

## Impact of Nanotechnology in Rural Area for Health and Safety: Farmers in Natural Agroengineering

**Author:** Brij Lal Meena and Rajendra Prasad

**Email:** blmeena@gmail.com; 1989.rpm@gmail.com

For 20 years, Brij Lal Meena has been trying to produce better and healthy food using fruit farming methodologies. He has noticed non-scientific and toxic chemical methodologies for farming and agriculture that cause various human health issues. Additionally, he has seen a rapid growth of cancer in rural areas “especially in North India.” Therefore, he decided to work for healthy food production without using carcinogenic chemicals. Recently, Brij Lal Meena started working with Dr. Rajendra Prasad, who is a Nanomedicine Investigator at Prof. Rohit Srivastava’s NanoBios Lab, Department of Biosciences and Bioengineering, Indian Institute of Technology Bombay, Mumbai Powai, India.

Brij Lal Meena is an agroengineer farmer who belongs to a remote village named Jirota, Karauli in Rajasthan. He has noticed various cancer cases in rural areas suffering from the high cost of treatment and lack of knowledge for early-stage diagnosis and treatment causing immense pressures on cancer patients that made him work for toxic chemical-free fruit farming “food production” as an Agroengineer. He has approached Dr. Rajendra to utilize and learn nanomedicine concepts for a better quality of fruit production without using toxic chemicals.



Brij Lal Meena  
Agroengineer Farmer



### How would you explain your work to the other farmers in non-scientific community?

It is hard to find better methodologies for natural Agroengineering in rural areas, which were common a few decades ago. Nowadays, chemical industries have taken the natural agroengineering/farming and produced various toxic food products and fruits. Additionally, chemical-based toxic fertilizers reduce soil fertility and quality; that’s why the overall production is going down day by day. Hence, natural Agroengineering could be a better solution to overcome these methodologies and limitations. In natural Agroengineering, farmers could use naturally derived fertilizers and components for farming to maintain the fertility and quality of the soil. Moreover, farmers in rural areas can collaborate with scientists and use scientific methodologies to produce healthy food products and avoid health-related issues. Further, nanotechnology based natural Agroengineering could have better quality and healthy food products and fruits. In my opinion, a collaboration between farmers and nano-scientists could yield safe and better quality of natural Agroengineering based food products. Also, I have been using natural Agroengineering with Dr. Rajendra Prasad, a well-known nanotechnologist and working on cancer diagnosis and treatment. I have used natural source-derived nanocarbon named as quantum dots with Goat Manure based

natural compost obtained from goat feces “natural fertilizer” for natural Agroengineering, especially for fruit farming. The availability of high-level nutrients and various elemental components helps in the overall growth of the plant and fruit. However, before applying this natural compost for proper agriculture and fruit farming, there are many important hurdles needed to be addressed and we are in the pre-mature stage of our work as shown in Figure 1.



**Figure 1.** Digital photographs of (a) prepared diluted carbon nanodots, (b) collected goat feces, (c) prepared goat manure, (d) prepared carbon nanodots mixed goat manure-based natural compost, (e) health observation of papaya plant and (f) Guava plant after the treatment with natural compost, (g) obtained papaya fruits and (h) Guava fruits after the treatment with natural compost.

### What are the possible consequences of these findings?

It is believed that agricultural production must reach around 70 % to meet the global food demand by

2050. Therefore, the applicability of fertilizers/and pesticides has become a common trend in agriculture. So far, agriculture farmers have been facing various health and safety challenges due to the wide usage of chemical fertilizers/and pesticides and flawed farming methodologies leading to multiple diseases. Moreover, low efficiency and high quantity usage of fertilizers reduce the fertility of soils, promoting the farmers' cost. Importantly, the agrochemicals' applications are at high peaks to achieve high yields of crops causing various environmental issues such as poor soil fertility and quality, toxicity, scarcity of water resources, climate changes, and several other ecosystem amenities. The excessive use of these traditional methodologies raised a lot of apprehension for human/animal health and the environment. The deprivation of knowledge sharing between technologists and farmers reduces the overall healthy agriculture fabrication, especially safe fruit production.

