NUTRIENT MANAGEMENT FOR RAINFED PULSES – A REVIEW

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ABSTRACT

Nutritionists regard pulses as an essential means to correct malnutrition. However, with increase in the world population, per capita availability of pulses is declining. The pulse production has to be enhanced to provide sufficient amount of protein to the increasing population. Pulses were grown under rainfed condition in soils of low fertility and poor nutrient management. Research evidences show that the application of organic manure to dry lands not only improves the soil fertility status but also improves the water holding capacity of the soil. Judicious nutrient management encompassing organic manure and inorganic fertilizers could bring out a definite improvement in the cost of utilization of nutrient with increased nutrient use efficiency and will certainly improve the productivity and economic returns.

Key Words: Rainfed, Nutrient management, Soil fertility, Organic manure, Pulses.

Pulses are gaining world wide importance as they are the cheap source of vegetable protein in human diet. Hence, there is a need to enhance the total pulse production to provide sufficient amount of protein to the increasing population. Several factors contribute towards low productivity of pulses. Pulses have been traditionally grown under rainfed condition in marginal lands and in soils of low fertility in contrast to cereal crops which have been grown in more fertile lands with assured water supply. Though pulses are energy rich crops, they are cultivated under energy starved conditions with application of low doses of organics and inorganic fertilizers resulting in inadequate growth rate. The use of organic manures along with fertilizers has great significance for maintenance of soil fertility, physical condition and biological activity (Patel et al., 2009). Hence nutrient management involving technological innovations brings out a definite improvement in utilization of nutrient with increased nutrient use efficiency and will certainly improve the productivity.

Nutrient management in rainfed conditions – Need and Approach

The challenging constraints of the dry farming region make it clear that successful farming in this region is possible only with the adoption of suitable nutrient management strategies individually, or a combined approach is the only viable solution for maximizing the fertilizer use efficiencies in dry farming region which are evidenced through the findings of Christopher Lourduraj et al. (1996).

Integrated Nutrient Management

Integrated nutrient management is an age old practice but its importance was not very much realized in pre-green revolution era due to low nutrient demands of the contemporary subsistence agriculture. This
The approach of nutrient management aims at judicious use of all the major sources of plant nutrients in an integrated manner, so as to get maximum economic yield without any deleterious effect on physico-chemical and biological properties of the soil. Thus the basic concept underlying the principles of integrated nutrient management is the maintenance and possible improvement in soil fertility for sustained crop productivity on long term basis (Singh and Dwivedi, 1996). Integration of recommended dose of fertilizer along with enriched farmyard manure would result in better yield of blackgram under rainfed condition (Harisundan et al., 2008). Slow and steady release of nutrients from organics and inorganics would increase the availability of nutrients, which will result in translocation of more photosynthates from source to sink and finally improve the yield attributing character.

**Effect of inorganic fertilizers on pulses**

Gangwar et al. (1998) indicated that 8.25, 1.03 and 5.65 kg of nitrogen, phosphorus and potassium were required to produce one quintal of pea seed. Muhund Joshi and Rundraradhya (1993) observed that seed yield of soybean could be increased by increasing the potassium dosage from 25 to 75 kg ha$^{-1}$ coupled with increase in nitrogen dose from 25 to 50 kg ha$^{-1}$. Balanced supply of nitrogenous fertilizers not only affected nodulation but also crop yield and nutrient use pattern in pulses. Srivastava and Srivastava (1987) found that application of higher dose of fertilizer nutrients (NPK) to pigeonpea intercropped with mungbean and urdbean recorded higher grain yield and available nitrogen in soil.

Raj Singh and Tripathi (1999) stated that increasing level of P from 0 to 60 kg ha$^{-1}$ increased yield attributes, seed yield and biomass yield of mungbean significantly over control. Phosphorus was the second most crucial plant nutrient, but for pulses it assumes primary importance owing to its important role in root proliferation and thereby atmospheric nitrogen assimilation. Application of nitrogen and phosphorus singly or in combination could significantly increase the uptake of potassium, magnesium, calcium and sulphur, thereby the soybean yield could be increased (Azeez and Adetunji, 2008).

