

INTEGRATED BAMBOO PORCESSING FACILITY WITH ZERO WASTE

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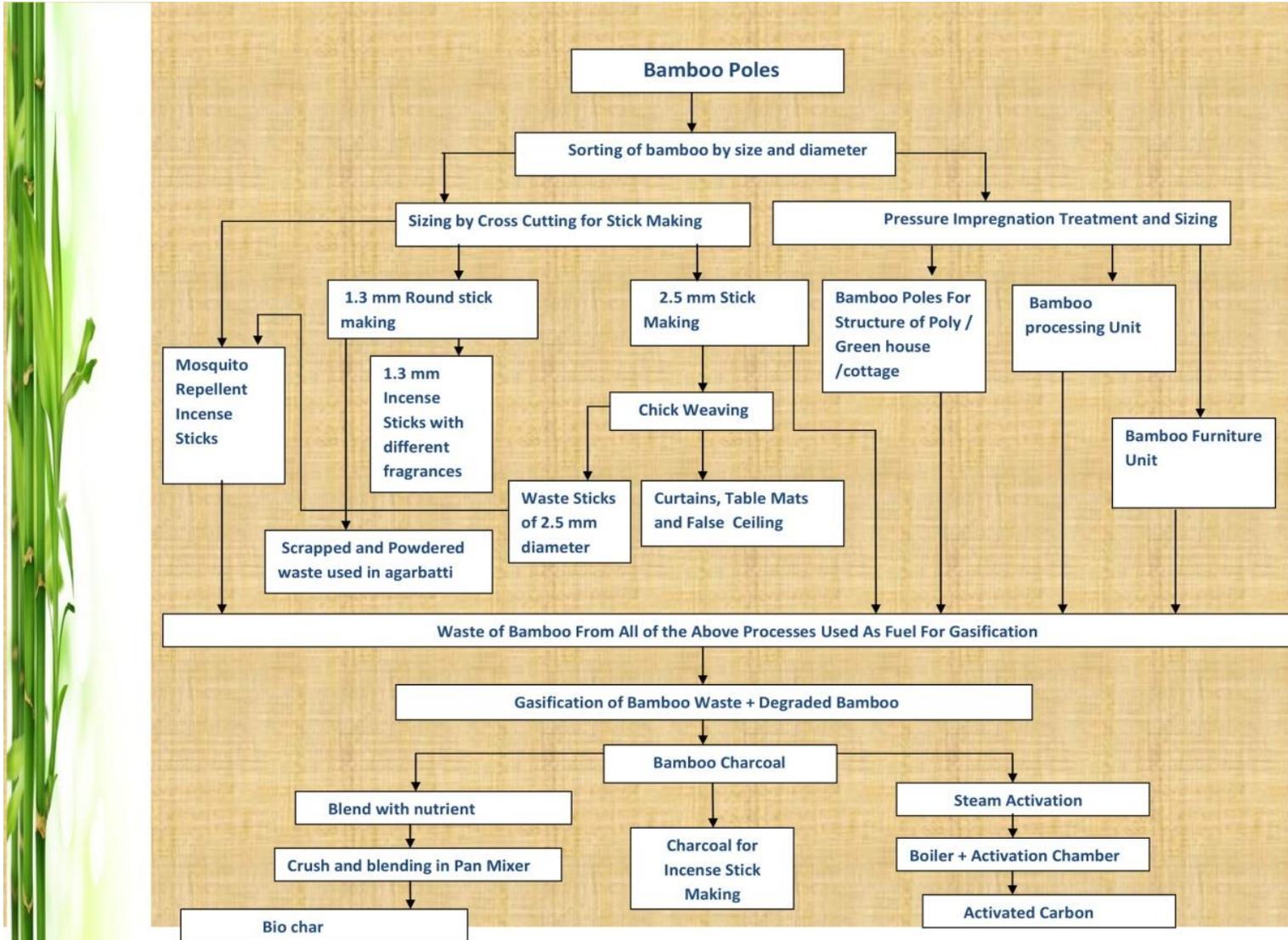
About us...

