gas, which must be expelled. This happens through belching. Bloat occurs when this mechanism gets inhibited somehow resulting in the increase in the rate of production of gas than the rate of gas expulsion. These three herbal healers from a backward district of Gujarat have developed herbal formulations for treating bloat in animals. An elaborate search of literature did not yield any reference of the usage of the said local herb to treat bloat.

## Herbal medication for curing bacterial mastitis in animals

**Boya Pedda Rajanna**
Anantpur, Andhra Pradesh
Scout: Dr. Subramanium
DRDA, Anantapur

**N. Govindan**
Salem, Tamil Nadu

Scout: SEVA, Madurai

Boya Pedda Rajanna (58) and N. Govindan (62) are healer experts in treating animal diseases using herbs. They have developed a herbal formulation using a local herb to treat mastitis effectively.

Pedda Rajanna is an agriculturist with ten acres of land and has five members in his family, his wife, son and three daughters. While farming is the primary occupation, a herbal healing tradition also runs in his family. The knowledge of the usage of herbs for treating animal diseases has been passed on over generations in his family. His family members help him in farming as well preparation of herbal formulations and drug administration. The practice for the treatment of mastitis was documented during a workshop organised with the support of the District Administration, Anantapur.

Govindan is an illiterate agricultural labourer with an acre of land. He has been supplementing his earning by working as a milk man in the local dairy. He has a son and a daughter who is married. As a young child his interest was in sports especially 'kabaddi' and did not go to school. Later he got interested in herbs when he started helping his father, a herbal healer, in the collection and identification of medicinal plants. He owes all his knowledge to his father and has been practicing for the last thirty years. He claims to have treated over a thousand animals for mastitis and about six dozen in his village itself. He has also willingly shared his knowledge with twenty other healers in his village and around.

Mastitis is an infection of the tissue of the udder that causes pain, swelling, redness, and increased temperature of the udder. The primary cause of mastitis in cattle, goats and sheep are well-recognized groups of microorganisms, Streptococcus sp., Staphylococcus sp. and coliforms, *Escherichia coli*, Enterobacter sp., *Pseudomonas aeruginosa* and Klebsiella sp. Sometimes

due to the infection visibly abnormal milk (e.g., color, fibrin clots) is also produced. As the degree of the swelling increases, changes in the udder (swelling, heat, pain, redness) may also be evident. Apart from giving pain to the animal, it also affects the quality and quantity of milk.

Clinical conditions affected with mastitis were identified in the regions of Andhra Pradesh, Gujarat and Tamil Nadu and milk samples were collected with help of state Animal Husbandry Departments. The intramammary medication was tested at different geographical regions and etiological agents for these clinical conditions were confirmed. The formulation was found to show better efficacy than conventional medications (cephalosporin and penicillin drugs). The clinical trials confirmed the therapeutic efficacy of the formulations in treatment of mastitis caused by gram negative bacterial organisms (*Pseudomonas aeruginosa, Klebsiella pneumonia)* as well as gram positive bacterial organism (*Staphylococcus aureus*). The trial results had confirmed broad spectrum therapeutic activity of this unique indigenous veterinary medication.

## Groundnut Digger

**Sanjay Tilwa**
Rajkot, Gujarat

Sanjay Tilwa (31), a farmer and a manufacturer of agriculture implements, has developed a groundnut digger, which helps in digging out, uprooting and cleaning the ground nuts.

His father is a retired school teacher while his mother is a house wife. Other members in his family include his wife, son, brother and sister. Talking about his childhood, Sanjay mentions that he could not do well in studies in higher classes due to lack of guidance in his village. He later went to Junagadh where he completed his B. Com while doing occasional jobs to take care of his expenses. In 2003, after his graduation, he returned to his village and engaged himself in farming. After a few years, he got restless and started planning to deal in agricultural machineries. Later with financial support of a relative, he started his firm Akshar Agro Engineering in Rajkot.

### Genesis

Sanjay has five acres of cultivable land where groundnut is grown mainly. While working in the field he observed the difficulties faced by farmers to dig the groundnut. He often used to discuss with them about these. The main points that came out of the discussions were high labor cost and lack of availability of labor, which would result in huge losses. It was sometime in 2007 that Sanjay decided to develop a device to dig groundnuts. Initially, he made a hand operated plough but its efficiency was quite low and was labour intensive as well. Then he developed a tractor operated plough using which he observed that the groundnut pods got broken or were left in the ground. We agin went back to the farmers with all his learnings and had discussions with them. Working persistently, he was able to develop a prototype in 2009. After its trial, he just had to add two wheels under the

conveyor for vibration and the machine was able to do what it was designed to.

He mentions about the testing period of development that it was important for him to believe in himself and his concept even though the results were otherwise. His elder brother and one of his friend were instrumental in supporting him by sharing their feedback and suggestions.

The Groundnut Digger

This is a tractor mounted PTO powered machine with a telescopic propeller shaft suitable for tractors of 35 HP and above to dig out and uproot the groundnut.

Groundnuts are uprooted from the soil with the help of the harvesting blade (V shaped) of the machine. The blade has been hardened by treating at very high temperature in oil and can work in different kinds of soil. It has an adjustable width and penetration angle can be varied. The uprooted groundnuts are conveyed from ground level to a a higher level for collection using a conveyor belt. The belt keeps vibrating as a result of which the pods get cleaned of the attached soil. Opening the collection box forms the spread bed of groundnut for drying. As the machine is heavy, wheels have been provided at the rear to reduce the load on the tractor. Though the productivity of machine depends on the type of the soil, but on an average the machine can harvest about 3 to 4 Veegha (0.4 Acre) per hour.

In comparison to other alternatives, this machine not only mechanises the digging but also undertakes cleaning and drying as well. Other alternatives commonly used are single offset beam digger and the manual pulling of groundnut. In the latter, three to five persons are required for pulling out plants, which have been dug and additionally other process such as cleaning (removing soil from plants) has to be done manually. In the single offset digger, digging is done mechanically and subsequently, the pods are collected manually. This machine saves considerable labour, operating time and cost of operation compared to conventional methods. Moreover, this one machine can be used in different kinds of soil. The testing of the device was done at CAET, Junagadh Agricultural Univesity, Junagadh where the results were found to be appreciable.

A Farmer to An Enterprenuer

Sanjay has started selling the ground nut digger and has managed to sell a few units. It seems to have good potential in the market as per the feedback of both the farmers and experts. While working on the ground digger, Sanjay also realised that as this machine had a season based demand, he needed to diversify. This made his develop another innovative tool – the reversible ploughs, which are also attached to the tractor. He has made different models of these ploughs viz. manual, machine, hydraulic operated and a fgew more. He started selling them few months back and has managed a decent sale since then.

Presently, Sanjay is actively engaged in fabricating and improving the digging machine, which he plans to make suitable for multiple crops. He also keeps a dream to become a successful businessman selling different agriculture devices so that farmers can have access to good quality machines at a reasonable price.

## Natural non-stick earthen utensil

Jentibhai Nayak, Desingbhai Dhanak, Raghubhai Bhil
**Dhanuka, Nayak and Bhil Community**, Parts of Gujarat and Madhya Pradesh

The use of non-stick cooking ware is traditionally considered as an urban prerogative. Who would image that rural communities in our backyard would be using non-stick coating on their earthen ware and doing it naturally. Strange but true! Members of Dhanuka, Nayak and Bhil community from Chota Udaipur region of Gujarat and nearby areas in Madhya Pradesh have been traditionally using lac to coat their earthen utensils.

Ambala, in Chota Udaipur, is among the few villages known for lac coating of earthenware making them suitable for making chappatis and better cooking of other food. Other villages of Gujarat where this tradition of lac coating can still be found are Devhaant, Kharkhad, Teemla, Bodgaon, Rangpur and Kanalwa and in Madhya Pradesh mainly in Chandpur and Khandala villages. Lac is used so that oil does not get absorbed in the earthenware. This way it uses less oil and ensures that the surface of the pot or the pan stays hot. It also prevents the surface from being scratched or damaged while scraping the food. Lac is obtained from the secretion of an insect *Laccifer lacca*, inhabiting the Pohim tree. The lac obtained from this tree is shiny and long lasting. Lac generally contains resins (70-80%), sugars, proteins and soluble salts (2-4%), wax (4-6%) and other extraneous matter (9-14 %). Scientific evidence proves that it is non-toxic. NIF also got the toxicity tests done, which prove it is non-toxic.

To make these utensils, only a particular kind of clay is used and only four or five types of earthen utensils are made like *tava*, *kadhai* etc. The process of coating is quite simple. The raw lac is added to water and brought to boiling twice. This makes the solution homogenous enabling lac to be spread uniformly on the pan, which is heated before application. Upon cooling the lac sticks to the surface of vessel, which can then be used for cooking. To make pots and pans, the people interestingly use moulds i.e. existing clay pots and pans. They do not make their earthen ware on a potter's

wheel. In fact, the clay is spread inside an existing pot and allowed to take the shape of the pot.

There are about twenty households in the village Ambala who practice this art. Every household sells around 10-15 pots every month earning about INR 1000 per month. The women normally make the earthenware while the men try to sell them in town markets or in other villages. The sand is brought from the nearby Orsang river. The sand from the river bed is very fine and gets exported to other countries too. The lac is purchased at INR 1000 per kg from places like Chhota Udaipur (Gujarat), Zoz (Gujarat), Kathiwada (MP), Alirajpur (MP). They need about 10 g of lac for medium sized pans and pots. For the large pan they require about 40g of lac costing 40 rupees. If purchased from the maker's house, the large pan is priced at 100 rupees while the smaller pan and the pot are both priced at 60 rupees. However, the price is more when the men go for door-to-door selling since transport costs and the drudgery involved in taking the fragile pots to faraway places have to be accounted for.

The economic condition of the villagers is not very good. Apart from the lac coated earthenware, they have very small farms holdings and meagre income. The diffusion of these pots can raise the living standards of these villagers enormously.

## Windmill powered water pump, modified stove, hybrid tractor and others

**Bharatbhai Agrawat**
Junagadh, Gujarat

Bharatbhai (47) runs agricultural equipments workshop. Despite having studied only till only class tenth, through sheer hard work he has achieved a lot of respect and admiration of people because of his innate creativity. He is a serial innovator who has developed many useful tools, devices and implements. He derives inspiration for his work from his father, Amrutbhai Agrawat, himself a well-respected innovator. His father was a *pujari* in temple and used to do machine repairing in his village. He then started making doors, boxes for granaries and iron gates. Bharat started helping his father in repairing items since he was in 6th standard. He is an environmentalist and understands the need of utilizing natural resources to generate energy in an efficient and eco-friendly way to power different applications or optimally use existing resources.

The early beginning

Bharat first participated in children's fair when he was in 4th standard and displayed a clay cow made with the help of his father. Later he made a rotary chair, sofa which were miniature models made from metal at their own workshop. While in 7th standard he made a modified sprayer pump model with help of his dad using a gas stove used in their kitchen. Bharat was an average student at school with more interest in machines and fabrication than in studies. He was so dedicated that every morning he used to visit the workshop in the morning, open it, do the morning *pooja*, and assign the work to the workers and then leave for school. Even his friends were also very supportive and used to assist him during his late night working hours, a favour which he used to repay by working on their farms.

Working with his father and their discussion around creating sustainable solutions added immense value to Bharat in his earlier working years. It was basically the Aaruni bullock cart (Innovation by his father – Amrutbhai) experience, which helped him develop technical expertise and innovator mindset. In 1986,

drought forced him to look out for work as a welder in a firm for six months, that's where he learnt the art of welding. This work also taught him about modern and heavy machines. He also worked at RCC water tank construction site with a government contractor, who was his friend.

The family as whole has been very supportive of the creative spirit of Bharat and they used to celebrate every time there was a breakthrough or success story for any innovation. Currently, Bharat lives in Keshod in a rented house where he moved 6 years back primarily for children schooling and their bright future.

Windmill powered water pump (1999)

The windmill drives a compressor, which sends a charge of compressed air into the bore well. The air charge is released near the bottom of the shaft, underneath the water pipe. The air charge pushes up the water through the pipe to the surface. He developed a model of water pumping windmill, which was provided to a voluntary organization working on environmental issues in Surendranagar district.

They tried out the windmill and found a water discharge of 50,000 - 60,000 litres in 24 hours. Based on their recommendation, last year, a private salt farm owner purchased and installed a two cylinder windmill. Satisfied with the performance of the windmill, the salt farm owner has ordered for an upgraded four cylinder version to be installed adjacent to the two cylinder model at his site in the Kutch salt farming region.