**Effect of farmyard manure on pulses**

In a study on mitigating the adverse effect of drought in rainfed blackgram, Muthuvel et al. (1985) reported that farmyard manure application significantly increased the soil moisture status besides addition of nutrients. Drylands are usually low in organic matter status due to rapid decomposition and lesser addition of crop residues. In such lands addition of organic manures or waste become necessary for increasing water holding capacity and to improve the fertility status (Venkateswaralu, 1987). Several authors have established the important role of farmyard manure in promoting the soil fertility status, improving soil physical properties, thus promoting soil moisture storage and its beneficial influence on yield of several crops. Application of farmyard manure along with inorganic fertilizers increased the blackgram yield by 8.6 per cent over control (Rani Perumal et al., 1991). Three years field experimentation by Pawar et al. (2009), reveal that application of FYM at 5t/ha resulted in significantly higher chickpea grain yield over no FYM application.

**Effect of farmyard manure and inorganic fertilizers on soil fertility status, nutrient uptake of pulses and economics**

Application of inorganic fertilizers along with farmyard manure significantly enhanced the uptake and availability of micronutrients. Phosphorus removal was affected by the rates of inorganic N addition but not the K removal (Singh and Rajat De, 1987). Considerable improvement in available...
status of soil can be observed due to application of farmyard manure. Mani et al. (2001) in a study on integrated nutrient management concluded that integrated package involving the recommended inorganic fertilizer with 5t farm yard manure ha\(^{-1}\) would be the best nutrient management practice for obtaining higher net returns.

**Enriched farmyard manure**

The term enriched farmyard manure implies to the well decomposed farmyard manure pre incubated with the recommended dose of phosphate fertilizers under anaerobic condition. Application of enriched farmyard manure increased the P availability in the soil which ultimately leads to increased solubilization of insoluble P fraction during humification and reduced P fixation in the soil due to the protective action of manure (Harisudan and Latha, 2007).

**Influence of enriched farmyard manure integration with inorganic fertilizer on yield and yield attributes of pulses**

The combined application of inorganic fertilizers and enriched farmyard manure (750 kg ha\(^{-1}\)) with *Azospirillum* recorded the highest yield in the sole crop of blackgram with 8.1 per cent yield increase (Rani Perumal et al., 1991).

According to Parasuraman et al. (2000) application of enriched farmyard manure along with recommended inorganic fertilizer considerably increased the seed and haulm yield of horsegram. The slow and steady release of nutrients due to the combination of inorganic fertilizers and enriched farmyard manure resulted in increased blackgram yield (Harisudan et al., 2009).

Parasuraman and Mani (2003) revealed that horsegram grown as a follow up crop of groundnut utilizes the residual nutrient of enriched farmyard manure resulting in relatively higher grain yields. Basavaraj and Manjunathaiah (2003) observed enhanced grain yield of bengalgram due to the residual effect of enriched farmyard manure by application of enriched farmyard manure and also reported that residual effect of enriched farmyard manure significantly enhanced the grain yield of bengalgram. Enriched farmyard manure integration with inorganic fertilizers increased the activity of blackgram root characteristics and thereby the yield was also increased (Harisudan et al., 2009).

**Influence of enriched farmyard manure integration with inorganic fertilizer on soil fertility status and nutrient uptake of pulses**

Veerabadran and Rajendran (1993) reported that incubation of chemical fertilizers with well decomposed farmyard manure during preparation of enriched farmyard manure leads to sustained availability of applied nutrients to the crop and hence it causes a greater response to applied nutrients. Sundaravadivel et al. (1999) made a study on cost effective P management practices, and concluded that, among the P sources, P enriched farmyard manure maximizes the P availability when compared to the application of inorganic P sources alone. He also observed the highest nutrient uptake from the plots which were applied with 20 kg P ha\(^{-1}\) as enriched farmyard manure. Harisudan and Latha (2007) reported that integration of enriched farmyard manure and inorganics will increase the nutrient uptake as a result of release of nutrients due to chelative effect of organic acids released during decomposition of organic matter.

