Review on effect of integrated nutrient management on seed yield and quality of pulses

Abstract

Pulses are also known as food utilised as legumes; they have been grown by humans for a very long time and are considered to be the meat of the poor due to their high protein, vitamin, carbohydrate, and mineral content.
Seed is a fundamental component of agriculture and a crucial ingredient.
The growth of the plants from sowing to harvest in pulses, such as soybean, redgram, cowpea, pea and moong depends on a number of elements including soil, nutrients, climate and the efficiency of agricultural operations.
An integrated nutrient management method that maintains a healthy ecosystem while decreasing
pollution is required to maintain good soil health and safeguard the environment from fertilizer pollution "Integrated Nutrient Management" (INM) describes the upkeep. The organic manures Farm yard manure (FYM, vermicompost and poultry manure etc.) increase crop yields either by acceleration of respiratory process by cell permeability or by hormone action. *Rhizobium and Trichoderma*) are living microorganisms when applied to seeds it colonize the rhizosphere (root zone of plants) or the interior parts of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plant. Fixes atmospheric Nitrogen symbiotically in french bean, soybean, cowpea and chickpea etc.

Key words: Organic, inorganic, FYM, Biofertilizers, seed yield and seed quality.

Introduction

The challenge in agriculture for the coming decades will be to meet the world's increasing demand for food in a sustainable way. Pulses are produced all over the world, India is the largest producer of pulses.

Pulses also include twice as much protein than whole grain cereals like maize, wheat, oats, barley, and rice, as well as large amounts of vitamins and minerals like iron, potassium, magnesium, and zinc, as well as higher levels of vitamin B; including folate, thiamin, and niacin.India imported USD 2696 million worth of pulses between January and December 2017, which shared 22.8% among world's top importers.The excess usage of fertilizers with minimum application of organic manures results in nutrient deficiencies, deterioration of soil and also causes environment pollution. Hence, there is an urgent need to optimize nutrient requirement in the crops through integrated nutrient management approach. For sustainable crop production in 2023 and future, Integrated Plant Nutrient Management (INM), which combines the use of mineral fertilisers with organic farm recycling resources like composts, crop residues, urban/rural waste, and bio-fertilizers useful for longer-term use, will be a key component of soil fertility and sustainable agriculture. The utilisation of both natural and artificial sources of plant nutrients to improve the management of plant nutrients and soil fertility is advantageous in the integrated nutrient management approach to the

management of plant nutrients for preserving and promoting soil health. It is a long-standing practise to apply farm yard manure, vermicompost or poultry manure to crops. Well-decomposed FYM not only provides plant nutrients but also serves as a binding agent and enhances the physical and chemical properties of the soil.

Protein, nucleic acids, and other substances that are good for plant growth include nitrogen as a component. It is a crucial nutrient needed for crop production as well as seed production that determines plant growth and productivity. Environmentally acceptable sources of nutrients for plants include biofertilizer and microbial inoculants, which are non-bulky, inexpensive, and renewable. These inoculants provide nutrients that would otherwise be unavailable to plants in a usable form and in sufficient quantities. The use of bio fertilisers enhances the biological activity of the soil. Secondary nutrients and micronutrients must also be included in a balanced fertilisation programme; these nutrients are frequently most easily obtainable from organic fertilisers like animal and green manures. Iron (Fe), Copper (Cu), Zinc (Zn), and Manganese (Mn) are the principal micronutrients that affect crop growth.

Nutrient interactions have synergistic effects so, these characters recognized the vermicompost as a biofertilizer ultimately increases yield in oat (Kale *et al.* 1992). High levels of available Phosphorus and Iron in soils also adversely affect uptake of Zinc. (Joshi *et al.*, 2007) so the application of micronutrients is beneficial for the crop growth and development. micronutrients play an active role in increasing the yield and quality in seed due to activation of enzymes (Ashok *et al.*, 2008), Zinc is an essential component of various enzyme systems for energy production, protein synthesis and growth regulation. Young plants show its deficiency growth symptoms.