Rolarmadh (2000)

During sowing in the field, there has always been a problem of harsh soil clots being separated after the first round of tilling. It makes the land surface in the farm uneven and hard and thus, it causes lot of problems for both farmers and bullocks to walk and work smoothly. Bharat developed an instrument 'Rolarmadh" to address this problem. It is a bullock drawn implement and consists of a drum on which several pegs are attached. These pegs are helpful in breaking the hard soil. The drum rests on two wheels for moving the implement to different locations. Using this tool farmers and bullocks can easily do their work in lesser time and with reduced drudgery. The

implement has been used widely in the Saurashtra region of Gujarat.

Lemon Cutter (2001)
Picking lemons manually from the plant has always been problematic because of the sharp stings on stem and branches. Removing the fruits by beating the leaves and fruits with sticks damages the plant and breaks its branches at times. Lemon cutter is a hand held implement, which has a PVC pipe with adjustable length and scissors fitted at the cutting side, which work with the help of lever. When the lever is pulled at far end, it makes the scissors to work and cuts the lemons. This makes plucking lemons easy, safe and less cumbersome.

Modified Wooden Stove (2001)
Traditional wood stoves, by virtue of their design, do not optimally use the heat generated and also emit much smoke and pollutants due to incomplete combustion. Bharatbhai fitted an exhaust chute to a wood stove and noticed that a lot of heat was still coming out, which made him infer that non-utilization of heat was the major fault in existing wood stoves. He decided to solve the problem by facilitating better heat utilization through sufficient air supply and a correct channel for burning. To improve it further, he developed a mechanism for simultaneous heating of multiple vessels using the same heat source. Bharatbhai made the first model of this stove in 1999, then after a few modifications, he came up with this multipurpose stove, which two multilevel burners and a single fuel feeding point.

The stove consists of two chambers, each with a burner for cooking, and a geyser for heating water. Both burners can be used simultaneously, saving time and using the heat effectively. The heating chambers are oriented at different levels in order to be able to completely utilize the heat energy produced connected to a chimney, which provides part of the draft. Inside the main chamber, mud has been used as insulating material to retain the heat. There are air vents on the sides of the first chamber to allow cooling of stove so that it is not too hot to touch for the women/men using it.

Groundnut Seeder

Groundnut seeders are attached to a plough shaft and seeds are fed through a pipe and delivered into the ground while the soil is ploughed so that it covers the seed. The earlier groundnut seeders would get clogged with wet soil and the seed would not be delivered. The innovation is structured in such a way that while the ploughing and seeding takes place, the flow of the soil does not clog up the delivery hole and a lot of time is saved. The device is being sold locally on demand.

Hybrid tractor

Conventional tractors available in the market are built using a 4-wheel chassis and are rear-wheel driven. While a rear wheel design is the norm as a far as the larger HP tractors are concerned (> 35 HP), the same design is also being used by the various manufactures in Saurashtra that are developing small 10 HP tractors.

Bharat has conceptualized the design of a tractor built on a 2-wheel chassis, which essentially forms the front wheel. It can be attached with a 2-wheel frame for fixing farm implements or a 2-wheel trailer, depending upon the purpose for which the tractor is to be used. The tractor, therefore, will essentially be front-wheel driven. Either trolley or santi (digger) attachment having two wheels could be joined to the tractor.

Future plans

NIF has helped set up a community fabrication workshop at Amrutbhai's place for the grassroots innovators' of the region, which Bharat also uses occasionally. He is also working on power generation through the windmill and experimenting with other forms of renewable energy to develop sustainable solutions. In his pursuit of his work, this is what he has to say, "*Jis rah pe chal pada hoon, ussi rah ke kadamo ke nishan kisi kerah ki manzil ban jaye*"

## Modified rickshaw and others

**Kanak Das**
Morigaon, Assam

Kanak Das (37) is a seasoned innovator from Assam whose mind just does not stop ticking. He is open to taking up challenges and enjoys being left alone with problems to work on. He has been working on a number of things, which include a self charging electronic bicycle, rickshaw with gear, low cost power tiller, and a bicycle, which can make use of the bumps on the road to move faster.

Having lost his father at an early age, he was brought up by his mother, who also passed away when he was in mid twenties. Due to testing circumstances at home, he could not complete his studies and had to work to earn a living. But that did not prevent him from obtaining a good understanding of science and technology. Much of his understanding of science comes from watching science based programs on the Discovery Channel on television. His special liking and area of interest is application of waste energy for useful purposes.

A calm and quiet person, Kanak Das also enjoys singing, playing tabla and cricket. He lives alone in a small house with tools and junk parts lying all over the place. He keeps a small diary in his pocket in which he notes down whenever an idea strikes him. Given his financial state, sometimes, making the choice between food and components for his new idea, becomes difficult. Many other times, he does not even have such a choice. However, his constant endeavor has been to make the everyday life of common people better by making small improvements.

Modified rickshaw with gear

Conventional rickshaw is difficult to pull over inclined terrains. Kanak Das has made a modification in these rickshaws by incorporating a gear, making them easier to pull. In addition to the normal sprocket of 44 teeth, another with 27 teeth is attached on the same axle. There is a clutch mechanism between the sprockets.

By pressing a lever on the left handle, the puller/operator can change the speed and torque thereby. The innovator claims that regular rickshaws don't have a gear system due to maintenance problems. However, the gear system developed by him is easy to install and maintain.

Kanak Das has modified one such rickshaw, which he has rented out to a puller on a daily basis. Seeing the advantages of his rickshaw, a few other pullers have expressed interest in it. The concept may have other applications as well for example in bicycles, especially by those who carry heavy loads like milk men. NIF has filed a patent application (496/KOL/2011) in the name of innovator for the same.

Bicycle that comes out faster from a bump

Bicycles continue to constitute a major means of transport by poor people in rural and urban areas. Given the uneven nature of roads, the rider on a cycle becomes very uncomfortable. Kanak Das had an old cycle, which required lot of effort to ride. He purchased a new cycle with a shock absorber, but he still wasn't satisfied. The major concern he had was that, the energy absorbed by the shock absorber was wasted. On August 15, 1999, an idea struck him about using the energy wasted in shock absorbers for propelling the rear wheel so as to supplement the pedal function. When cycle bumps on an uneven road or undulating terrain, the force induced by the bump and rider's weight is stored in a battery of six springs attached under the pedal. In the first prototype, there was a problem with reverse pedaling. It was overcome by designing a new model. Kanak Das's cycle would not slow down after bumps as conventional bicycles do. It would accelerate after every bump because of its ability to convert vertical movement due to bumps into horizontal propulsion. Kanak Das won a National award in NIF's 2nd National Award ceremony in 2002 for this bicycle.

Though the idea still holds great promise, it could not be commercialized yet due to the lack of interest shown by bicycle manufacturers. NIF is willing to discuss possibilities of technology licensing with an interested entrepreneur to take this idea forward. A couple of years ago, a few MIT students also claimed this idea to be theirs to which NIF put up a strong objection to.

E-bike

Having utilized the energy generated by shock absorbing springs for propelling rear wheel, Kanak wondered whether he could if change batteries also with this energy. In his E-Bike the energy dissipated in the shock absorbing springs below the seat is used to charge the battery. This charge is then used to propel the cycle. The concept is innovative as it is a novel attempt to recharge the battery by using rider induced and terrain induced forces on the bumpy road. However, as of now the efficiency is not as desired hence further research is being undertaken.

Kanak Das has made many improvements in the rice mill also. He has attached a blower to separate chaff from the grains after milling. He has also designed a low cost power tiller and a paddy transplanter machine and keeps on working on ideas of different kinds that come in his mind. Fighting poverty and solitude, Kanak Das has kept himself motivated by thinking of problems of the people and ways to solve them. Such ideas give him company and help him tide over the many somber moods and phases in his life, which tend to bog him down.

**Soil scrapper cum loader**

**Resham Singh Virdi**
Hanumangarh, Rajasthan
and
**Kuldeep Singh**
Mansa, Punjab

Uneven agricultural land is difficult to sow. Sometimes it also becomes important to remove extra soil, which may have deposited on the surface after rains. Resham Singh (56) and Kuldeep Singh (52) have independently developed machines, which could not only scrap soil and level the land but also fill tractor trailers with the scrapped soil. The machines are tractor PTO operated which take one and a half to two minutes to fill a 11 ft x 6 ft x 2.25 ft size trailer consuming about 5-6 liters of fuel per hour.

Hailing from Faridkot in Punjab, Resham Singh has a farm equipment and machinery workshop in Hanumangarh, Rajasthan where he shifted after his father's death. He studied till class tenth and thereafter took admission in ITI but could not continue due to poor financial conditions. He started working as a mason, tried Punjabi poetry for a while as well and then settled as mechanic/ fabricator. He has his wife, two sons and a daughter in his family. Prior to the soil scrapper and loader, he had made a cutter and bending machine for sheets and rods for which he was awarded by the then collector of the district on Republic Day in 2006.

Born in a farmer's family, Kuldeep Singh grew up to be an expert mechanic and a fabricator. Though he has studied only upto class tenth, he has great sense of technology and the science behind it. As a child he was never interested in studies, and machines were a constant distraction. In early 1980's his family felt the need to have a harvester combine but due to its cost, it was beyond their reach. Kuldeep took it as a challenge and developed the harvester combine, which they also rented it to other farmers. He also has a wife, two sons and a daughter in his family.

Genesis of the innovation

In Hanumangarh, during monsoons, a lot of soil gets deposited in the farms, which raise the height of the

field. This soil level difference makes getting canal water difficult. Hence soil needs to be scrapped to bring the level to the original or below it. Depending upon the quantity of soil, this task is generally undertaken by a tractor mounted land scrapper or a JCB. Leveling and loading in case of land scrapper is cumbersome while costly in case of JCB. Resham Singh, who was known in his area for his expertise in making new and innovative machinery, was approached by a farmer in 2009 to develop a land leveling machine. He took up the challenge and could develop the machine as per the requirements in a few months' time.

Kuldeep was not able to sow his 40 *bigha* land as it was very uneven. He first tried to level the land using tractors but even after incurring much expenditure, he did not get satisfactory results. Using labour would have been quite costly. This made him think and he decided to develop a land leveling machine. He started working on it in 2005 and finished it in 2009 after continuous work and improvement.

The land leveling and soil loading machine

Resham Singh's land leveler cum loader is a tractor PTO operated machine, which scraps and collects soil/sand from the land surface through a scrapper blade and fills it in the tractor's trailer through a conveyor arrangement. It can cut 4" deep at a time and takes about one and a half minute to fill a 11 ft x 6 ft x 2.25 ft size trailer (it sometimes takes less than a minute if the soil is not hard). It can be attached to any tractor of 50 hp and above. With this machine, tractor consumes about five to six liters of diesel in an hour. The machine has cutting width of 4 ft and sand is dropped from a height of 8.5 ft height.

Kuldeep Singh's land leveler cum loader is also a tractor PTO operated machine with the same function as above. It can cut 3" deep at a time and takes about

one minute to fill a 11 ft x 6 ft x 2.25 ft size trailer (less than a minute if the soil is not hard). It can also be attached to any tractor. About five to seven liters of diesel is consumed in an hour by a tractor with this machine. The machine has cutting width of 3 ft and sand is dropped from a height of 8 ft height. It is claimed that on an average both the machines can level about 1 bigha of land (5 acre) in a day.

While Resham Singh has sold forty machines in Hanumangarh and nearby areas, Kuldeep Singh claims to have sold over 200 machines in Punjab, Rajasthan, Haryana, Maharashtra and Gujarat. The machines are of great help to farmers as they can level the land and fill sand in the trolleys, which can then be sold in the market.

## Tree climbing device: the innovator who climber very high

Late MJ Joseph alias Appachan
Kannur, Kerala

The first thing that comes to the mind when one imagines Kerala is the ubiquitous coconut tree, and why not, Kerala literally means the land of the coconut palm. Kerala and coconut trees have been much in the news together just a couple of years ago. Not any problem with either the tree or Kerala but with the coconut climbers. Traditionally professional climbers (*thandan*) have been engaged by coconut farmers for harvesting. With time the choice of profession has also changed. It has become quite difficult to find such climbers for the farmers. As imagining life without coconut is impossible, the only option available is to find a way to climb the coconut tree. An innovative farmer from Kannur imagined this problem coming almost a decade and half ago and developed a coconut tree climber.

M J Joseph alias Appachan was a school dropout but an innovative farmer. Though Appachan could not get much formal education, he had the gift to learn from his surroundings. His first invention was an instrument that could squeeze coconut milk and juice from fruits. It could not gain popularity, as the instrument was expensive. He tried several other innovations also but most popular of them even today remains the tree climber.