**Influence of enriched farmyard manure combined with inorganic fertilizer on economics**

The cost benefit ratio of application of 30 kg N and 20 kg P\(_{2}O_{5}\) ha\(^{-1}\) as enriched farmyard manure with *Azospirillum* inoculation was 1.79 as against 1.15 for the same level of nutrients applied as straight
fertilizers with farmyard manure and 1.03 for the application of farmyard manure alone. The cost involved in transport and application of farmyard manure is high whereas use of enriched farmyard manure as a carrier for fertilizer in rainfed crops is cost effective (Veerabadran and Rajendran, 1993).

Highest monetary return and highest return per rupee invested on fertilizer were realized with the application of 20 kg P ha\(^{-1}\) as enriched farmyard manure (Sundaravadivel et al., 1999).

Highest benefit cost ratio was recorded with integrated nutrient management involving P enriched farmyard manure, inorganic fertilizers and biofertilizers. The integrated nutrient management practice with farmyard manure resulted in less benefit cost ratio than with P enriched farmyard manure due to higher cost involved in the application of 10 t of farmyard manure whereas only 750 kg ha\(^{-1}\) of enriched farmyard manure is applied.

**Micronutrients**

The high intensity cropping through improved production technology and use of high analysis fertilizers has rendered the soils prone to deficiencies of single or multiple micronutrients. Pulse crops respond well to application of micronutrients like Zn, B, Mo and Fe. Each and every micronutrient has an essential role in growth, grain yield and quality (protein content) of pulse crop (Thiyagarajan et al., 2003).

**Effect of micronutrient and macronutrient combination on growth and yield of pulses**

Protein content and yield of soybean could be increased by application of micronutrient. Saxena and Sheldrake (1980) has reported the beneficial effect of applied doses of iron on the grain yield of chickpea. Highest grain yield (602 kg ha\(^{-1}\)) of cowpea was recorded in treatments (ZnSO\(_4\) at 25 kg ha\(^{-1}\)) when coupled with 2 per cent DAP spray (Krishnaswamy et al., 1985).

Verma et al. (1998) reported that combined application of P and Mo has significantly increased the grain yield of chickpea. Chandel et al. (1989) found that application of micronutrients like Zn, B, Fe and Mo increased the grain yield and quality of soybean crop. Improvement in grain yield and protein content of cowpea can be obtained by application of manganese and molybdenum (Baldeo Singh et al., 1992).

Wankhade et al. (1996) found that the combined application of micronutrients and macronutrients had deleterious effect on gram. The composite form of micronutrients had pronounced effect on growth and yield parameters of greengram (Sarkar et al., 1998). Molybdate and borax applied at the rate of 1 kg and 10 kg ha\(^{-1}\) enhanced the grain yield of chickpea by 25.79 and 19.86 per cent, respectively than control (Mehar Singh et al., 1999).

Combined application of micronutrient and macronutrients significantly increased the dry matter production, stover and grain yield of soybean (Thiyageshwari and Ramanathan, 1999). Duraisamy and Mani (2001) stated that combined application of macronutrient, Fe and Mo has significantly increased the protein content and yield of horsegram.

Thiyagarajan (2001) stated that application of soil test based NPK along with micronutrient mixture has registered higher yield and it was comparable with the application of soil test based NPK alone. Poongothai and Chitdeshwari (2003) suggested that soil application of multimicronutrients has significantly increased the grain yield of blackgram.

**Effect of micronutrients and macronutrients application on soil fertility status and nutrient uptake of pulses**

Krishnasamy et al. (1985) reported that ZnSO\(_4\) resulted in the highest uptake of
NPK in cowpea and soil application of 50 kg P$_2$O$_5$ ha$^{-1}$ was found to be significantly superior in increasing their uptake. Wankhade et al. (1996) reported that combined application of micronutrients had a deleterious effect on uptake of macronutrients. Application of 5.0 kg Zn + 1.5 kg B + 0.5 kg Mo + 40 kg S ha$^{-1}$ to blackgram has significantly enhanced the available nutrient status of the post harvest soil (Poongothai and Chitdeshwari, 2003).

The literatures reveal that appropriate nutrient management technology innovations encompassing integrated use of organic manures, inorganic fertilizer and micronutrients could increase the productivity of pulses and as a result the gap in per capita availability of pulses can be overcome.

REFERENCES