On the other hand, nanotechnology is a well-established technology for various applications such as bio-medicine, catalysis and energy. Further, the suitability of nanotechnology in agriculture applications is a recently conceptualized research area. Interestingly, it is trusted that nanotechnology-based approaches help to deliver a dynamic junction balance between agricultural production and environmental sustainability. Majorly, United States, China and Israel are applying nanotechnology approaches and applications in agriculture that are now growing in India. Further, these countries are focusing mainly on implementing agriculture projects where nanotechnology demonstrates its potential performance, such as the usage of nano-formulated pesticides. Overall, the benefits of nanotechnology-based agroengineering in fruit farming and agriculture have received international attention for

better health and safety. Consequently, scientific validations and regulations of nanoparticle-based fertilizers and pesticides are an urgent need and widespread nanotechnology knowledge in rural areas.

### **What was the exciting moment (eureka moment) for this work?**

Being a farmer, the Natural Agroengineering and scientific methodologies always excite me to cultivate healthy food products and develop naturally derived composites as safe fertilizers. Corroborating nanotechnology-based products with naturally obtained composites as safe fertilizer named "DESI KHAD" was challenging for me. However, *healthy fruits and plants results* have shown significant importance of our designed natural composites (see Figure 2). This was the moment that excited me to think more and more about Natural Agroengineering.

### **What do you hope to do next?**

These observations gave us hope to try the designed natural compost at a large scale and setup a Natural Agroengineering based start-up for further scientific studies that may provide a chance to translate our product for better human health.

### **Where do you seek scientific inspiration?**

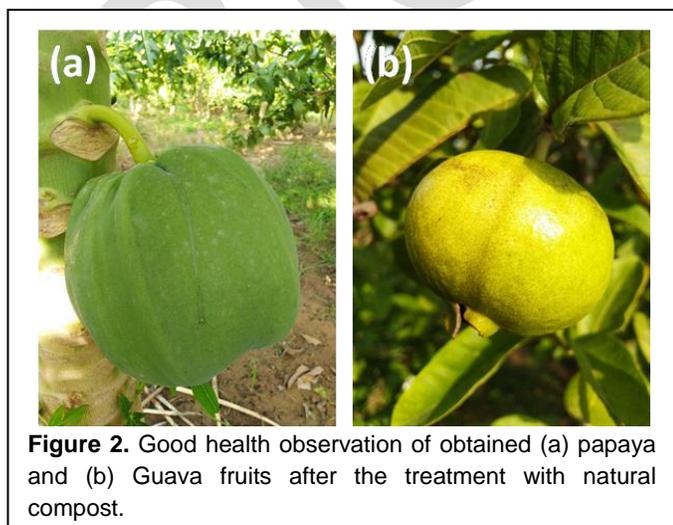
The worst situation of cancer patients due to chemical based food products made me clear to work in Natural Agroengineering.

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### **Author information**

**Brij Lal Meena:** V+P-Jirota, Zeerota, Sapotra, Dist. Karauli, Rajasthan, India

**Rajendra Prasad:** Department of Biosciences and Bioengineering, Indian Institute of Technology Bombay, Powai, Mumbai, India



**Figure 2.** Good health observation of obtained (a) papaya and (b) Guava fruits after the treatment with natural compost.

The global population has manipulated the demand for food products promoting the common usage of fertilizers on a large scale. Chemically derived agricultural fertilizers/and pesticides and flawed farming methodologies hamper the health, safety and agri-foods production instigating various diseases. Remarkably, low awareness of scientific cultivation and the frightening of natural agroengineering are major hurdles in rural areas that need to be resolved. On the other hand, nanotechnology based functional materials in agriculture is a recent development. Moreover, a combination of chemical fertilizers and functional nanomaterials have become a common trend in agriculture but, environmental toxicity and side effects on human and plant health are critical concerns. Therefore, naturally derived organic compost has become a new hope for better cultivation and safe fruit farming that is further conceptualized in the combination of nanomaterials and naturally prepared compost. However, agriculture farmers and technologists in rural areas are less explored with the impact and knowledge of nanotechnology. Herein, we discuss the natural agroengineering developed by nanotechnologists and farmers. We have observed the impact of carbon nanodots and goat manure mixture as natural compost for healthy fruit farming. Overall, a relationship between the nanotechnologist and farmers could bring new hope for better health and safety in the rural areas.