The palm climber consists of two metal loops that are meant for holding the legs. They have a handle on the top for hand grip and a pedal base at the bottom. The loops are put around the tree trunk on the opposite sides. Loop on either side is lifted up by simultaneous movement of the hand and the feet. By such alternate motion, one can easily climb a coconut tree in minutes.

This simple and easy to use device to climb up or down coconut palm, arecanut or other similar trees is handy for people untrained to climb up such tall trees, swiftly

and with ease. It can be very useful for even trained people. They can reduce drudgery, and climb faster using lesser energy. It can be used for gathering nuts or spraying pesticides. It can also be used to climb electric poles with some modifications.

Appachan and his tree climber bagged a prize in the farm implements category in the Second National Grassroots Technological Innovation and Traditional Knowledge Competition, organised by National Innovation Foundation (NIF) in the year 2001-2002. The utility of this device attracted Kevin Davies, a distributor of new products in USA to place an initial order of 25 units. "The device worked perfectly. I climbed a 40-feet coconut tree very quickly and safely. I am impressed", he wrote with satisfaction. He infact, offered to be its distributor for North and South America. Coupled with some basic safety devices like a harness, this device makes climbing up a straight - trunk tree or a pole quite quick, easy and safe. The device, with no sophisticated technology has not only been well accepted in US, but also achieved whopping success back home (Para courtesy: Honey Bee, 17(1) & (2): 14, 2006).

Appachan had a workshop, St Mary's Engineering Works, where he used to manufacture tree climbers. While he was alive, NIF facilitated sale of his climber to customers in USA, Maldives, Thailand, Australia, Brazil, Mexico etc., and is still trying to help his family expand the business. After his demise this work has been carried forward by his wife, Salliamma. His other family members are also manufacturing this tree climbing device. Some other agencies have tried to copy this climber without giving Appachan's family any royalty or compensation. One an average the family manages to sell about 600 tree climbers every year. Salliamma recently got a few inquiries from Maldives, Malaysia and Philippines. 100 tree climbers have been dispatched to Maldives and order of another 500 is expected soon. Appachan's contribution is not only in innovating this particular tree climber but also inspiring a whole lot of people to improvise, innovate and come up with their own versions of the same. Prominent among them are innovators, Mushtaq Ahmad Dar of Jammu and Kashmir who has developed a smaller pole cum tree climber and DN Venkat of Tamil Nadu who has developed a seating type tree climber.

## Manual Paddy Transplanter

**Ranjit Mirig**
Sambalpur, Orissa
Scout: Himanshu Shekhar Sahoo

Facing labour scarcity for transplanting paddy seedlings in the field, Ranjit Mirig (60) developed a manual paddy transplanter to do the same. He developed the first prototype in 1986 and kept on modifying it till he could develop a successful model in 2008. Facilitated by NIF, the transplanter has been further modified with the help of IIT Kharagpur.

Ranjit Mirig was born in a poor Dalit farming family and could not study much because of financial problems. In 1986, after many years of having troubles in dealing with farm labourers for rice cultivation, he decided to make machine that can help him be independent. He was tired of labour costs, difficult labour management and unfair demands from labourers. He started work on a paddy transplanter then. It took him over 25 years to come up with a satisfactorily working model and the journey has been tough. In one of his poetic moments, he says,

*"Panth hai pathreela, jaana hai door.*
*Pau ka chala gir jaaye per jaana hai zaroor."*
(The path is rocky, the destination is far. My feet may hurt but I cannot stop.)

When he started working on the paddy transplanter, he could not believe that Indian scientists had sent successful space missions but no one had been able to make a proper paddy transplanter for Indian farmers. This inspired him to work on this problem. He says that often he was so lost in his work that he would forget to eat or sleep, almost have accidents on the road, and sometimes his wife would be angry with him for not drinking his tea while it was still warm. A couple of times, he recalls, the tea would go cold and flies would drop into it; when his wife got angry, he would simply pick out the flies and drink the tea.

The paddy transplanter machine

The manual paddy transplanter requires two persons for its operation. One person is needed to pull the machine while another for cranking the handle in order to provide drive to seedlings' trays and fingers, which place the seedling in the soil bed. The machine can transplant five rows while maintaining row to row spacing of about 18 cm and plant to plant spacing of about 15 cm. It has a field capacity of 0.3 acre/h. When tested at IIT Kharagpur, which NIF facilitated, it was found to consume less than one-seventh of the time required for manual plantation and double the time needed by a self propelled machine to cover the same area.

The conventional way of transplanting rice seedling requires standing in water for a long time, leading to skin infections. This innovation significantly lowers the time required for transplanting rice seedlings. Since labourers need to stand in the water for a shorter time, it reduces chances of getting skin infections.

Ranjit Mirig hopes that this machine will alleviate Indian farmers' problems and bring happiness to them. He also wishes that his younger generation skips the pain and suffering that he had to go through. He wants his grandchildren to take the machine forward. And his doting grandchildren are very enthusiastic about it. All of them have contributed in their own small way to get Ranjit where he is today.

He is grateful to his family for supporting him all the way. He first wife, who passed away over a decade ago, never complained about him spending long hours working on the machine. His current wife has been very supportive too. His children and grandchildren are proud of him. But he has painful memories of how

the villagers treated him, calling him crazy and often ostracising him. He does not feel that perception has changed much even now. Although locals have started hearing about his accomplishments, they still don't acknowledge him and spread rumours about him. After a slight grimace, his face beams again as he announces, "As much as people have wronged me, God has done me right!" He believes the biggest proof of this is the respect and recognition he has found from all corners.

## Innovative Printer Head for Golden Embossing

**Ravindra Chopade**
Mumbai, Maharashtra

Ravindra Ganpat Chopade (41) owns a printing shop and has modified/developed three different kinds of printers for golden printing and embossing.

He was born in Nanded but moved to Mumbai with his family when he was about 3 years old. Since they arrived in Mumbai in the year 1972-73, the family has stayed in Powai, a locality in Mumbai suburbs. He has witnessed his house walls transform from wood to aluminium and then to brick wall. Living in a slum at Gokhale nagar of Powai, Ravindra's biggest wish is to own house someday. His motivation to create an identity for himself has driven him so far in spite of difficulties.

The early life

Ravindra's father initially worked as a social worker and also supported local politician in writing speeches. He also sold vegetables, fruits and fruit juices to ensure a steady income for the family. Later he secured the job of a security guard at IIT, ensuring a steady monthly income for the family. Few years later, his mother also got a job at IIT in one the ladies hostel. His brother and sister are well placed. His wife takes care of his house and both his sons, who are school students.

While, his mother and wife have always supported him in his ventures, his friends were not too convinced in the early phases, but have now started to appreciate his efforts. Though his mother was supportive she always stressed steady income into the family before investing in research and development activities. His wife who generally does not visit his shop or enquire about his machines makes it a point to visit and oversee whenever there is positive development in making of the machine.

Ravindra failed thrice in 6$^{th}$ class before deciding to quit studies and focus on his passion for developing new

ideas. His interest in electronics led him to pursue Electrical fundamental course and Electronics fundamental course initiated by IIT for their workers' children. It was during this time that he developed his first machine, a manual motion picture machine. However, he always regretted not being able to complete his basic education and so appeared to 10th class examination but unfortunately did not succeed.

Ravindra worked for about twenty years in various capacities as a video librarian, as a driver and at TV repairing and other electronic shops. His IIT certificate helped him in terms of basic knowledge and also gave credibility during employment. Later, he decided that he would start his own business of Xerox for IIT students. He secured a loan of 3 lakhs, under Mahatma Phule scheme of Government to set up a shop at IIT Hostel No. 12 for xerox and printing business. However, the business was not successful due to limited customers and in one and half years he shifted his location to Powai market area, outside the IIT gate.

Genesis of Innovation

When he shifted to the new location, he faced stiff competition from other stationery and printing shop owners. They started charging higher prices almost double for his binding assignment and since Ravindra did not have binding machine he was forced to comply. But determined to turn his venture to success he purchased a second hand manual machine for binding and golden embossing. While his business increased, problems of labour forced him to creatively think about automisation of embossing machine. Even today he dedicates his innovations to these unsupportive people who forced him to be self sufficient and speedy to beat competition.

As burden of work of embossing was increasing day by day, Ravindra was searching for alternatives of conventional punching type method for doing golden embossing. He thought of some computer operated

machine, which can perform embossing but he didn't find such device in the market.

One day, while he was repairing the wire of the speaker by soldering iron, a golden foil was lying near him. He kept the golden foil on the leather and wrote his name with soldering iron on it and found that his name was embossed in golden fonts on leather. This gave him the idea to search for a pen which could do golden embossing.

Ravindra first experimented with a soldering machine and foil on a piece of rexin. When he saw this experiment being successful he searched on Google for existing machines and found that one machine, a plotter of company named Graptek could be used for his purpose. However he could not find an old machine and new was expensive for him to purchase. One of his dad's friends helped him locate one such machine for his research and development purpose.

Machine 1

In the first machine soldering iron tip has been replaced with a ball pen tip and fixed on the Graptek machine. A sheet of foil is placed over rexin and the pen is used to imprint desired content on the rexin sheet. Since the Graptek machine was old and had some errors he purchased a vinyl cutting machine and started his further research and development work on it. Later the old Graptek machine was disassembled and parts used for R&D. The vinyl cutting machine was successfully modified made into a golden embossing machine. This machine had FIXE software, which provided the filling effect option, which proved instrumental in giving depth to the content embossed on rexin or leather. This machine was converted into completely self assembled flat bed machine in the year 2003. The current model has been completely built from scratch by him.

Machine 2

The second machine was initially developed in the year 2006-07. This machine can be used as an attachment to any printer. The machine traps and uses the heat of the ink on the paper. The foil rolls over the paper as it

passes out of the machine and the ink is super imposed with gold from the golden foil rolling over the paper. The attachment supports content up to 1200 dpi. This is a very good machine for golden embossing on any paper. Also, since it comes as an attachment it could be a suitable product in the market.

Machine 3

In the third machine a dot matrix printer is used for golden embossing. The innovator experimented on about 15 - 20 printers before finally arriving at precise measure of specific heat and punch required to achieve the best results. At one point of time he had 22 credit cards, which he used to purchase machines on credit. He accumulated massive debt, which he eventually cleared with great difficulty. This machine has been built by modifying the Epson dot matrix printer and anything up to 100mm, book, paper, leather, rexin, PVC and cards can be embossed. The machine cannot emboss on metal.

Future plans

Ravindra plans to launch all the three machines in the market either by starting his own venture or under royalty arrangement through bigger enterprise. Commercialisation of his innovations is the key focus for him in near future. He is also planning of developing another machine which can be used to print on ribbons.


Smt. L. R. T. College of Commerce, Akola

(2008-2009)

PROJECT REPORT ON

"the scope of entrepreneur in the field of interior designig"

A project submitted to the
Sant Gadge Baba Amravati University, Amravati
In practical fulfillment of the requirement for the

"Degree of Master of Commerce"

Submitted By

Miss. Sarita S. Chitlange

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## Auto rickshaw suitable for lower limb physically challenged

**K.S. Sudheer**
Thrissur, Kerala

K. S. Sudheer (52), an auto rickshaw driver from Thrissur, has come up with an auto rickshaw for physically challenged.

Sudheer was born in a farming family and had seven siblings. Their childhood was spent fighting poverty and makng ends meet. As a result he could not study beyong secondary level. But he always had this strong inclination towards electronics and automobiles since childhood and he regularly used to participate in science fairs. All toys he played with were made by him using scrap. When he grew up, he tried to make a career out of photography at Mumbai where her sister was based. But not being able to adjust to the place, he came back to Kerala and bought an auto rickshaw. He also opened a small workshop at his home. He got married and has two grown up sons, who are studying. The workshop gave him an opportunity to hone his mechanical skills and he kept on experimenting with one thing or the other.

Genesis of the idea

Once during an auto strike in the city, Sudheer noticed a couple facing problems in taking their physically challenged son to the hospital. He thought of the boy had an option, his parents would not have had to face so much problem and he would also have been self-dependent. Sudheer also recalled discussions with a physically challenged friend of his, who lost his lower limbs in an accident and had desired for a device or a system, which could make him independent. This gave him an idea to modify the existing auto rickshaws so that lower limb physically challenged persons can also drive them.

He started actively thinking about the same in 2009 but did not have much clue to begin with. Due to his schedule, he could only spend time on Sundays. Not being able to get any breakthrough for over seven months, he stopped all work in frustration. However, the local handicapped associated egged him up and

he restarted his work. After a lot of hit and trial and moments of anxiousness, he was finally able to come up with a working model in 2010.