Sustainable Options is a Bhopal based organization working for promotion of bamboo based technologies for sustainable development for over 15 years. We have an integrated bamboo processing unit for producing round sticks of bamboo, treatment of bamboo in pressure impregnation plants for its longer life, production of bamboo charcoal, organic biochar mix, and do primary processing of bamboo for making various value added products and bamboo structures for polyhouse, housing / cottages etc and generate clean power from gasification of bamboo process waste in our bamboo gasification based power plant.

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- Bamboo is the most versatile base material having multiple applications as an environment friendly building material, source of clean & renewable energy ,raw material for biochar/activated charcoal with many beneficial applications and a very potent climate change mitigation agent.
- We have setup an integrated bamboo processing unit as a zero waste facility at Bhopal.
- We work on all aspects of bamboo from plantation of bamboo of appropriate varieties , growth management ,harvesting and post harvest management , treatment of bamboo for its preservation and longer life and manufacturing of round sticks of bamboo , raw agarbatti rolling ,production of bamboo chicks and other value added products.
- The entire bamboo process waste is used as fuel in our bamboo gasification based power plant to generate producer gas which is used for clean and renewable power to energise & operate all the machines in the unit and bamboo charcoal is produced as bi-product to be used as biochar and activated carbon.

Our integrated bamboo project



Following are some of the products manufactured /promoted as value added products

- Production of round sticks for agarbattis and raw agarbatti.
- Production of bamboo Charcoal (biochar for soil amendment ,as an animal & fish feed additive, clean fuel ,cost effects water treatment, pharmaceutical & beauty products).
- Clean power generation from bamboo gasification for captive use.
- Treatment of bamboo poles for polyhouse structures, Cottages and Gazeboes
- Bamboo roll up chics and table mats for interiors.
- Bamboo flooring tiles and bamboo Mat board for housing.
- Pre fabricated wall panels for bamboo houses & other structures.
- Pre fabricated toilet structure

Consulting services for bamboo plantation planning and execution

Disaster Management with Bamboo-

- Pre fabricated emergency shelters
- Bamboo structure for toilets
- Bamboo rings for leach pit lining of toilets

An integrated production unit of 2.5 MT/ day of round sticks of bamboo can potentially utilize bamboo grown on one acre of land per day ,thus facilitating an assured high income to the bamboo farmers and the whole integrated facility can provide sustainable employment for 100 local persons

Bamboo Charcoal / Biochar obtained from gasification of bamboo process waste

Biochar is a carbon-rich, fine-grained residue which can be produced either by ancient techniques (such as covering burning biomass with soil and allowing it to smoulder) or state-of-the-art modern biomass gasification / pyrolysis processes. Combustion and decomposition of woody biomass and agricultural residues results in the emission of a large amount of carbon dioxide, whereas Gasification / pyrolysis of such biomass would convert it to Biochar which when applied to soil can store this CO₂ in the soil leading to reduction in GHGs emission and enhancement of soil fertility.

Biochar holds the promise to tackle chronic human development issues like hunger and food insecurity, low agricultural productivity and soil depletion, deforestation and biodiversity loss, energy poverty, water pollution, air pollution and climate change.

Besides biochar, bio-oil and gas can be collected from modern Gasifiers /pyrolizers.

In our unit we use bamboo obtained as waste material from various processing as shown in our flow chart. This waste then fed into the biomass gasifiers, under controlled conditions and in absence of oxygen the process of manufacturing of biochar takes place. This process produces gas and charcoal, this obtained gas is called producer gas and can be use for thermal or electrical application.

Benefits of bamboo for making biochar

While the forest coverage in tropical and subtropical is decreasing, the bamboo forest area is increasing. It is estimated that the Bamboo area is increased annually by 1-2% in the world ..The reasons behind this phenomena are :

- ➔ Easy to be managed, high biomass production.
- ➔ High economic value.
- ➔ Bamboo timber can be harvested every year after 4-5 years, compared to 20 to 50 years for trees.
- ➔ Bamboo can be selectively harvested annually and regenerates without replanting.
- ➔ Bamboo generates 30% more oxygen than trees.
- ➔ It helps reduce carbon dioxide gases blamed for global warming. Some bamboo sequesters up to 12 tons of carbon dioxide per hectare, which makes it an efficient replenisher of fresh air.
- ➔ Bamboo biochar can increase the amount of carbon locked into the soil for hundreds or thousands of years. It also helps soil retain water, and reduce methane and nitrogen emissions.