Soil fertility and sustainability of cropping systems by Pulse crops

Pulse crops can fix nitrogen (N) from the atmosphere and supply organic matter to soils, they boost soil fertility and reduce the need for inorganic nitrogen fertilisers. Examples of these crops include chickpea, soybean, green gramme, black gram and others. Rotating between cereals and pulses helps control weeds and lower disease and insect infestations. Pulses' deep (tap) root systems draw water and nutrients from the soil's deep layers, minimising the effects of water stress. The nodules in the roots contain bacteria called *Rhizobia* that transform air nitrogen into ammonia, which the plant then takes up. There are 195 megatonnes of nitrogen fixed biologically into the atmosphere each year on a global scale.

Major components of integrated nutrient management (INM)

The availability of applied and native soil nutrients is increased as a result of integrated nutrient supply, which also enhances carbon sequestration and controls nutrient losses to the atmosphere and water bodies. These improvements to the soil's physical, chemical and biological properties also help to prevent degradation of the soil, spoilage of the water and degradation of environmental quality. The application of organic or inorganic fertilisers combined with conservation methods can assist the soil retain and replenish its nutrient reserves. However, an excess of nutrients could also be a problem, harming the environment, the economy, and in some cases, the plants themselves as well as the animals and people who consume them or goods manufactured from them. Hence the requirement Integrated Nutrient Management are as follows.1) Integration of soil fertility 2) crop residues

management 3) use of organic manures like FYM and vermicompost 4) biological agents 5) genotypes 6) balanced fertilizer nutrients 7) Animal components include diary, poultry, pigery and fisheries. The recovery of additional nutrients is influenced by the fertiliser application techniques, kind, and timing. For example, the best nitrogen source among nitrogenous fertilisers for highland crops is ammonium nitrate, while the best nitrogen sources for rice crops are ammonia and amide forms of nitrogen. Split application is superior to basal application for the application of N. Utilise pulse crops that produce nodules to fix atmospheric nitrogen. In the case of phosphorus, basal application and split application. Good management practices of P-based fertilizer, most cereal growing areas overcome the problem of low P availability (Ortiz- Monasterio et al., 2002). The availability of Phosphorus is affected by soil pH and it is maximum when pH of soil is in between 5.5 and 7.5 which is possible by the application of organic fertilizers.

Sheep and goat manure

More nutrients are found in goat and sheep droppings than in FYM or compost. The manure typically comprises 3% nitrogen, 1% P2O5, and 2% potassium oxide. It is used in the field in two different ways. The sweeping of sheep or goat shelters is disposed of in pits for subsequent application to the field. The second approach, known as sheep penning, entails keeping sheep and goats overnight in a field while incorporating urine and faeces into the soil to a shallow depth using a cultivator or blade harrow.

Poultry manure

Excreta from chickens and birds quickly ferment. If exposed, its nitrogen will be lost in 30 days at a rate of 50%. Comparatively speaking to other bulky organic manures, poultry manure contains larger levels of nitrogen and phosphorus. This dung has an average nutritional content of 3.05 percent N, 2.64 percent P2O5, and 1.3 percent K2O.

Concentrated organic manures

Bulky organic manures are less nutrient-dense than concentrated organic manures. Oilcakes, blood meal, and fish manure are a few of the concentrated organic manures. Also referred to as organic nitrogen fertiliser, these include. Bacterial action transforms their organic nitrogen into readily accessible ammoniacal nitrogen and nitrate nitrogen before it is utilised by the crops. As a result, these organic fertilisers have a relatively slow onset yet provide accessible nitrogen for a long time.

Oil cakes

Oilseeds can be used to extract oil, and the leftover solid material is dried and made into a cake that can be used as manure. There are two categories of oil cakes:

• Edible oil cakes, such as groundnut, coconut, and sunflower cakes, that can be fed to cattle without risk. secondly

• Non-edible oil cakes that can't be used to feed animals, like castor, neem, and mahua cakes

Principles of integrated nutrient management (INM)

One of INM's guiding concepts is to maximise nutritional intake from all sources, adequate soil nutrient availability and crop demand by using various methods to reduce nitrogen losses, abiotic stress should build up as little as possible, soil erosion must be controlled, soil acidity, salinity and sodicity should be kept to a minimum and hazardous component should not accumulate in the soil. To maximise yields and enhance nutrient-use in Integrated Nutrient Management, the amount of nutrient and the timing of administration must be in agreement with the crop's nutrient requirements (Cassman et al., 2002).

According to Witt and Dobermann (2004), frequent use of nitrogen fertilisers may be able to prevent n itrogen losses, hence improving crop production and quality.
The combined effects of nitrogen intake, immobilisation, nitrogen losses by volatilization, leaching, d enitrification, and runoff were also documented by Li et al. in 2015.

