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SABUJEEMA

An International Multidisciplinary e-Magazine

Volume 1| Issue 6 | September, 2021

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sabujeema-international multidisciplinary-e-magazine

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NUTRIENT MANAGEMENT IN AEROBIC RICE

[Article ID: SIMM0136]

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AEROBIC RICE

Aerobic rice production is a revolutionary way of growing rice in well-drained, non-puddled, and non-saturated soils without pounded water Bouman, (2001). This system uses input-responsive specialized rice cultivars and complementary management practices to achieve at least 4-6 t ha^{-1} using only 50-70% of the water required for irrigated rice production. The ecology for this type of rice is intermediate between upland and favourable shallow low lands. This type of cultivation practice can be adopted in target areas like, tank irrigate area, deep bore well / well irrigated area and the places where presumed to receive delayed channel / river water i.e. in delta region during kharif (June – July) and summer (February).Yield of aerobic rice is low due to faulty practice of fertilizer use. An aerobic rice crop attaining 4-6 t ha^{-1} yields obtains many of its required nutrients from the soil. But this “indigenous supply” of nutrients is typically not sufficient to meet all the nutrient needs, and fertilizers will need to be applied. Hence there is a need to have proper knowledge of nutrient management as well as techniques for enhancing the nutrient use efficiency prior to growing of aerobic rice.

NUTRIENT MANAGEMENT IN AEROBIC RICE

Proper fertilization is a major factor to improve the rice yield in aerobic condition and this system of rice cultivation also mitigate the water problem. The nutrients, their sources, method and time of application form an important component of fertilizer management strategies (Vijayakumar et al., 2019c). Inorganic fertilizer mainly N, P, K is one of the key factors to increase the rice productivity. Yield and production increased rapidly due to increased use of chemical fertilizers but it is not a solution to continuously increase the yield year after year. Integrated nutrient management holds promise in sustaining crop yield and improving soil health. In addition to N, P and K, it also supplies considerable amount of secondary and micronutrients, and causes the improved growth and high yield of rice crops (Mondal et al., 2010). Requirement of micronutrients is small compared to macronutrients; nevertheless, micronutrient deficiency can limit crop growth and production but excess use of micronutrients may lead to toxicity that will hamper food safety or quality. Besides major nutrients, Zn is the most important micronutrients and also the essential mineral for IAA synthesis. Boron (B) is an also important constituent of cell walls and its deficiency results in reduced pollen viability and pollen tube development (Arif et al., 2012). Borax should be broadcast and incorporated before planting, top-dressed, or as foliar spray during vegetative rice growth. Integrated Nutrient Management (INM) approach is flexible and minimizes use of chemicals but maximize use efficiency and improve the soil health. Using judicious combination of chemical and organics for achieving enhanced and sustainable production by adopting integrated nutrient supply is imperative.

TOOLS AND TECHNIQUES

Site Specific Nutrient Management (SSNM)

The SSNM a term that widely used in all parts of the world. The earliest use of the term 'site-specific' comes from the late 1920's in USA, when scientists at University of Illinois were providing recommendations on the application of lime to acidic soils (Jones, 1993). A plant-based SSNM approach developed in the early 1990s by the International Rice Research Institute (IRRI), Philippines in collaboration with other partners has been adopted by International Plant Nutrition Institute (IPNI) in India.

The "Precision Nutrient Management (PNM)" or "Site Specific Nutrient Management (SSNM)" is a precise method of application of nutrients, based on the variability in soil and micro-climatic conditions that occur within the field. The scale of nutrient management recommendation domains change from large regions to farms, single field or even single parcel within a large field. The precision nutrient management practices allow timely and precise application of fertilizer to meet plant needs as they vary across the landscape (Patil, 2009). The stagnation in the rice yields recorded in intensive irrigated rice systems due to deterioration in soil quality, negative nutrient balances and depletion of nutrients. Further, large variability exists in soil nutrient supply, Nutrient Use Efficiency (NUE) and crop response to applied nutrients. Nutrient management is a major component of a soil and crop management system. The SSNM is applying those concepts to area within a field that are known to require different management options from the field average. Generally, it addresses the nutrient differences which exist within fields, and making adjustments in nutrient application to match these location or soil differences.

The "Site specific crop and soil management" is a 'repacking' of management concepts. The SSNM avoids indiscriminate use of nutrients by preventing excessive and or inadequate nutrient inputs, and it not only reduced the fertilizer cost but also reduced the usage of pesticides. It provides a field-specific approach for dynamically applying nutrients to rice crop as and when needed. This approach advocates optimal use of indigenous nutrients originating from soil, plant residues, manures, and irrigation water. Fertilizers are then applied in a timely fashion to overcome the deficit in nutrients between the total demand by rice to achieve a yield target and the supply from indigenous sources. The optimal N, P and K doses based on soil testing would help not only to attain desired yield target, but also help to maintain soil health over a period of time.

RATE OF NUTRIENT APPLICATION

- The recommended dose of fertilizer is 80 kg of nitrogen, 40 kg of phosphorus and 40 kg of potash per hectare.
- Ten tons of farm yard manure, 100% phosphorus and 50% of potash has to be applied at the time of last ploughing i.e. at the time of sowing.

- The first dose of nitrogenous fertilizer 30% is applied at 10-12 days after germination.
- During top dressing of fertilizer, sufficient moisture in the soil has to be ensured to make the nutrients available to plants.
- Nitrogen fertilizer applied in three splits, 30% at 10-12 days after germination, 40% at 30 days after sowing and balance 30% at 50 days after sowing.
- Potassium fertilizer has to be applied in two splits, 50% at sowing and 50% at 50 days after sowing.
- Further, zinc sulphate and iron sulphate 20kg and 12kg per hectare respectively have to be applied at the time of sowing.
- A useful tool to assist in the application of nitrogen (N) fertilizer is the Leaf Color Chart (LCC; part of the SSNM approach).
- In the absence of trained extension personnel in SSNM and LCC, an amount of 70-90 kg N ha-1 could be a useful starting point (to be subsequently optimized).
- Instead of basal application of the first N split, the first application can best be applied 10-12 days after emergence to minimize N losses by leaching (the emerging seedling can't take up N so fast, so it will easily leach out).
- Moreover, basal application of N also promotes early weed growth. Second and third split applications of N may be given around active tillering and panicle initiation, respectively.
- On acid soils, aerobic rice will likely be less prone to zinc deficiency than flooded lowland rice; but on high pH soils with calcium carbonate, the reverse may be true.

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