The Modified Auto rickshaw

Sudheer has modified the auto rickshaw by attaching the brake assembly to the steering bar through a hydraulic cylinder. The lower limb physically challenged driver only has to press the steering downwards to apply the brakes.

While in certain cars, hand operated clutch, brake and accelerator systems are available but in auto rickshaws such systems are nto available. Incorporation of this system provides mobility to the physically challenged and also gives him another livelihood option.

Sudheer launched the modified auto rickshaw in 2011 in a function organized by the Handicapped Asociation, Thrissur and the District Social Welfare Department. He received positive feedback fro many present on the occasion. Sudheer since then has been using this modified assembly in his rickshaw. Seeing the potential of the device, NIF filed patent in the name of innovator (1123/CHE/2011). Sudheer already has received many orders but is waiting for the patent to be granted. Efforts are also on to get it tested and certified by regulatory authorities.

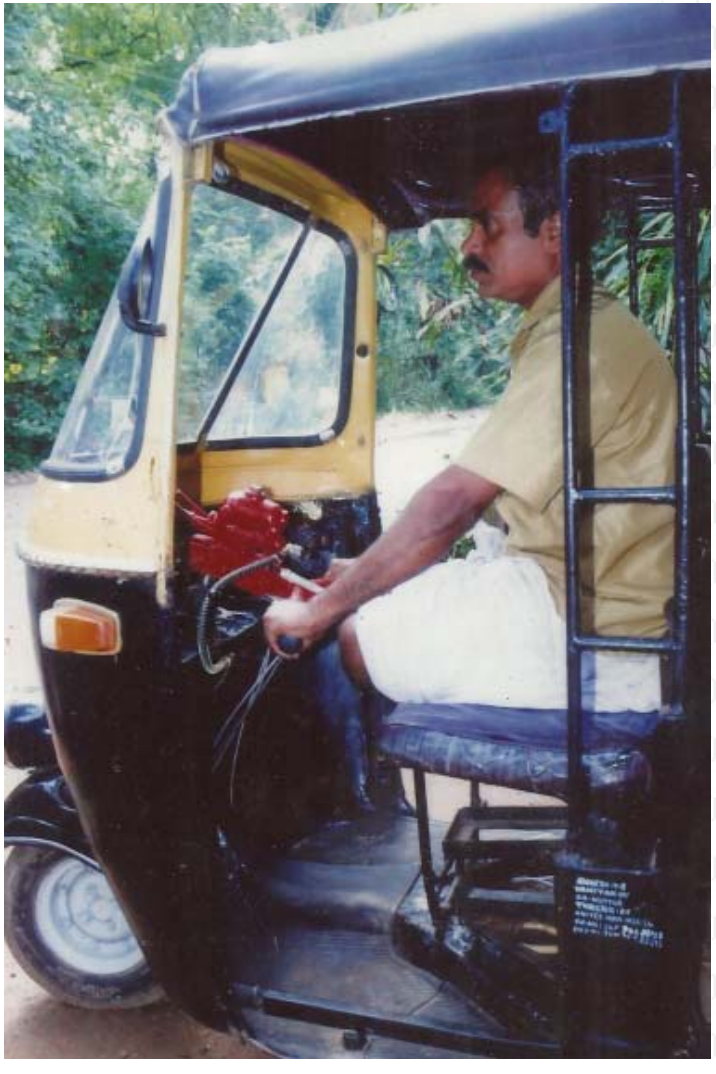
Other ideas and the way ahead

Sudheer is a social innovator and all his innovations try to address one or the other problem of the society. Earlier, he had developed the side stand gear lock system for two wheeler for which he was appreciated in NIF's fourth national award function in 2007. This gear lock system is a retrofittable kit consisting of a clamp, which restricts the engagement of gears when the side-stand is not removed. He also developed a coconut husker and a modified chimney.

Much has been written about his work in local news papers, apart from some national ones like The Hindu.

He has participated in a number of engineering exhibitions as well in Kerala and neighbouring states.

Sudheer wishes to start an enterprise based on his innovations. Perhaps, then he believes he may have more to concentrate on his innovations than now, as he has to drive auto during the weekdays. He is also waiting for his sons to settle down before starting out with his own venture as financial risk is involved in it. Sudheer is a determined man of many talents who has not lost his smile after many years of hardship. A self made man, he faced all challenges with tremendous grit and determination.



## Raman Deep Eco Hamam

**Durlabh Singh Puri**
Solan, Himachal Pradesh

Durlabh Singh Puri (55) is a photographer and an innovator. He has modified a *hamam* (water heater) such that one can get warm water at different temperatures.

Born to an engineer in Punjab Irrigation Department, Durlabh was an average student with an interest in science. While television and radio were his childhood fascination, he also had interest in electronics, gardening, photography, painting, listening *ghazals* and classical music. Since he had a good technical sense, his friends and even teachers used to take his help in case there was some problem in any instruments in the science laboratory. He had drug reaction when he was in class 10 due to which he developed some issues with his vision in his left eye and also had to be bedridden for a year. Thereafter, he joined ITI and started working in a repair shop. After a year, he started a workshop of his own. Meanwhile, he also developed interest in plants and environment and attached himself to various environmental initiatives. Due to a spondylitis attack he could not continue his workshop and took up photography, his childhood hobby as the profession. In his family, he has his wife who is a teacher and a son, who suffers with cerebral palsy.

Genesis of the innovation

The innovator lives in a cold region where warm water is required for daily use. His family had a conventional *hamam*, or water-heater, which used wood as fuel. Watching smoke escape from the burning wood made him aware of heat wastage. His innovation came out of his experiments on the *hamam* to use this heat efficiently. He named the innovation after his son Raman Deep as *Ramandeep Eco Hamam*. The phrase "Eco" is used as the device is fuel efficient and produced less smoke.

Conventional *hamams* get damaged very soon and a lot of energy gets wasted as well. Every year or two, either a new one has to be purchased or the top portion needs to be replaced. To address this problem, he modified the hamam by removing the top portion and using aluminum sheet instead of iron sheet. One day when *hamam* was being used, he forgot to remove a four litre water container he kept on its top. After half an hour while draining out hot water, he realised that he had got additional four litres of hot water without extra effort or cost. This triggered him to utilize the heat otherwise going waste.

In his attempt, he removed the aluminum cover and placed a ten litre container of water directly on the top of *hamam*. But instead of heating the water, the fire got extinguished as the air flow got blocked. The *hamam* had to be lit again. A metal ring was kept on the *hamam* and sides were punched to ensure better air flow. But for refueling, still, the container on the top had to be removed, which was cumbersome. A window was then cut for refueling but that led to the escape of flames to the outside and loss of heat. Then instead of the window, a door was used, but then complete combustion was not taking place and a lot of smoke was being generated. He kept on addressing one issue after the other and modifying the *hamam* till he was satisfied with the output.


The Raman Deep Eco *Hamam* (Water heater)

The modified *hamam* consists of a conventional hamam and two heat exchangers. Water is filled in the tank through the inlet and wood is ignited. Similar to the conventional *hamam*, water is directly heated in the lower most chambers. The heat exchangers channelise heat generated through smoke and flames to further heat the water. Valves are present to allow water to pass from one chamber to another. When the water in the lower most chamber attains a temperature close to 100 degrees Celsius, it can be drained out separately. On being emptied, the lower chamber can be refilled with water from other chambers. As this water is preheated, it takes less time and fuel to reach 100 degrees Celsius. Alternatively, once water in the lower

chamber reaches 100 degrees Celsius, it can be mixed so the overall temperature becomes around 55 degrees Celsius. The water from other chambers can also be separately drained out through separate outlets. Better fuel utilization reduces the money and/or labour involved in obtaining fuel wood.

The *hamam* has been tested at CTAE, Udaipurm which has found its thermal efficiency to be 58% against 38.5% of conventional *hamam*. The CO/CO2 ratio was found 0.035 in modified *hamam* and 0.038 in conventional *hamam* which are within the safe limits.

The concept of utilizing heat of smoke by using heat exchangers in the path of smoke or flumes is known in art (US Patent 4377200, 4397297, 4628869, 4137965, etc) however, the same is not available for domestic stoves. Accordingly, NIF filed a patent in the innovator's name (1743/DEL/2011). He is awaiting the grant of the patent to start commercialization of the *hamam*.

He takes time out from his photo studio to organize flower shows in town, particularly for school children and teachers. His technique of growing begonias on bricks has been tested and proved successful by 'The Royal Horticulture Society', UK, which also published his work in their publication *Garden* in 2000. He is a life time member of the society and was invited for the Chelsea flower show held at London during 23-26 May 2000. Also he was invited for the London Flower Show organized during June 20-21, 2000. In 2004, he also received National Integration Award for Environment Protection. He has also been interacting with schools, voluntary organizations, and government officials and sharing his work.

## Mobile groundnut thresher cum collector

**Mohanbhai Savjibhai Patel**
Surendranagar, Gujarat

After digging, the harvested groundnut crop is left to dry in the field. Using conventional threshers, a lot of manpower is needed to collect the harvested groundnut crop at one location. Mohanbhai (53) faced scarcity of labour, which resulted in delay in the collection of the dried crop and ultimately loss in yield. To overcome these problems, he developed a tractor mounted PTO powered mobile thresher, which has a separate chamber for collection of groundnut pods and stalk.

Born in a farming family, Mohanbhai could only study till class five. He has his wife and three sons in his family, while one helps him in his work; two others deal in drip irrigation products. Due to water shortage and other issues, his family had to relocate to their present place, from their ancestral place in Sabarkantha. Here he owns about thirty acre of land, where he grows cumin, potato, groundnut, wheat, watermelon, pomegranate, etc. Since childhood Mohanbhai had ideas of machines and gadgets, which were innovative but could not convert those ideas into prototypes due to financial constraints.

Genesis of the innovation

Once during groundnut harvesting season, Mohanbhai faced labor scarcity, meanwhile rain arrived and spoilt his entire crop resulting in huge losses. For groundnut threshing large manpower is required and time is required. He then decided to develop a thresher, which can thresh and collect the waste simultaneously. He started working on the machine in 2009-10 and developed his first model in a few months' time. While the work on refining the technology was going on, he had to stop it due to his ill health. For the development of his first model, his villagers pooled in money and funded the development of the machine as they strongly believed that this

would be helpful for the entire village. Later NIF also supported further development of the machine.

The mobile groundnut thresher cum collector
The machine is a tractor mounted, PTO powered, mobile thresher, which can thresh groundnut and collect the waste as well.

It has a separate chamber for collection of groundnut pods and stalk for ease of collection. The crop is harvested and dried in the field for a week. Then the dried crop is fed to the inlet. The lifting mechanism guides the harvested crop to the cutter where the crop is threshed. The cutter detaches the groundnut from the stalk, after which they fall over a sieve and are separated. The groundnut is collected at the bottom of the sieve and is transferred to the groundnut collecting chamber through the conveyor system. The stalk is separated with the help of blower and collected in a separate chamber. It is powered by tractor PTO (size of tractor 35 HP or above) and has a field capacity of 0.5 acre/h (approximately 0.5 ton of crop) consuming 3.5 liters of diesel per hour. Six persons are required for threshing 4 tons of crop in a day using this machine as compared to 20-22 persons for threshing using conventional machines. NIF has filed patent application in his name for the machine (3141/MUM/2012). The initial test results of conducted at CAET, JAU Junagadh have been quite encouraging. The present machine can only do threshing of groundnuts. Presently, Mohanbhai is trying to modify the thresher to enable it thresh other crops as well.

## Travel bags with folding seats

**Nisha Chaube**
NOIDA, Uttar Pradesh

Who has not faced problem in finding a seat at the railway or bus station! Considering the problem commuters have to face every day while waiting for buses/trains at stations, Nisha (19) has suggested incorporating light-weight folding seats in traveling bags so that the same can be used when needed.

Nisha is chirpy young girl with quite an innovative bent of mind, which keeps on brimming with ideas of different kinds. She has been a good student and manages her time well between studies and her hobbies. Nisha enjoys writing poetry and essays. She won an essay competition through which she got a scholarship to visit China on an educational tour. She worked as a student on Times of India editorial team for a week where she collected ideas from students for publication and also got to write her own pieces. She is also a good artist and likes to sketch portraits whenever she gets the time.

She is thankful to her parents for giving her the space to do things she likes. "My parents are my biggest support system as they motivate me to keep on trying no matter what happens. They advise, suggest, question and console – depending on what I'm feeling at the time," she says. However, with a younger brother and sister, things at home do get a bit difficult. She admits, "My younger brother is in 4$^{th}$ and he's fine, but my sister, who is in 10$^{th}$, does get a bit too much to handle at times. We seem to fight about everything. But we make up quickly."