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- Biochar is a carbon-rich product made from renewable agricultural/woody biomass waste residue like bamboo ,corn cobs, cotton stalk, lantana ,mulberry etc.
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- We produce it through gasification of bamboo waste (heating in the absence of oxygen).
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- It can be used either alone or mixed with organic additives in suitable ratio.
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- Research findings and experience on the field show that there is an increase in crop yields by using Biochar Soil amendment.
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- Biochar has tremendous potential for water conservation in agriculture and horticulture ,specially in poly houses/green houses and new plantations.
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- It is very useful in areas where water is scarce and soil is degraded.
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- It is a soil amendment that is plowed-in only once and has a lasting effect for centuries.
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Effect of biochar on different soil properties

Factor	Impact	Source
Cation exchange capacity	50% increase	(Glaser et al., 2002)
Fertilizer use efficiency	10-30 % increase	(Gaunt and Cowie, 2009)
Liming agent	1 point pH increase	(Lehman and Rondon, 2006)
Soil moisture retention	Up to 18 % increase	(Tryon, 1948)
Productivity	20-120% increase	(Lehman and Rondon, 2006)
Methane emission	100% decrease	(Rondon et al, 2005)
Nitrous oxide emissions	50 % decrease	(Yanai et al., 2007)
Bulk density	Soil dependent	(Laird, 2008)
Mycorrhizal fungi	40 % increase	(Warnock et al., 2007)
Biological nitrogen fixation	50-72% increase	(Lehman and Rondon, 2006)

Biochar as an agent for climate change mitigation

Decaying or burning biomass releases CO₂ into the atmosphere and plants reabsorb it; this active carbon cycle has been in balance for millennia. Burning fossil fuels puts excessive CO₂ into the air, more than can be absorbed naturally. This traps heat in the Earth's atmosphere. Reducing atmospheric CO₂ is critical to combat climate change.

Large amounts of forestry and agricultural residues and other biomass are currently burned or left to decompose thereby releasing carbon dioxide (CO₂) and/or methane (CH₄)—two main greenhouse gases (GHGs)—into the atmosphere.

Under biochar conversion scenarios, easily mineralized carbon compounds in biomass are converted into fused carbon ring structures in biochar and placed in soils where they persist for hundreds or thousands of years.

When deployed on a global scale through the conversion of gigatons of biomass into biochar, studies have shown that biochar has the potential to mitigate global climate change by drawing down atmospheric GHG concentrations.