Integrated nutrient management on soil fertility:

The world has a limited supply of natural resources, particularly agricultural lands.
The challenge of feeding the world's population in 2020 and beyond will be extremely challe nging due to declining soil fertility, improper utilisation of plant nutrients, and these factors.
A lack of knowledge of the biological processes required to optimise nutrient cycling, reduce the need for external inputs, and increase input use efficiency, particularly in tropical agricult ure, has exacerbated the negative effects of environmental pollution, land constraints, populat ion explosion pressure, institutional deficiencies, and natural disasters, minimize use of external inputs and maximize input use efficiency, particularly in tropical agriculture (Kumwenda et al., 1996).

Gupta et al., (2006) noticed that improper utilization of fertilizers or manures is an important issue in an Indian agriculture, hence now alternate option is combined use of organic and inorganic sources of essential nutrients increases the production, productivity and profitability of field crops. It was also observed by Kumar et al., (2009) and Ahlawat *et al.* (2023) that organic manures in combination with fertilizers will surely enhance crop growth.

Benefits of Integrated Nutrient Management:

A key element of INM is the adequate and balanced use of organic and inorganic fertilisers. The Rothamsted Experimental Station has conducted a number of historical field experiments that have yielded a wealth of knowledge about INM related to crops grown continuously and in rotation with various soil fertility amendments. These studies can be used to draw a number of conclusions about precise and balanced fertilisation. Wheat that is continuously cultivated without the use of organic and inorganic fertilisers normally produces yields of around 1.2 tonnes per acre. A one- to three-year short fallow rotation has little impact on production. The use of fertilisers, both organic and artificial, can boost typical wheat yields by up to 6-7 tonnes per hectare. The maximum wheat yields are 9.4 tonnes per acre.

Discussion:

Rhizobium application, PSB inoculation, and 100% nitrogen application all outperformed other treatments in terms of days to 50% flowering, days to maturity, plant height (cm), branches per plant, pods per plant, and seeds per pod.
When compared to the control (23.93q/ha), a combined inoculation of biofertilizers and 100% nitrogen produced the highest seed production (29.94q/ha).
According to these data, field pea produced more and was more productive when organic manure, inorganic fertilisers, and biofertilizers were used together 2007 (Vineeta Pandey).

Combining organic and inorganic nutrition sources may boost the availability of nutrients from inorganic sources by improving the physical, chemical, and biological characteristics of the soil.
Thus, further microbial activity results in the conversion of insoluble inorganic nutrients to forms that may be used.
The cumulative effect of higher growth and yield qualities is what has caused the increase in seed yield. Grain yield may have increased as a result of biofertilizer inoculations.
It is commonly known that PSB produces vitamins, IAA, and chemicals that resemble GA for growth (Ponmurugan, 2016).
These growth elements, along with better dietary conditions, may have had a big impact on the field pea crop's ability to produce more seeds.
According to (Patil, 2010), treatment 100% RDF+FYM 5 t/ha and biofertilizers inoculation with and without inoculation with Rhizobium sp. + Pseudomonas striata significantly increased blackgram's uptake of phosphorus, protein content, nitrogen, and potassium content compared to other treatments.
Additionally, (Mukherjee, 2016) showed considerable increase in similar observations.
Comparatively speaking, applying 50 to 75 percent of the necessary dose of inorganic fertilisers and the remaining 25 to 50 percent of organic fertilisers will result in greater yield and higher-quality seed spice harvests than applying the whole recommended dose of inorganic fertilisers.
Micronutrients are extremely important for enhancing the growth, productivity, and seed quality of pulse crops such green gramme, pea, and soybean.

Conclusion: Despite the fact that organic sources can contribute more to the supply of plant nutrients, there has been a recent significant growth in the use of mineral fertilisers day by day to fulfil the food needs of human populations by the year 2025 and beyond, especially in developing nations the management of plant nutrition and the incorporation of minerals and organic sources of plant nutrients into the soil lack prioritisation and strategic problem-solving in agricultural research. Participatory and farmer-adapted approaches to technology development are required. It is crucial for donors and national governments that, in the majority of cases involving developing countries, emphasis is paid to the future of those countries' agricultural sectors, including macroeconomic issues.

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