Genesis of the idea

The inspiration for the idea is as interesting as the idea itself. On the way to her grandmother's home, she saw a huge advertisement of travelling bags, which showed Shah Rukh Khan sitting on the floor beside it. She thought, "If would be better if there was a chair for him to sit on instead of the ground." Thinking further,

she realized that standing while waiting for a bus or train was a common problem and that having an attached seat would be great.

She created a prototype of her idea. NIF later engaged multiple design firms for creating an aesthetic and marketable product based on her idea. After making six prototypes, the final version is now ready. NIF also files an application for design registration in her name. It is hoped that her idea would soon be seen in the market as a product.

Hopes and Dreams

She has opted to do B.Tech after school as it will give her technical knowledge that will help in implementing new ideas. After B.Tech, she wants to join NIF because "I like to explore new things and do something different, and what better way than to join an organisation that works on innovation," she explains.

## Child Poet Innovates a Machine to Clean Rice without Hassle

**Mohd. Sajid Ansari**
Ranchi, Jharkhand
Scout: Social Upliftment Trust

*"Tamanna aapki is kadar poori ho jaye, Ki sapno ki duniya haqueeqat ho jaye,*
*Ho aapka muqaddar itna roshan, Ki aameen kehne se pehle har dua kabool ho jaye*."*

*Sajid (15) is a sensitive and compassionate child. Seeing his mother hassled while cleaning rice every day, he thought of making a device to help her. His automatic electric machine separates broken rice grains and other physical impurities from unbroken rice grains.

An uphill task

While getting the idea was easy, putting it together was not. Sajid wondered what kind of machine could do this work. He had his eureka moment a few days later while at a flour mill. He was fascinated by the machine's rhythmic motion where wheat grains fed from the top were ground into flour that accumulated at the bottom. Watching the 'atta chakki', he visualized another machine where rice put in from the top comes out cleaned from the bottom!

"I was excited because I now knew what to do. But I was not sure if I could make such a machine with my limited knowledge of science," he shares. Money was also a problem. Their only income came from his father's mobile tailoring shop, which was essentially a sewing machine placed on a pushcart. It was just enough to support a family that also included Sajid's younger sister and an elder brother who was mentally challenged.

Making the rice cleaner

But these difficulties did not put him off. Inexperienced but full of optimism, he set about making the rice cleaner. To save costs, he picked up used parts from a neighbourhood scrap shop.

The biggest challenge was getting the correct motion for separating the impurities from the rice. He chuckles as he recalls, "I first used four motors of 12 volts each and connected them directly to 220 volts. But all the motors burnt out. I realized that they were too weak for the power supply. So next time I used eight motors, reasoning that if four people cannot lift the weight, why not use eight!" Of course, these also burnt until addition of a transformer finally got the system running.

Many changes and trials later, the rice grain cleaner was ready for testing. It was a working model that used electricity to separate physical impurities from rice. It could clean up to three kilograms in an hour. Presenting the machine to his mother was an emotional moment for him. "My mother just could not believe it until she herself saw the machine working. My family and neighbours knew I was trying something, but no one paid any attention till it was ready. So everyone was excited to see it in action," he mentions.

Around this time, Sajid came to know of IGNITE competition organized by NIF. He entered and won an award for the rice grain cleaner. At the award function, everyone was charmed with his poetic skills. NIF facilitated development of a compact prototype of the rice grain cleaner through a design institution. This was also showcased at the Innovations' Exhibition organized by NIF at the Rashtrapati Bhavan in 2012, where it was highly appreciated. A patent application (1075/KOL/2011) in Sajid's name has also been filed by NIF.

## Poetry Opening Doors to Education

Sajid pens down beautiful poetry. His love for poetry not only makes him a crowd-puller, but has also helped him realize his dream of a good education.

Since childhood, Sajid wished to study in a good school. But it was unaffordable. So he studied in a school that did not charge fees till class 3, when he got a lucky break. While performing at a state function, he recited an emotional poem on education. It moved the Governor sufficiently to secure his admission in a well-known school in the area on full scholarship. The poem went something like this:

*Jab Hum Padenge, Aage Badenge,*
*Zile ka naam roshan karenge,*
*School mein papa naam likha deejiye,*
*Bujhe hue deep ko jala deejiye,*
*School mein papa naam likha deejiye.*

Good times at New School

He fondly recalls his first day at school saying that "the teacher took me from class to class, introducing me as a poet!" Eventually, two other classmates joined him to make a close-knit circle of friends. They share everything from their food to their thoughts. On holidays, the trio can be seen zipping around town on a borrowed scooty.

Sajid spent five fun-filled years in the school when a new problem across. The family's small shack in a slum colony was razed to the ground in an anti-encroachment drive. They moved to stay with relatives in a village some 15 km away from his school. Poor road connectivity meant that Sajid left home at 5 in the morning and returned only late in the evening. His school had a hostel, but again, affordability was an issue.

Happily, Sajid again received help unexpectedly. Representatives of a company read an online news story on IGNITE award winners, which included Sajid's rice grain sorting machine and his background. They approached NIF with a request to meet him. They were sufficiently impressed to offer to pay for the hostel, in addition to gifting him a computer.

Just For Fun

Although staying in the hostel has made things easier for Sajid, he looks forward to coming home during holidays. He loves the taste of his mother's cooking, especially his favourite – cooked fish head in 'dal' accompanied with hot 'rotis'. Back home in the village, he loves playing 'pitthu', a local game. "I love this game because I like hitting the other team with the ball," he shares with a grin.

When not playing with friends, he loves to curl up with a book by Maithili Sharan Gupt, a celebrated Indian poet who is known for his inspirational poetry. He has picked up from his favourite poet the ability to eloquently present one's opinion through poetry. This was evident during the 27$^{th}$ Shodh yatra (a walk in search of local creativity) at Ranchi in the summer of 2011. Although one of the youngest participants in a group of at least 30 adults, he did not shy away from having his say, of course through poetry!

Hopes & Dreams

Sajid is proud that he has become a minor celebrity at school because of IGNITE. Combining his interest in science with a love of poetry, he aspires to become a scientist like Dr Kalam because he "wants to find a

solution to most problems and simplify things so that no individual faces any problems".

His next project is a machine that will make easy the otherwise tedious manual process of sifting sand used in construction. His father proudly says that his "nanha shayar" (little poet) has gone on to become a "baal vigyanik" (child scientist) and he feels confident that his son will go on to do much bigger things.

## Helping the Disabled: Modified Crutch with Shock Absorbers, Bell and Light

**Archana Konwar**
Dhemaji, Assam

Troubled seeing her physically challenged friend walk with discomfort using a crutch young Archana (14) thought of an idea. Her idea is to have a crutch with shock absorbers for the comfort of the user and also a bell to alert other commuters and a light to be used during the night.

Her village, Bordolopa, is situated in Dhemaji, considered amongst the remotest and most backward districts in Assam. Although it boasts of pristine natural beauty, the area is a conflict-prone zone that is also vulnerable to frequent floods. For a young girl living in such challenging conditions to demonstrate so much compassion for the suffering of others is truly remarkable. It is a testimony to the spirit of hope and enthusiasm inherent in children that does not prevent them from trying new things for fear of failure.

Archana sees her father as her role model as "he is an excellent teacher who truly has a passion for teaching. He has a soft corner for all students and is always willing to help out however he can. All of us in the entire family look up to him and I wish to be just like him when I grow up," she mentions. Interested in painting, music and dancing, she aspires to become a doctor as it will allow her to serve society. "But I also want to be an actress," she says with a twinkle in her eyes and a naughty smile playing on her face.

Genesis of the idea

Being physically handicapped and dependent on crutches is a challenge in itself. But the problem gets compounded if the device that is meant as an aid becomes a source of pain. One day, while walking to school, our young innovator, Archana, saw a handicapped struggling with the pain caused due to constant use of crutches. The sight may not have elicited empathy from most, but the plight of the man

touched a nerve inside her and she set about trying to find a way to alleviate his pain. After brainstorming, she got the idea of improving upon the current design of crutches by adding shock absorbers to reduce pain during usage, a bell to alert other commuters to give way and a light for better visibility during the night.

Archana sketched a design of this improved crutch incorporating these features and shared it with NIF. Archana's idea was selected by NIF and to translate her vision into reality, it utilized the services of a local fabricator to develop two prototypes based on the sketches. Subsequently, a professional design firm was engaged by NIF to further make value additions and improvements on the prototypes, which are now ready for trial. NIF has also filed a patent application (1246/KOL/2010) on her behalf. As a safeguard against copying of the design, an application (241930) for design registration has also been filed and is currently under examination.

NIF is currently exploring the potential of tying up with interested entrepreneurs for commercially launching the product.


**No. of states/UTs from where entries received**

| State/UT | Count |
|---|---|
| Andaman & Nicobar | 01 |
| Andhra Pradesh | 828 |
| Arunachal Pradesh | 14 |
| Assam | 327 |
| Bihar | 1960 |
| Chandigarh | 2 |
| Chhattisgarh | 315 |
| Daman & Diu | 1 |
| Delhi | 141 |
| Goa | 6 |
| Gujarat | 8291 |
| Haryana | 76 |
| Himachal Pradesh | 53 |
| Jammu & Kashmir | 619 |
| Jharkhand | 976 |
| Karnataka | 198 |
| Kerala | 384 |
| Madhya Pradesh | 119 |
| Maharashtra | 204 |
| Manipur | 263 |
| Meghalaya | 18 |
| Mizoram | 39 |
| Nagaland | 4 |
| Orissa | 418 |
| Puducherry | 10 |
| Punjab | 136 |
| Rajasthan | 835 |
| Sikkim | 1 |
| Tamil Nadu | 517 |
| Tripura | 349 |
| Uttar Pradesh | 1284 |
| Uttaranchal | 179 |
| West Bengal | 662 |
| **Total** | **19230** |

# 7th National Biennial Competition

(February 1, 2009 – March 31, 2011)

| Category | Count |
|---|---|
| Agriculture | 705 |
| Animal science | 2685 |
| Artisans | 0 |
| Energy | 102 |
| Engineering | 3614 |
| Forestry | 3 |
| House hold innovation | 118 |
| Human health practices | 11753 |
| Others | 250 |
| **Total** | **19230** |

## Modified knapsack sprayer

**Mohan Muktaji Lamb**
Beed, Maharashtra

Mohan Muktaji Lamb (39) is a farmer and an innovator. He has modified the commonly available knapsack sprayer, which has resulted in obtaining and maintaining higher pressure for spraying. His sprayer is a low cost, labour efficient and low maintenance product.

He comes from a farming background and lives in a small village with his family of four members including two sons and wife. As a child he was always fond of science and technology and liked making equipments and toys of various kinds. He could not study beyond class ten and took up farming as a profession. He has four acre of land where he grows vegetables of different kinds.

Mohan observed that many of the existing sprayers are difficult to operate due to fatigue which sets in early and poor efficiency due to frequent nozzle blockage. The pressure also dropped after short spell of use. He tried to come up with something of his own but without success. Once he was helping his son make a simple model of a sprayer that an idea struck him. He then made certain modifications in the knapsack sprayer, which include changes in pressure reservoir, resulting in higher pressure and the provision of changing the stroke length for varying the delivery rate. His sprayer has three gear systems, low cost filtration unit, and prolonged handle for more pressure. It also has a pressure chamber of greater size which can store more pressure for longer use of the sprayer. Two booms can be attached to his sprayer, which can cover 1 ha/ 7 hr with a single nozzle and over 1 ha/ 5 hr with both the nozzles. This sprayer helps the farmers to spray more area in lesser time.

For the development of his sprayer, he received some grant from NABARD as well. NIF filed a patent in his

name and forwarded the same to Central Institute of Agricultural Engineering, Bhopal for testing and possible inclusion in the subsidy list, which will ensure higher sales for the innovator.

## Power tiller operated turmeric harvester

**P Ramaraju**
Erode, Tamil Nadu

P Ramaraju (40) has been involved in farming since an early age. He faced acute labour shortage while harvesting turmeric rhizomes. Delay in harvesting resulted in loss of yield and adversely affected the quality of rhizomes. In 2008, he studied machines available in market for solving this problem and developed an attachment for a power tiller to harvest turmeric. The first prototype damaged over 50 percent rhizomes during trials. He continued his experimentations and making prototypes after prototypes. In 2011, he could develop the final prototype with over 95 per cent efficiency.

