

Abstracts

【Special Issues: Fertilizer from Waste】

1. Amendment of Fertilizer Regulation Law for the Promotion of Soil Fertility and Organic Resource Recycling

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Abstract

Soil management that is heavily dependent on chemical fertilizers has led to serious deterioration of soil fertility and nutritional balance. The recycling and fertilizer use of organic resources such as livestock manure and industrial by-products has therefore become significant. It enables a reduction of dependence on overseas raw materials for fertilizers and also reduces the overall environmental load. In order to create the conditions for promoting such efforts, the Fertilizer Regulation Law was amended in 2019. The amendment enables the compounding of livestock manure and chemical fertilizers, introduces the compulsory management of raw materials for fertilizers, and introduces a labelling standard for quality and functions other than ingredients. We will make use of the amendment of the law to produce new organic fertilizers and to meet the needs of farmers, as well as to construct systems for recycling of organic resources and to change the mindset of farmers with regard to soil fertility. Collaboration among related parties will be essential for achieving this recycling of organic resources.

Keywords: Fertilizer Law, soil fertility, organic resources recycling

2. Problems of and Prospects for Organic Fertilizers Derived from Municipal and Industrial Solid Waste

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Abstract

In this paper, the current status, problems, and prospects are discussed regarding the production of organic fertilizers (compost) from food waste derived from municipal and industrial solid waste. The annual amount of food waste in municipal solid waste is estimated at 10 million tons or more and it is almost totally incinerated in Japan except for compost production at 81 facilities in 2019. Approximately 30% (5 million tons) of food waste in industrial waste is not being used as resources. Small-scale household compost production from kitchen garbage is performed by using plastic containers called 'composters', along with box composting and electric garbage treatment apparatuses, which are recommended by many municipalities for reducing waste discharge. Large-scale machines for treating garbage are widely used in hotels, company cafeterias, hospitals, etc. Over 60 municipalities and organizations are involved in compost production from municipal and industrial food waste in Japan. Problems associated with the lack of quality standard of compost in Japan and the promotion of compost production from unutilized food waste are discussed.

Keywords: food waste, garbage, kitchen waste, organic fertilizer, compost

3. Challenges and Prospects for the Conversion of Agricultural Wastes into Fertilizer

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Abstract

Agriculture generates 5.25 million tons of livestock excrement and 4.98 million tons of inedible agricultural crop parts as organic waste. There are several productive ways to utilize these wastes in the agricultural process, including: 1) direct plowing; 2) composting; 3) carbonization; and 4) use of digestive liquid after methane fermentation. Composting is the most common method for managing livestock manure and straw, while direct plowing is most common for vegetable waste. Although composting technology is widespread, it has the disadvantage that the composition varies greatly depending on the raw material and production method. Fertilizer is mainly dried and raw materials, such as chicken manure, may be limited. Carbonization is not only limited by raw material sourcing but also due to applications. Methane fermentation has the advantage of high moisture content, energy recovery, and liquid fertilizer production, but it requires large-scale facilities. In order to promote the use of agricultural wastes in the future, it will be necessary to introduce new businesses that focus on mixing compost with chemical fertilizer and also experiment with new methods such as liquid fertilizer production by hydrothermal decomposition. Biogasification will also need to be more widely promoted by new entrepreneurs.

Keywords: agricultural wastes, livestock wastes, composting, fertilization, hydrothermal degradation

4. Challenges and Prospects for Utilization of Sewage Sludge Fertilizer and Compost

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Abstract

Sewage sludge with concentrated amounts of nutrients, such as phosphorus in particular, has been projected to become a viable resource for use as fertilizer and compost in plant cultivation. Up to now, sewage sludge has been not used more frequently than animal manure compost. This paper summarizes the expectations and concerns regarding this anticipated trend toward application of sewage sludge compost. In addition, the paper refers to research examples that describe what type of sewage sludge compost would be required for its gainful utilization. Sewage sludge compost contains almost the same levels of organic matter and nutrients (nitrogen, phosphorus, calcium, etc.) as animal manure compost, excepting potassium. The amount of toxic metal(loid)s in sewage sludge compost is approximately the same as that found in animal manure compost. The level of insoluble phosphorus is higher compared to animal manure compost, but phosphorus in sewage sludge compost can be slow-releasing. It will be necessary to further evaluate the physicochemical properties of sewage sludge compost, taking into account the effects of coagulants and trace substances for the realization of its ultimate use. In addition, points and procedures for sewage sludge compost evaluation, as well as its quality standards need to be assigned and planned.

Keywords: potassium, toxic metal(loid), organic matter, nutrient phases, phosphorus

5. Use of Biomass Resources as Fertilizer for Soil Fertility Management

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Abstract

In Japan, it has become apparent that imbalances such as excessive phosphate and potassium in the soil due to over-fertilization in upland fields and greenhouses, along with soil fertility decline in paddy fields caused by insufficient application of organic matter and silicate fertilizers is leading to a marked polarization of soil fertility. This is part of the reason that livestock manure compost has been applied as a soil amendment rather than as a fertilizer in the upland fields. In addition to this, due to low rice prices and a shortage of manpower, the amount of compost and silicate fertilizer applied to paddy fields, which require compost, has been drastically reduced. Biomass resources produced in Japan, such as livestock manure, sewage sludge, and food waste, contain fertilizer components that far exceed the amount of nitrogen, phosphate, and potassium in the chemical fertilizers used in Japan. Before now, biomass resources were mainly used as compost. However, in the future, it will be necessary to develop and promote the use of fertilizers that look and feel like existing ones. Organic farming, which relies solely on organic matter, may contribute to nutrient imbalance in the soil. To prevent this from happening, it is essential to use chemical fertilizers in combination, which can adjust the amount of fertilizer components applied at any given rate.

Key words: soil fertility, biomass resources, livestock manure compost, sewage sludge, food waste

6. Importance of Ensuring Sustainable Fertilizer Resource Management

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Abstract

Nutrients, including Nitrogen (N) and Phosphorus (P), are essential elements for plants and animals to grow and thrive. Fertilizers play a major role in improving soil productivity. On the other hand, excess use of fertilizer results in eutrophication, which degrades waterbodies, soil, and the atmosphere. Increasing population is inevitably associated with an increase in food demand, which amounts to a greater requirement for nutrients. In addition, low-carbon technologies create new demands for reactive nitrogen and high-purity phosphorus. Increasing demand for nutrients for a low-carbon society raises alternative concerns, not only negative impacts on the environment but also competition between agricultural and industrial/energy applications. Awareness of the need to sustainably manage our nutrient resources has become more important than ever. It is necessary to oversee the flow of nutrients through supply chains and create a practical system which involves all stakeholders.

Keywords: nutrient, phosphorus, nitrogen, material flow, stakeholder engagement

7. Future Forecast for Waste Fertilizer

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Abstract

With the revision of the Fertilizer Law, it has now become possible to utilize a wide range of organic resources centered on livestock excrement. In particular, there are increasing expectations for a fertilizer distribution system that can be administered over a wide area by eliminating the distance restrictions from the demand area due to uneven allocation of livestock excrement. Fertilizer production using compost, however, has restrictions such as location conditions, manufacturing equipment, manufacturing know-how, etc. This means that fertilizer manufacturers that can be commercialized due to the revision of the legal system are limited and there are still issues including the application methods for agricultural land. Based on the current situation of fertilizer production using compost, we further discuss the idea of fertilizer application management in the near future using smart technology.

Keywords: compost, livestock, fertilizer, smart technology, fertilizer applicator