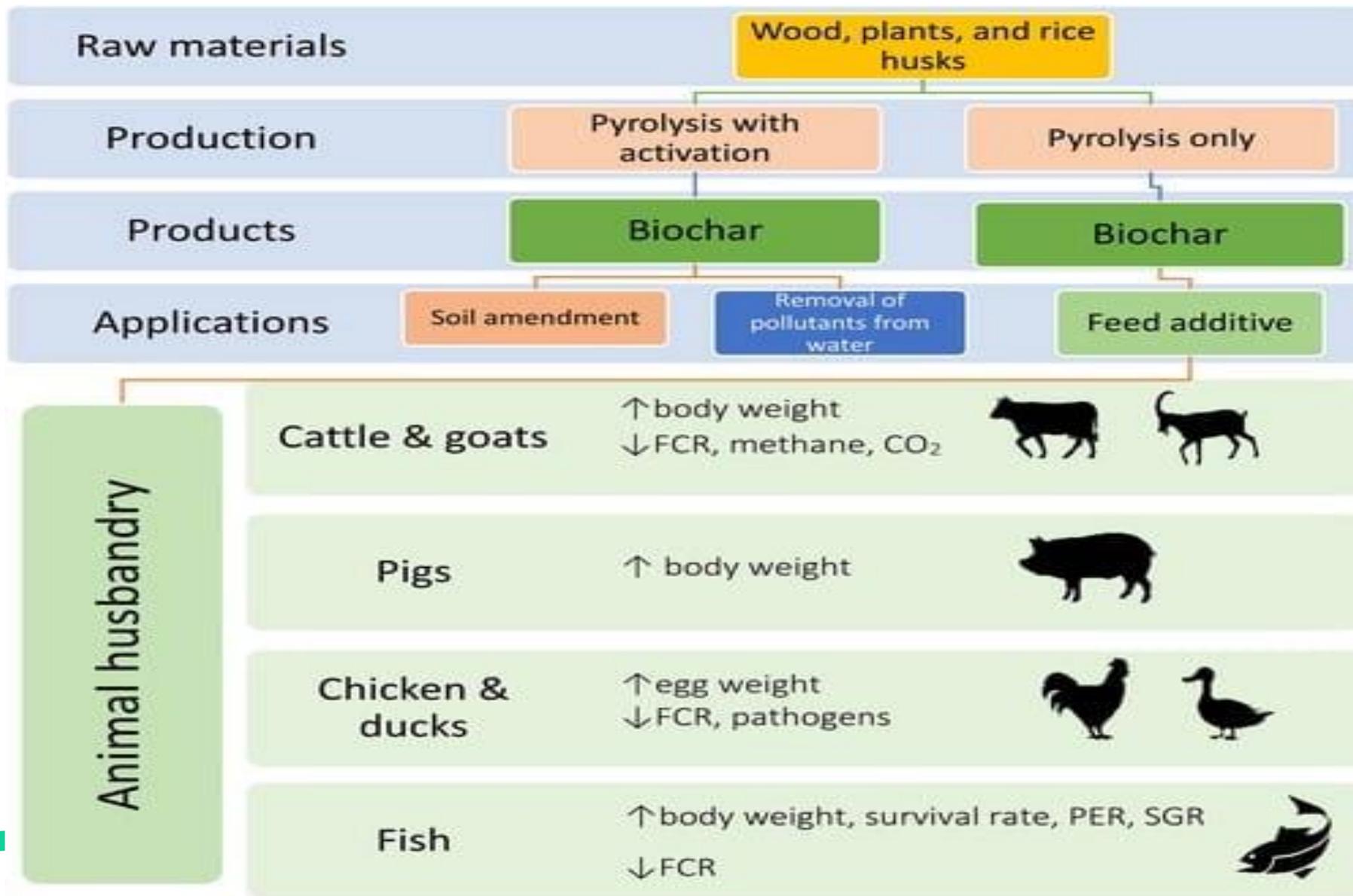
Use of Biochar in animal farming

At present approx. 90% of the biochar used in Europe goes into animal farming. Different to its application to fields, a farmer will notice its effects within a few days. Whether used in feeding, litter or in slurry treatment, a farmer will quickly notice less smell.

Used as a feed supplement, the incidence of diarrhoea rapidly decreases, feed intake is improved, allergies disappear, and the animals become calmer.

In Germany, researchers conducted a controlled experiment in a dairy that was experiencing a number of common health problems: reduced performance, movement disorder, fertility disorders, inflammation of the urinary bladder, viscous salivas, and diarrhoea. Animals were fed different combinations of charcoal, sauerkraut juice or humic acids over periods of 4 to 6 weeks.

- Biochar, has been used in acute medical treatment of animals for many centuries. Since 2010, livestock farmers increasingly use biochar as a regular feed supplement to improve animal health, increase nutrient intake efficiency and thus productivity
- Studies on beef cows in the Great Plains of the US found that adding biochar to feed reduces cows' methane emissions by between 9.5 % ...
- The use of biochar as feed additive has the potential to improve animal health, feed efficiency and the animal-stable environment; to reduce nutrient losses ...
- Oral applications of biochar from 200-400 g/day has proved beneficial.



Improved Digestion:

Biochar has been shown to promote improved digestion in animals.