This harvester is actually an attachment for power tiller, which is mounted at its rear by replacing the conventionally attached rotavator. It takes drive from the power take-off (PTO) through a belt and pulley. Incorporating a certain mechanism he obtains oscillating motion in the blades, which separates the

turmeric rhizome from soil without damage. It has a field capacity of about 0.2 acre per hour while consuming 1.5 liter of fuel (diesel). The cost of harvesting per acre almost comes to half if the present machine is used for harvesting and laborers are engaged for collection.

A local manufacturer 'Mani Automobiles' has an informal agreement with the innovator. He is manufacturing and selling the harvester attachment and paying royalty to innovator at the rate of ten percent on sales. Over 200 units have been sold in last three years under this arrangement.

**Multi angle power weeder**

**P R Nadaraj**
Erode, Tamil Nadu

P R Nadaraj (67) could study up to class 5 and had to involve himself in farming at an early age due to poverty. Presently, he has 10-acre irrigated land on which he grows chilly, brinjal, cotton, jasmine, banana, tomato, tobacco, etc. As a progressive farmer, he used to visit the Tamil Nadu Agricultural University (TNAU), Coimbatore regularly and liked interacting with scientists. He realised that they keep updating themselves by reading latest research papers. He tried and liked some research papers he saw on farm machineries at the library. However, most of them were in English. He then joined tuition classes to learn English. Although he cannot still speak it fluently, he understands it well enough to read journals and research articles an understand them. His interest in development of farm machinery for improving the mechanization in farms triggered him to develop a bullock-drawn weeder in 1997, which he used in his field for years. Later in 2002 he developed a simple petrol engine operated weeder when he faced difficulty in getting and maintaining bullocks. While developing the petrol engine operated weeder, he used to study research articles on the configuration of blades. He developed number of prototype for experimenting with different configurations of blades and observed the change in the direction of throw of soil and its effects on growth of plants.

It took him an effort of over ten years to come up with the design of multi angle weeder suitable for variety of crops at different growth stage. His weeder is a self propelled diesel engine operated weeder having L-shaped blades arranged in spiral configuration. The arm holding the tool is adjustable and retractable to enable the weeder to move between the plants. The novelty lies in the provision of changing the angle of cutting shaft (holding the blades) both in horizontal and vertical planes according to the growth stages of

the plants. The machine can cover 0.22-0.25 ha/h consuming one liter of diesel per hour.

## Raking Machine for Poultry Farms

**Suresh Narottam Patel**
Valsad, Gujarat

Suresh Patel (55) has had the passion of learning and developing new technologies since his childhood. Once he modified a Maruti Omni to run on LPG for his personal use. He has a keen interest in reading magazines and tries to keep himself updated on the latest technologies.

He has a poultry farm where raking (turning of layers of poultry waste accumulated on the floor) was done using manual rakes. It was a time-consuming and ineffective process. But raking was necessary to keep poultry in good health. Scarcity of labour made manual raking difficult in his farm. He wanted to mechanize the process. He started building on the ideas he had and developed the first prototype in 2007. It had certain issues, which he fixed in the second prototype developed in 2008. This machine was quite successful and since then he has been using the same machine in his farm.

The machine has an electric traction motor and a raking tool with an effective width of 0.75 m. Two people can rake 15,000 square feet per hour using this machine. There is a noticeable reduction in foul odour when raking is done using this machine, as against manual raking. Suresh Patel has also modified tractor operated blower/sprayer, JCB type soil collector for tractors, load lifting arrangement in tractor for suiting the local requirements and making them at low cost. The tractor operated blower/sprayer has higher coverage and capacity of holding liquid than competitive products available in market and costs less than half of the same. He has sold 18 such units locally.

**Tender coconut breaking and instant coconut water cooling machine**

**Mahadeviah Vinod**
Bangalore, Karnataka

Vinod (40) is an entrepreneur who has a shop where he sells coconut-based food products such as chilled coconut water, coconut cream, coconut jelly, coconut ice-cream etc. He and his wife prepare these products themselves. He has developed a tender coconut breaking and instant coconut water cooling machine.

The innovator wanted a machine that could break a tender coconut, draw out its water and cool it instantaneously. He also wanted to simplify the difficult process of cutting open the coconuts.

His machine can break a tender coconut, draw out its water and coos it instantaneously. The cutter has been customized for cracking the coconut. The coconut water passes the cooler through the collecting tray and passing through ice covered pipes gets cooled to about 14-15 degree C. At its maximum capacity, the machine can cool about 400 glasses (200 ml) of coconut water.

NIF has filed a patent in the name of innovator 1138/CHE/2011)

Ever since he has completed and installed this machine in his shop, the number of visitors to his shop has increased. As he developed this machine for self-use he does not want to commercialise for the fear of losing to competition, though there appears to be a good scope of diffusion.


Instant Cooled
Tender Coconut Water

## Fish Dryer

**Maibam Deben Singh**
Imphal West, Manipur

Traditional sun-drying of fish is a time consuming process where the fish needs to be protected from animals while drying as well. Deben Singh (63), blacksmith by profession, has developed a closed vessel dryer that dries the fish uniformly in a significantly lower time than the traditional method.

Deben, who is class seven passed, used to be a jeep driver. As he had travel to far flung places, he decided to settle down as a blacksmith. Occasionally, as per requirement he also casually worked for construction of electric poles by the electricity department.

Once, one of his sisters got terminally ill due to cancer. Traditionally ailing persons are given smoked fish as source of proteins. He thought that smoked fish may further aggravate the deteriorating health of his sister. It was then when he thought of an efficient drier and a low emission biomass stove. Without bringing it in the knowledge of his family members he kept on developing the prototype at a secluded place. There were technical glitches like designing the inner chamber. However, with hard work and perseverance, he finally completed his work and came up with this device. The dryer uses charcoal and paddy husk as fuel and is available in three models with capacities ranging between 3-10 kg/h.

Deben Singh wants to set up a small production unit of his innovation to give employment to youth and serve the community. He is also willing to declare his innovation open source as he believes that it may be difficult for him to stop any one from copying his design. His remarks that an innovator's aim should be to produce quality products at an affordable price each.

## Electric loom for manufacturing bandages

**Salam Rajesh Kumar Singh**
Imphal, Manipur

Rajesh has been running a bandage manufacturing unit since 1999. With increasing demand, it became difficult for him to meet it due to shortage of skilled weavers for his eight semi-automatic looms. He then developed an automatic handloom by modifying manual one and incorporating a half HP single-phase motor.

Good in studies, Rajesh wanted to be a pilot as child. The family was financially well off but their fortunes changed when their hotel got demolished in a road widening drive. As a result he had to drop out and start work to earn a living for the family. Being good in studies, he started by giving his classmates tuitions. He was also a master kite maker and used to make and sell kites in his locality. Later he joined the work of making bandages.

While running his bandage manufacturing unit, he had to incur high labour charges due to lack of skilled worker. Sometimes he had to suspend his production as well. He therefore started thinking about developing a mechanised loom instead of using traditional handloom. It took him about four years and numerous trials to finally develop his mechanised loom, which he installed in his unit in 2000. The machine has provision to vary shuttle speeds depending on the type of cloth being weaved. His wife, who supported him a lot during developmental stages of this innovation, is happy for his achievements. Compared to the commercial power looms, his innovation is of low cost and with less manpower requirements as compared to the traditional loom. He recently got some support from the District Innovation Fund as well. He is planning to scale up production of mechanised loom presently.


FOR HANDLOOM DESIGN

## Hoe cum shovel, foldable water bottle, apple catcher and others

**Refaz Ahmad Wani and Ishfaq Ahmad Wani**
Anantnag, Jammu & Kashmir

Refaz and Ishfaq (18) are twins from a small village in Anantnag district of Jammu and Kashmir. They never fail to surprise others with their creativity and hence they are known as the 'Creative Twins'. They have an amazing line-up of 'big ideas', which includes a foldable water bottle, a hoe that also doubles up as a shovel, an easy apple catcher among others.

Growing up in the remote village of Wandewalgam some 80 kilometers from Srinagar, they had little access to the outside world. Their father worked as a labourer in Delhi/ Jammu. Money was short and they had just enough for basic things. But this lack of resources shaped their creativity as they learnt to be self-reliant.

Twin Brothers Innovation Club
As more ideas came, they wanted a place where they could discuss, share and work without disturbance. But there were no spare rooms in their home that could be used. Undeterred, they zeroed in on the storeroom on the roof. They got construction material from outside to put it back in shape. Unable to afford paint, the walls were covered with gift wrapping paper to brighten them up. And the 'Twin Brothers Innovation Club' was ready. It is populated with innovations in the making, awards won and sundry pieces of used wires and other equipment. The brothers come here to thrash out current ideas and work on new ones. All these ideas are duly noted down in their 'Book of Ideas', which already has more than 100 ideas.

Collapsible water bottle for storing different liquids
Standing in front of their house, twins Refaz and Ishfaq saw a little boy struggling with his water bottles on way to school. To beat the summer heat, he was carrying multiple bottles for different fluids. But it was a pain to manage them, especially after they were empty.

Refaz and Ishfaq came up with a remarkably simple solution: a single bottle with separate compartments for different fluids. What's more – once emptied, it collapses to become smaller!

Combined Hoe and Shovel

They belong to an agricultural family and sometimes help out in the fields. One day, they were out in the market to purchase a hoe and shovel. They wanted both tools but had just enough money for one. Not giving up, they innovated their way out of the problem by making a two-in-one tool that can do the work of both. It has a handle to which either a hoe or spade can be attached. NIF filed a patent for their device (3171/DEL/2011).

Apple catcher

Though apple trees are not too tall but still one has to use ladder to climb up for fruit plucking. As the plantations are mostly on slope or uneven ground, using ladder many times results in accidents. In order to enable a person standing on the ground to clip an apple and catch it in a net, the twins have made this device.

It is a hand held agriculture tool, which can be used for plucking fruits. It consists of a rod, a cutter on its farther end, a clutch on its closer end to operate the cutter and a net below the cutter to catch the clipped fruits. When clutch is pressed, it cuts apple with help of scissor and the apple is collected in net. This arrangement allows the plucked apple to get collected so that apple won't fall on the ground and won't get damaged. Belt is tied on shoulder while catching the apples from the apple tree.

Their other innovations include a drain cleaner, an injection breaker to safely get rid of small pieces, an egg breaker and a geometric pen also fitted with a clock, torch, pencil and compass.

Dreams for the Future

"We want to become scientists but because of not enough money we chose to study arts instead of science at school," they mention. Although this wish could not come true, they are very confident about the future. With pride in their voice, they tell how their father always tells them to keep their hopes up when things get difficult. Their enthusiasm has also motivated their younger sister Runcy Jaan. Getting tired of washing dishes at home, she has come up with an innovative dish washer. She shared the idea with NIF where it is under evaluation.

The brothers' most cherished dream is to turn the Twin Brothers Innovation Club into a place where local kids can come to discuss ideas and conduct experiments. "We want to teach them how to look at a problem and how to find a solution. They should not give up their dreams just because others do not see them."

## Herbal preparation for controlling borer in vegetable crops

**Jokhu Shah**
East Champaran, Bihar

Jokhu Shah (70) uses fermented extract of two local plants (name withheld for IP reasons) for controlling shoot and fruit borer in vegetable crops.

His father was a farmer who had taught him the uses of many herbs for agricultural use. They have a seven acre farm and some cattle head. Since he is quite old now, he does not regularly to his fields. The farming is taken care of his three sons. The formulation he has suggested has been used by him for twenty years.

In the validation tests, the formulation was found to reduce the population of the borer (*Helicoverpa armigera)* by 38 per cent and that of mealy bug by 52 per cent as compared to the untreated control.It also showed moderate larvicidal effect against the larvae of borers (*Spodoptera litura* and *H. armigera*).

## Herbal preparation for controlling insects and pests in paddy crop

**Madhav Lal Shav**
East Champaran, Bihar

Madhav Lal (38), a laborer and a farmer, uses the extract of the leaves of a local plant (name withheld for IP reasons) to control insects in vegetables, pulses and paddy.

He has studied till class tenth and has wife and three children in his family. He has about 2.5 acre land. He has suggested a herbal preparation for controlling leaf folder infestation in paddy and pod borer infestation in pulses. The formulation, which he learnt from his father, is sprayed in the morning. Spraying needs to be done twice a month. The formulation is effective against rice, pulses and other vegetables. He has been using this formulation for more than three years now. Since it is prepared using locally available herbs, it can be prepared anytime of the year and also can be stored in an air tight container for a few months if required.

In the validation tests, the formulation was found to reduce the plant hopper population by 42 per cent and leaf folder population by 24 per cent as compared to the untreated control. The herbal preparation was found to have moderate larvicidal effect against borers' (*Spodoptera litura* and *Helicoverpa armigera*) larvae under *in vitro* conditions.

