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A CRITICAL STUDY ON THE USE, APPLICATION AND EFFECTIVENESS OF ORGANIC AND INORGANIC FERTILIZERS

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ABSTRACT

Agrochemical is evolved by the contraction and combination of words agricultural and chemical, and is a generic term used for the various chemical products typically used in agriculture. Agrochemicals essentially help in intensifying crop production and to reduce the effects of pests and parasites on farm animals. Agrochemical basically refers to the broad range of pesticides and fertilizers. A fertilizer is any material, organic or inorganic, natural or synthetic, that supplies plants with the necessary nutrients for plant growth and optimum yield. Organic fertilizers are made from materials derived from living things. Animal manures, compost, etc. are organic fertilizers. Chemical fertilizers are manufactured from nonliving materials. Rock phosphate for example, is a common source of phosphorus in chemical fertilizers. This paper focuses on the differences between the organic and inorganic fertilizers in terms of their use, in terms of application and in terms of their effectiveness. It is summarized that the best approach is probably to use calculated quantities of organic fertilizers in combination with inorganic fertilizers so as to overcome the disadvantages and utilize the advantages of both these types of fertilizers.

INTRODUCTION

Agrochemical is evolved by the contraction and combination of words agricultural and chemical, and is a generic term used for the various chemical products typically used in agriculture. Agrochemicals essentially help in intensifying crop production and to reduce the effects of pests and parasites on farm animals. Agrochemical basically refers to the broad range of pesticides and fertilizers.

A fertilizer is any material, organic or inorganic, natural or synthetic, that supplies plants with the necessary nutrients for plant growth and optimum yield. Organic fertilizers are natural materials of either plant or animal origin, including livestock manure, green manures, crop residues, household waste, compost, and woodland litter. Inorganic (or mineral) fertilizers are fertilizers mined from mineral deposits with little processing (e.g., lime, potash, or phosphate rock), or

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industrially manufactured through chemical processes (e.g., urea).

Mined inorganic fertilizers have been used for many centuries, whereas chemically synthesized inorganic fertilizers were only widely developed during the industrial revolution. Inorganic fertilizer use has also significantly supported global population growth - it is estimated that almost fifty percent of the people on the Earth are currently fed as a result of synthetic nitrogen fertilizer use.

Fertilizers typically provide, in varying proportions:six macronutrients: Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), Magnesium (Mg), and Sulfur (S); Eight micro nutrients: Boron (B), Chlorine (Cl); Copper (Cu), Iron (Fe), Manganese (Mn), Molybdenum (Mo), Zinc (Zn) and Nickel (Ni).

This paper focuses on the differences between the organic and inorganic fertilizers in terms of their use, in terms of application and in terms of their effectiveness.

Differences in terms of their use

For organic fertilizers, soil fertility on small farms is almost entirely dependant on locally available resources. Cattle manure, cereal and legume stover and woodland litter are the commonly used organic fertilizers, but these are rarely applied in sufficient quantities to impact on crop yields. The use of high quality organic fertilizers is rarely practised, although through research and extension activities, some farmers now include legume green manures or legume-based fallows in crop sequences. The main advantage of using organic fertilizers is that, compared to inorganic fertilizers, they are usually available on or near the farm at very little or no cost other than labor costs of handling, transportation, or opportunity costs of land used for their production.

Inorganic fertilizers need to be applied to crop at least two times within a growing season (split application), either basally at planting or top-dressed during vegetative growth. The amount of inorganic fertilizer used in most small farms falls far below standard extension recommendations, due to poor purchasing power, risk aversion due to poor and unreliable rainfall and lack of significant returns. When available, fertilizer use is less labour intensive, thus allowing extra time for other tasks (or for earning income elsewhere).

Differences in terms of application

The method and timing of fertilizer application is an essential component of good farming. For organic materials, decomposition rate and timing of application influence the release of nutrients to the crop. Organic fertilizer application methods include broadcasting, banding, and spot application (or side-dressing). Broadcasting requires less labour and helps to evenly cover the field surface before incorporation into soil through plowing or hand-hoeing. Incorporation generally increases the fertility status of the whole plow layer. If the quantity of organic fertilizer is limited, it may be banded along furrows or spot applied, but the seed needs to be placed away from the fertilizer. Side-dressed organic fertilizers are not likely to have much immediate effect due to delayed nutrient release.

Inorganic fertilizers can be applied by hand or with application equipment. When hand applied, it is essential to distribute the fertilizers uniformly and at the recommended rates to avoid over- or under-fertilization. Application equipment needs proper adjustment to ensure uniform spreading. Broadcast fertilizer should be incorporated after application to enhance effectiveness or to avoid evaporation losses of N. With banding or spot application, take care that no fertilizer is placed too close to either the seed or the germinating plant, to avoid damage to the seedling or roots.