Increased Immunity:

As an adsorbent, biochar has been shown to lock up toxins in the digestive tract. This maintains the balance of microbial activity and avoids subsequent damage to the animal's digestive system.

Reduced Chronic Botulism:

Botulism in cows has been an increasing concern in recent years.

Increased Feed and Energy Efficiency:

The addition of biochar to poultry feed has been shown to improve the absorption of energy from feed, ultimately improving the efficiency of the feed.

Increased Growth Rates:

Increased growth rates and final body weights in broilers as a result of biochar have also been documented.

Biochar in poultry:

An immediate use of biochar in poultry farming is to reduce and even eliminate odours from poultry litter, particularly ammonia.



Biochar adsorbs gases, liquids, and ions, and ammonia (NH_4^+) is all three. Ammonia irritates skin on contact and degrades even hard tissue, such as hooves. It also attracts insects, such as flies. This is one reason biochar can even serve as a fly deterrent.

Biochar is also a catalyst to facilitate populations of microbes. Many bacteria, fungi and other simple life forms take up residence in char micropores. Feeding biochar stimulates beneficial bacteria in the GI tract to strengthen digestion and immunity. It can increase nutrient adsorption, retention, and transport to improve the liver-intestine circuit.

Biochar promotes digestion and improves feed efficiency and thus increases energy gained from feed. Toxins effectively bind to biochar, mitigating adverse effects on the digestive system and intestinal flora. The health and vitality of animals also improves, as will meat and egg production. With animals' immune systems stabilized, infection risks from pathogens decrease.



Biochar as construction material

- The two interesting properties of biochar are its extremely low thermal conductivity and its ability to absorb water up to 6 times its weight. These properties mean that biochar is just the right material for insulating buildings and regulating humidity. In combination with clay, but also with lime and cement mortar, biochar can be added to clay at a ratio of up to 50% and replace sand in lime and cement mortars. This creates indoor plasters with excellent insulation and breathing properties, able to maintain humidity levels in a room at 45–70% in both summer and winter. This in turn prevents not just dry air, which can lead to respiratory disorders and allergies, but also dampness and air condensing on the walls, which can lead to mould developing.
- The biochar-mud plaster adsorbs smells and toxins, a property not just benefiting smokers. Biochar-mud plasters can improve working conditions in libraries, schools, warehouses, factories and agricultural buildings.
- Biochar is an efficient adsorber of electromagnetic radiation, meaning that biochar-mud plaster can prevent “electrosmog”. Biochar can also be applied to the outside walls of a building by jet-spray technique mixing it with lime. Applied at thicknesses of up to 20 cm, it is a substitute for Styrofoam insulation. Houses insulated this way become carbon sinks, while at the same time having a more healthy indoor climate. Should such a house be demolished at a later date, the biochar-mud or biochar-lime plaster can be recycled as a valuable compost additive.

Biochar as decontaminant

- As a soil additive for soil remediation – for use in particular on former mine-works, military bases and landfill sites.
- Soil substrates – Highly adsorbing and effective for plantation soil substrates for use in cleaning wastewater; in particular urban wastewater contaminated by heavy metals.
- A barrier preventing pesticides getting into surface water – berms around fields and ponds can be equipped with 30-50 cm deep barriers made of bio-char for filtering out pesticides.
- Treating pond and lake water – bio-char is good for adsorbing pesticides and fertilizers, as well as for improving water aeration.

Use of Biochar in wastewater treatment

- Bio filtration of the municipal wastewater with Biochar acting as the bio adsorbent allowed to take place over a 5 day period will reduce COD concentration in the municipal wastewater by 90% upon treatment with bio-char.

Biochar in textiles

- In Japan and China bamboo-based bio-chars are already being woven into textiles to gain better thermal and breathing properties and to reduce the development of odours through sweat. The same aim is pursued through the inclusion of bio-char in shoe soles and socks.



Bamboo biochar nutrient characteristics.

The range of total :

N: 0.2-0.5%

P_2O_5 : 0.06-0.20%

K_2O : 0.6-1.1%

Ca, Mg and Na: 0.2-0.6%





Thank you for your attention



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