## Herbal preparation for controlling insects and pests in paddy crop

**Raghunath Prasad Nirala**
West Champaran, Bihar

Raghunath Prasad (62) effectively controls Gundhi bug (*Leptocorisa acuta),* leaf hopper and other pests in paddy using extract of a local plant and ash of a part of another plant (names withheld for IP reasons).

As he was the only child he studied till class tenth only and got married early. Initially he started practicing herbal medicines but later in parallel took on farming as well. He has a three acre land but due to ill health does not work regularly. His son takes care of the farm.

Prasad has suggested a herbal preparation for controlling pests infestation in paddy. They have been using this for over fifteen years and prepare it using locally available herbs. This formulation, once made, can also be stored for three months or so. Apart from this, he has also informed about a unique herbal medication for inflammation in the affected body part and for vitiligo.

A reduction of 31% in leaf hopper and 55% in larval (*H. armigera* and *Earias vittella*) population was observed in the validation test as compared to untreated control. Also, the fruit damage in Okra was found to be reduced by 53% as compared to the untreated control. The herbal preparation was also found to be effective in controlling the leaf folder (*C. medinalis*) of paddy with reduction of 34% in the leaf folder population as compared to the untreated one. The herbal preparation was also found to have moderate larvicidal effect against borers' (*Spodoptera litura* and *Helicoverpa armigera*) larvae under *in vitro* conditions.

## Herbal preparation for controlling insects and pests (leaf folder and stem borer) in paddy

**Vijay Prasad**
Hazaribag, Jharkhand

Vijay Prasad (40) uses the leaves of three local plants (names withheld for IP reasons) to control insect-pests in paddy crop.

Born in farmer's family Vijay, had seven siblings, and studied till class ten. All of them are married and settled. His mother lives with one of his brothers, who work as daily wage labourers. His family comprises wife and three children. He is also a farmer and grows rice, maize, pigeon pea, potato and onion in his field. During lean agricultural seasons, he works on a daily-wage basis in white-washing, cement, construction work and other works. Vijay uses home-made herbal formulation for pests in his field. This herbal knowledge has been handed over to him by his late father.

The herbal preparation was evaluated for its ability to control insects and pests in field conditions in Okra crop. A 37% reduction in the population of leaf hoppers was observed as compared to the untreated control. The formulation was also found to be effective in reducing the population of larvae (77%) at farmer's dose. A reduction of 53% in fruit damage was also found in plants treated with the formulation as compared to the untreated control. The herbal preparation was found to be effective in controlling the leaf folder (*C. medinalis*) of paddy with reduction of 54.0% in the leaf folder population as compared to the untreated one. The herbal preparation showed moderate larvicidal effect against borers' (*Spodoptera litura* and *Helicoverpa armigera*) larvae under *in vitro* conditions.

## Herbal preparation for controlling leaf folder in paddy and fruit borer in vegetable crops

**Rajesh Mishra**
East Champaran, Bihar

Rajesh (48) uses crude leaf extract of a local plant (name withheld for IP reasons) and *Azadirachta indica* (Neem) for controlling leaf folder in paddy and fruit borer in vegetable crops.

A priest and a farmer, Rajesh studied upto class ten only. He lives with his father, wife and five children. He has developed a herbal formulation, after experimentation, for controlling pests infestation in rice, *khesari chana*, mustard, etc.

During the validation tests, the herbal preparation was found to be effective in controlling leaf folder (*C. medinalis*) of paddy with 51% reduction in the leaf folder population as compared to the untreated one. The herbal preparation was also found to have moderate larvicidal effect borers' (*Spodoptera litura* and *Helicoverpa armigera*) larvae under *in vitro* conditions.

## Herbal medication for preventing and curing retention of placenta in animals

**Harshadbhai Patel**
Anand, Gujarat

Harshadbhai dries and grinds leaves of a local plant (name withheld due to IP reasons) and feeds the dried powder to the cattle directly or fodder.

Married and with two sons, Harshadbhai comes from Anand, the birth place of the white revolution in the country. He worked for some time in a *bidi* making set up in Bihar where he came to know *tendu* and various other herbs. Slowly while interacting with herbal healers he developed the knowledge about various herbs and their uses. He also purchased a cow and opened a provision store there. His gained more herbal knowledge taking care of the cow. After a theft in his shop he returned back to Gujarat.

Harshadbhai keeps himself engaged in administering herbal formulations for cattle diseases like bloat, diarrhea, and retention of placenta. Apart from this, he has also developed herbal solutions for dermatitis, fungal infections, and stomach ache in human beings.

For the validation test for his practice for retention of placenta, twenty clinical animals in advanced stage of pregnancy were selected where twelve clinical cases were observed in control group and 8 clinical cases were observed in test group. The average duration for expulsion of placenta in control animals was found to be 21.58 hours and 4.02 hours in the treatment group.

**Consolation Award**

## Herbal medication for curing anestrus in cattle

**Khumaji Badaji Kataviya, Badaji Didaji Kataviya, Babubhai Badaji Kataviya**
Sabarkantha, Gujarat

Born in 1958, Kataviya lives with his father Badaji Didaji Kataviya, mother, wife, one of their sons and his wife. Badaji is very old and mostly bed-ridden. Babubhai Badaji Kataviya, his brother, also lives nearby. Both the brothers are school drop outs. The family's chief occupation is agriculture, dairying and cattle-rearing. They have a two acre land, where they grow wheat, rice, pigeon-pea and corn as main crops. They have some cattle also.

The present herbal formulation for treating anestrus is meant for buffaloes primarily. The herbal formulation has been practiced in the family for a long time. Khumaji learnt the formulation from his father, Badaji. His brother, Babubhai Badaji Kataviya, knows about the formulation as well.

The healers administer a part of a local herb (name withheld due to IP reasons) to animals affected with anestrus. The animal shows signs of estrus in eight days. To validate the practice, some clinical conditions were identified with signs of flaccid uterus, smooth ovaries and with no estrus behavior. The clinical cases were administered medication for 4 days. The animals resumed estrus cycle in 8 days and both got inseminated.

## Herbal yield enhancer

**Tulsyabhai Somabhai Pavar**
Dang, Gujarat

Tulsyabhai (53) is a well known *bhagat* (traditional healer) in his area. His wife is also a healer especially in maternal health care. Both of them have been administering medicines for over thirty five years now. All their services are fee for both human and animals. He has about forty hectare of non-irrigated land where he cultivates finger millet, rice, pigeon pea, black gram etc. He also indulges in casual daily work. Most of his herbal knowledge has been taught by his father.

He uses the roots of a particular tree to make a formulation for growth promotion in crops. The same has been tested at SRISTI Laboratory where moderate effect on growth promotion of test crops was found.

## Herbal Preparation for pest control

**G Chandrasekhar**
Krishna, Andhra Pradesh

Chandrasekhar is a farmer and likes to experiments with herbs for agricultural use. In his childhood, he was an avid reader and wanted to become a scientist. His first innovation was a peanut sowing machine. He believes that the cure of problems of natural origin would be found in nature only. He developed a formulation for controlling pests in crops. The formulation was tested at SRISTI Laboratory, at ICAR, Hyderabad and Directorate of Oilseeds Research (DoR), Hyderabad. The herbal formulation was found to be effective against mosquitoes and their larvae, nematodes, gram caterpillar and mealy bug as well.

Chandrasekhar wishes to continue serving the society, by constantly and continuously innovating. He would like to diffuse the innovations free of cost.

## Healthy Air Machine: Germ-free, Dust-free, Cool Air

**G Brahadees**
Thiruvallur, Tamil Nadu

Brahadees is a young creative student who has come up with an interesting idea to develop a 'healthy air machine' that gives out germ-free, dust-free, cool air. It proposes to combine the cooling effect of an AC with the cost efficiency of a fan.

This idea came to Brahadees as he sat sweating on a hot summer day. He was inside a room with the ceiling fan at full speed, but found no respite from the heat. Looking up, he realized that the fan was only throwing air in the centre of the room while the corners remained hot. He thought of alternative cooling options. An air conditioner was expensive, and consumed too much electricity.

He then thought of creating his own solution: A portable 'Healthy Air Machine' that can be carried around the house. It can heat, cool and also purify air. It's low-cost and has an air curtain system and spot-cooling effect to save energy.

What's more, it can also help in farming. He explains, "Farmers use winnowing to separate chaff from the grains by blowing air through it. This machine can carry out the same function. It can also suck in dust, thus acting like a vacuum-cleaner." It can even have commercial and industrial applications. He has made a working prototype and applied for a patent.

He thanks his teachers and parents who encouraged him to build on his idea. "I could not work on this project daily because of the regular school curriculum. So I asked for permission to use the Physics lab on Sundays to work on my idea. My school was very supportive and gave me permission, which was a privilege," he shares. But the biggest thanks is reserved for the electricians and plumbers of his school who helped in selecting the right types of pipes etc!

He enjoys reading Chetan Bhagat's novels and watching science fiction movies. He is currently pursuing B. Tech (NIF received his entry when he was a school student). His dream is to become an IAS officer and continue coming up with something better and useful every time.

## Foldable & Portable multipurpose device that can act as a chair, hammock, table, stairs etc.

**Pankit Gami & Ekta Patel**
Tapi, Gujarat

Young Pankit and Ekta have come up with a multi-purpose device that turns into a regular chair, a hammock, stair, table, bed, trolley, stool, and a rocking chair. It helps with the problem of space crunch in most urban homes. It is foldable and portable. One can even attach a stroller to it and carry both along wherever one goes. It would also come in handy during camping or trekking and can be fitted easily atop a car. They also feel that it will be of use to soldiers on a march.

The idea was inspired by difficulties faced by Ekta when she once travelled with her family by train without reserved seats. The design was inspired from a sofa-cum-bed seen in the market. They bought it as a sample to do a thorough study of the parts. Next, they bought books on technical engineering and finally started working on their project. Three prototypes had to be made before arriving at the final one. It was made of stainless steel to make it more durable.

Parents of both are very supportive of their children's creative pursuits. While Ekta shared that "Without my parents' support, this project would not have been successful," Pankit added that although his parents are not actively involved in his work, they offer whatever support is asked. Their school and teachers were also very encouraging.

Pankit likes reading William Shakespeare while Ekta is an outdoor person who loves to trek and uses her innovation to build hammocks, tables and chairs on trekking trips. "Once an army camp was set up near my house. My father suggested that we lend them this device so we could get authentic user feedback. All the jawans really appreciated it," she recalls proudly.

Pankit is fascinated by aeronautics while Ekta dreams of becoming a neurosurgeon. They aspire to start a company that invents new devices that help others. On a personal level, they are compassionate individuals

who care for others. Pankit beautifully puts it when he says, "Above all, I want to become a good person."

Ekta is an animal enthusiast who gets disturbed on seeing animals caged. "Just like human beings are given their share of freedom, animals need to be free as well,' she emphatically declares.




## Pressure Detector for Water Pipelines

**Himala Joshi**
Nainital, Uttarakhand

In many places in India, water is supplied for only one or two hours in a day. People have to keep turning taps on every few minutes to check the water supply. Himala has thought of a pressure detector fitted in the pipeline. It rings an alarm immediately on sensing the flow of water, thereby alerting people.

Himala experienced this problem in her own home. "I belong to a place in Uttarakhand where water is scarce. Especially in summers, my mother had to constantly keep an eye out on when water would come. She would be completely preoccupied with it. That's when I thought of a device that could save her this worry," she shares.

The device has a sound sensor that gets activated with the slight pressure that comes just before water flow begins.

She is very close to her little sister, who is 12 years younger. "Of course, we fight a lot – at least once a day. But we also share everything, from clothes to our secrets. It's a happy relationship and I love her a lot," she mentions. She also has a big group of friends. She enjoys interacting with different types of people as she feels "it's important to respect differences in a friendship."

Hemala is currently pursuing civil engineering (she submitted her idea to NIF when she was in school). She enjoys athletics and played at the state level in track events. At some point in the future, she wants to get involved in social work. "I want to be a part of some project that has the ability to change the way people live their lives, like the Delhi metro," she adds.

## Safe Driving: Sensors to Prevent Mobile Usage while Driving

**Divyam Gupta**
Bulandshahr, Uttar Pradesh

Even as an increasing number of road accidents are being attributed to mobile phone usage, talking on the phone while driving is becomingly increasingly common. Divyam's innovative solution to check this problem is to place touch sensors on the gear lever and the steering wheel while driving. Safe driving requires both hands to be either on the gear or the steering wheel. Therefore, if either hand is disengaged from both the gear and the steering wheel for an extended time, the sensors will infer that the driver is handling a mobile phone. This will cause a pre-programmed reaction in the vehicle, such as gradually slowing down and bringing it to a halt or moving to a side by giving an indicator or by simply giving an alert alarm to the driver.