Differences in terms of their effectiveness

Continued use of organic fertilizers results in increased soil organic matter, reduced erosion, better water infiltration and aeration, higher soil biological activity as the materials decompose in soil, and increased yields after the year of application (residual effects). Proper handling of organic fertilizers enhances their quality and effectiveness. Mineral fertilizers, on the other hand, immediately supply nutrients needed by crops. Basal fertilizers contain elements required for good crop establishment and early growth while top-dressing can be done through split applications depending on visible hunger signs and/or moisture availability. In risky environments, spot application of small amounts of N fertilizers improves fertilizer effectiveness. The best response to fertilizer use is obtained if the soil has a high inherent fertility level (high organic matter status). Building inherent fertility requires practices such as retaining crop residues on the field.

DISCUSSION

Organic fertilizers are not immediately available to

plants. Before the plants can use them, they must be broken down by soil microorganisms into simpler, inorganic molecules and ions. In contrast, the nutrients in chemical fertilizers are already in inorganic form and so can be immediately used by the plants. It is important to understand that there is no fundamental difference in nutritional quality between organic and inorganic fertilizers.

Organic fertilizers improve biodiversity (soil life) and long-term productivity of soil, and may prove a large depository for excess carbon dioxide. Organic nutrients increase the abundance of soil organisms by providing organic matter and micronutrients for organisms such as fungal mycorrhiza (which aid plants in absorbing nutrients), and can drastically reduce external inputs of pesticides, energy and fertilizer, at the cost of decreased yield.

On the other hand, organic fertilizers may contain pathogens and other disease causing organisms if not properly composted. Nutrient contents are variable and their release to available forms that the plant can use may not occur at the right plant growth stage.

Although inorganic fertilizers are immediately available to plants, they have three major disadvantages. They are subject to leaching, which occurs when the fertilizers are washed by rain or irrigation water down below the level of the plant roots. Nitrogen is particularly susceptible to leaching. As well, a heavy application of chemical fertilizers can "burn" seedlings and young plants. This is actually a process of drying out, or desiccation, due to the presence of chemical salts within the commercial fertilizers. A third problem associated with the use of chemical fertilizers is that overly heavy applications can build up toxic concentrations of salts in the soil and create chemical imbalances.

Unlike chemical fertilizers, organic material does more than provide organic nutrients. It also improves the soil structure, and increases its ability to hold both water and nutrients. As microorganisms in the soil break down the organic material into an inorganic soluble form, a slow release of nutrients is provided over a longer period of time. This is probably a healthier situation for plant growth in that an oversupply of a nutrient such as nitrogen can lead to lush, succulent tissue growth which is more vulnerable to fungal and bacterial entry, more appealing to some insects, and more prone to stress injury from heat, cold, or drought.

With organic fertilizers a buildup of toxicity in the soil is unlikely, as long as the amount of organic material incorporated into the soil is fully decomposed. On the other hand, there are some disadvantages to the use of organic fertilizers. One of these is that they are not immediately available to the plants. The manure which is applied to a vegetable garden in the spring may not be broken down into organic form by soil bacteria (and therefore available to plants) until midsummer. If organic nutrients have been added to soils continually on an ongoing basis, this may not be a problem. However, if one just begins to rely solely on organic material as a nutrient source, the garden may experience an initial nutrient deficiency until the system is in place.

The amount of nutrients and the exact type of elements available from a given amount of manure, compost or other inorganic fertilizer can only be guessed at. It is dependent on such factors as: the age of the manure or compost; its origin (chicken, cow, horse, sawdust, garden residue, grass clippings); and weather conditions such as temperature and rainfall. It is therefore a less exact way of providing for a plant's nutritional needs. With inorganic fertilizers, the type and amount of any given element in the fertilizer formulation are known.

CONCLUSION

Major advantages of organic and inorganic fertilizers are: Organic fertilizers are usually available on or near the farm at very little or no cost other than labour costs of handling, transportation, or opportunity costs of land used for their production. When available, inorganic fertilizer use is less labour intensive, thus allowing extra time to the farmers for other tasks (or for earning income elsewhere).

Major limitations of organic and inorganic fertilizers are: Organic fertilizers generally require large amounts to have desired effects; extra investment in labour for harvesting (green manures) and preparation (cattle manure); unavailability of seed for green manures is one of the major limitations; quality for most has to be enhanced by combining with expensive mineral fertilizers; Green manures must occupy land at a time when other food crops could be grown. Inorganic fertilizers require high purchasing power; availability is an obstacle, especially in remote areas; need to be applied seasonally; high risk in low rainfall and very high rainfall areas.

To summarize, the best approach is probably to use calculated quantities of organic fertilizers in combination with inorganic fertilizers so as to overcome

the disadvantages and utilize the advantages of both these types of fertilizers.

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