The idea occurred to Divyam on seeing a number of newspapers reports related to road accidents. He says, "Going through the papers, I was struck by how many of these accidents were said to occur because the driver was talking on the phone. That is when I started thinking that a mechanism that would restrict mobile usage while driving would be effective in preventing many road accidents." He strongly believes in the importance of building a culture of creative thinking amongst students and credits his parents for encouraging him to think in an offbeat manner.

## The Cycle-O-Cleaner

**Riya Kothari, Nimran Kang,**
**Kaamya Sharma & Mehr S. Mehta,**
New Delhi

Often, we lament the lack of compassion in today's generation. However, children are often not only found to be more sensitive towards the hardships experienced by others due to inequalities present in our society, but are also willing to proactively find a solution to address the problem. This innovation was born out of a desire of four friends to simplify an impossibly dreary task carried out daily by sweepers of keeping our roads clean.

Riya, Nimran, Kaamya and Mehr, all class six students in the same school, on observing the difficult work that sweepers on the road were doing routinely, thought of mechanizing the process to make it easier. Thus was born the cycle-o-cleaner.

It is essentially a bicycle to which brooms and brushes are attached. The motion of the cycle moves the brooms and brushes that are fitted with spiral bristles. As the cycle moves forward, the dirt and garbage on the road is pushed to a side, to be collected later. The cycle may optionally include an extra dustbin attached to the front to collect large scraps and pieces of garbage. Discussing how they thought of the idea, they revealed that they had only two preconditions: whatever they designed should be eco-friendly and must help the sweepers.

When quizzed on what they want to be when they grow up, one replied that she wanted to go to Yale Law School and was willing to work very hard to reach that goal, while others said that although they had not yet decided what is it that they wanted to be, they definitely knew that they wanted to have fun and enjoy life. The answers are as varied as the personality of each friend, but what unifies them is a common feeling of empathy for others.

## Green Technology: Recycling Waste Plastic Packaging

**Hetal Vaishnav**
Rajkot, Gujarat

Hetal (19) is a young student from Rajkot doing her graduation now. She has been a good student, an environmentalist and an innovator. She has come up with a process that can recycle multi layered laminated plastic used for shampoo pouches and packaged food like biscuits, potato chips etc. This plastic is difficult to recycle and is usually thrown away after usage.

She was inspired from a casual observation. "Once near my home, I saw rag pickers collecting various things from the garbage for recycling, but no one was touching certain plastics like chocolate wrappers and biscuits packets. I asked them why and was surprised when they told me that they found no one wanting to purchase this plastic," she shared. On doing some basic research, she figured out that it was because there was no technology available for recycling this type of plastic.

From Idea to a Working Prototype

She visited factories making such laminated plastic wrappers to understand the process. Her father's pressure dye casting factory was used as a lab where she tested her idea. After consistent efforts, she was able to apply heat treatment for converting this plastic into a powdered composite material, which is a combination of two or more materials. This powdered recycled material is further made into plastic sheets through moulding and can have multiple uses, particularly for making furniture. It is also nonflammable and can be recycled safely with no emission of harmful gases.

She got it tested at laboratories for strength, density and other properties. The reports were positive, especially when compared with other products such as plywood that is commonly used in furniture.

## Herbal preparation for controlling insect pests in agricultural crops

**KM Chellamuthu**
Erode, Tamil Nadu

Chellamuthu (56) uses combination of plants (name withheld for IP reasons) for controlling of insect pests in various agricultural crops. The validation test demonstrate significant efficacy of the herbal formulation against insect pests in different crops.

An agricultural labourer from Erode district, Chellamuthu has undertaken a long arduous journey on the path of innovation and entrepreneurship. During the 1990's, as a labour working in the fields, he was often exposed to chemical pesticides. This resulted in persistent health problems for him. In order to overcome this problem, he started exploring herbal options and working slowly over a period of a decade standardized herbal pesticides for different crop pests. Most of his experiments were undertaken during 1997-2000 on two acres of leased land, where he invested most of his savings from agricultural wages.

Success was not easy to come, however. Farmers were not ready to give their fields for treatment with herbal pesticide. It happened one day that he went to his uncle's field and saw four months old turmeric infested with sucking pests. Without his knowledge, he brought his pesticide and sprayed over a portion of the field. The positive results were to be seen in a few days, which surprised his uncle, who asked him to spray the formulation on his entire field. He then got his first order for pesticide's spray over three acres, which gradually increased to about 150 acres in a few months time.

Initially he was targeting crops such as turmeric, sugarcane, paddy and banana. During 2001 there was an outbreak of disease in coconut trees caused by Eriophyid mite, which resulted in under sized nuts and reduction in sales. The tree also shows stunted growth. He improvised his existing formulation and used it successfully. He has so used his formulation for over

10, 000 trees against the mites. The result is also an increase in 10-15 kg increase in each bag of nuts.

During 2005, in his area there was infestation of mealy bug outbreak in sugarcane, which could not be controlled by his formulation. He further modified his formulation, and after a lot of hit and trial, he was able to standardize the formulation for mealy bug as well.

Later in turmeric he noticed '*semporian*' disease caused by a fungus and usually occurring during November - December. Sometimes, the disease is also coupled with root rot disease caused by nematodes. Normal prescription to control the same is chemicals, which are quite costly and cause a hole in farmer's pockets. He tried his mealy bug formulation but without any success. He then experimented for a while and developed another formulation, which he used to get desired control.

From Labourer to Entrepreneur

He came in contact with a bank manager who organised a meeting and invited farmers from different villages where the bank was servicing. Chellamuthu had to deliver a talk on organic farming. This helped him get a few more customers, many of which had been trying chemical pesticides. Happy with the response of the pesticide, they returned their chemicals to the dealers, who in turn threatened Chellamuthu.

By that time, he had garnered support of a few famers and won a NIF award, whose pictures got published in local newspapers, so this problem subsided soon after. Chellamuthu also trained some farmers to develop the formulation but still a few hundred farmers depend on him for their regular supply of herbal pesticides. He is mainly supplying his pesticides in Tamil Nadu. Through an agent he is also supplying his pesticide for orchard crops such as guava, sapota, pomegranate, grapes farmers in Andaman and Nicobar islands. He also had a query from France after a news item published in The Hindu Newspaper. He sells about 2500 litres of pesticide every year, at a modest cost so that it remains affordable to all farmers. Mostly farmers are using the herbal pesticide for turmeric and paddy.

The herbal pesticides developed by Chellamuthu have been developed using locally available ingredients with three pesticides for pest problems noticed in different crops. These pesticides have a positive effect on crop yield and quality of produce. Unlike chemical pesticides, this does not have an adverse or toxic effect on humans. The only worry Chellamuthu has now, is of a successor who would take this forward once he is no more.

## Efficient stove using paddy husk as a fuel

**Ashok Thakur**
East Champaran, Bihar

Ashok Thakur (44), a blacksmith by profession, has developed a chulha, which uses paddy husk as a fuel. He has sold over 400 paddy husk stoves locally.

He lives with his wife and son, who is completing his graduation. His three daughters are married. Dropping out of school after class seven, he moved to work with his father in a factory but returned back soon to start his own workshop. He learnt all the skills of a blacksmith under guidance from his father. He started his work making and selling coal chulhas and wood dust chulhas. Meanwhile he also observed in his area that a large amount of paddy husk was discarded as an agricultural waste. He experimented with a common stove using wood dust as fuel and suitably modified it for paddy husk. The stove weighs about four kilograms and burns for an hour with one kilogram of paddy husk with a smokeless flame. This stove has undergone testing at IIT Guwahati and TERI University, New Delhi. The fuel combustion rate reported by IIT Guwahati for the stove was about 4.67 per cent. TERI University during tests found its thermal efficiency to be 23% in cold & hot start and 32% during simmering. NIF filed a patent (311/KOL/2011) in his name. Speaking about his stove, Ashok claims that this can even be safely used on a boat for cooking food. He wishes to scale up his production based on the growing demand and also experiment further.

## Low cost wind mill for power generation

**C. M. Subramanian**
Namakkal, Tamil Nadu

As his new house was far away from existing electrical lines, the electricity board asked Subramanium (51), a mechanic by profession, to deposit a certain amount towards the cost of electric poles. Since it was beyond his capacity, he gave up the idea of obtaining an electric connection from the electricity board. He then started working on ideas to address his household energy needs.

While experimenting with batteries and thinking about using solar panels, he realised that wind was abundant near his house and decided to build a wind mill. Being an electric mechanic, he had sound knowledge of motor winding and dynamos. He started his work in 2007 and complete one round of prototyping by 2009 installing a windmill on the roof of his house. However, this had problems which he rectified after careful observation.

His windmill cost him about Rs 70, 000 to develop. It can be installed near the house or on the roof with a RCC construction and produces 0.8-1.2 kVA (80 volt @ 10-15 A) electric power at a wind speed of 3-3.5 m/s. The turbine blades can also be stopped from rotation or the direction of rotation can be reversed from ground itself by electric brakes.

**Remote control for electric appliances and others**

**Mallesh Bommagani**
Nalgonda, Andhra Pradesh

Scout: C Mallesham


Mallesh (27) is a young grassroots innovator and a budding entrepreneur who has come up with a number of interesting ideas, made innovative products and commercialized them.

After completing class tenth, Mallesh discontinued studies to take up a job in a bakery, then worked as a milkman and house help and then joined an electronic repair shop to learn job work.

While working in the electrical shop, Mallesh made a circuit to replace the choke and starter of a tube light and another circuit to light fused tube lights. He started selling this in 2001 at the age of 16 years and has sold more than 1000 kits. To help her bedridden mother he installed a remote operated electric switch operation system in his house in 2004 and since then has sold over 300 pieces so far. Same year he made a cell phone charger using bicycle dynamo and sold 300 pieces in the nearby villages. In 2005, Mallesh made a solar based cell phone charger and sold 20 pieces. He then went on to make a solar based bicycle, solar FM radio, solar cap, solar TV, small desert cooler, LED lights for kerosene lamps, motor controller for overhead tank, circuit to control motors in wells, SMS based cell phone operated remote starter etc. To facilitate farmers rapidly remove weeds from the fields and also to overcome the shortage of labour for this purpose, Mallesh is designing a solar operated weeder.

Now that he has been able to come out of the abject poverty he found himself earlier in, Mallesh plans to scale up his production ensuring, at the same time, that the quality of his products is not compromised with. Mallesh continues to believe in himself and moves towards a brighter future with a smile.

## Black Pepper Plucking Tool

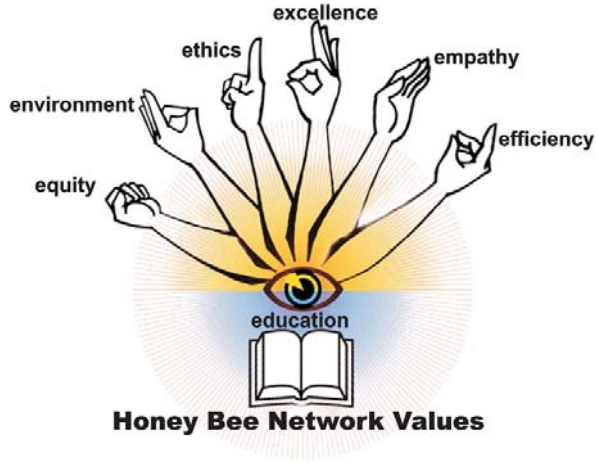
**Pratheesh C**
Palakkad, Kerala

Scout: Peermade Development Society

Pepper is either plucked using a regular nipper or manually. A nipper drops the pepper on the ground while manual plucking damages the pepper. Pratheesh (22) developed a plucking tool with a triangular cup below the blades to hold the cut pepper bunch.

Pratheesh is a mechanic and has his own workshop for making grills, gates etc. After studying till class ten, he undertook training at an Industrial Training Centre (ITC). Thereafter he met another innovator and started working together on several innovations including stone cutting machine and sand separating machine. Later he started a workshop for production of some of these innovations. However, he found it challenging to market them successfully.

To make the pepper nipper, a farmer from his village had approached him and had sought a solution. The nipper consists of a two feet long PVC pipe attached to a triangular cup with teeth on the upper side of the cup. The stalk of the pepper is cut by the teeth of the nipper, and the pepper gets collected in the cup below. The length of the nipper is adjustable by attaching PVC or GI pipe. While nippers are available for fruits, this is a simple modification to suit pepper plucking.

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