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Short Communication

Pulse Production and Ecology: The Issues of Community Mobilisation in India

Sengupta Kajal[1] and Biswas Sritama[2]

[1]Professor and Head, Department of Agronomy Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia-741252, West Bengal, India

[2]Post Graduate Student, Department of Agronomy, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia-741252, West Bengal, India

Corresponding author email id: drkajalsengupta@gmail.com

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INTRODUCTION

Malnutrition is a predominant problem in our country. Hence, nutrition oriented sustainable agricultural development is of utmost necessity in the present context. To alleviate protein malnutrition, a minimum of 50 g pulses per capita per day should be available in addition to other sources of protein such as cereals, milk, meat or eggs. Pulses are recognized as an integral part of Indian diet and the ideal supplement of cereals by virtue of their high protein and essential amino acid content. Pulses are inseparable ingredients of vegetarian diet and one of the cheapest sources of dietary nutrition protein in the state. The present emphasis on soil health, environmental quality and economic consideration, has stimulated a paradigm shift in cropping pattern leading to pulse based cropping system. Any cropping system can become compatible and complete only when a pulse crop is included in it. Pulses won a strategic position in intensive as well as subsistence agriculture, as they are excellent source of dietary protein for millions of people, nutritional feed for livestock and having profound ameliorative effect on soil.

Importance of Pulse Crops in India: Pulses are rich in proteins and found to be main source of protein to vegetarian people of India.It is second important constituent of Indian diet after cereals. It can be grown on almost all types of soil and climatic conditions. Pulses being legumes fix atmospheric nitrogen into the soil. It play important role in crop rotation, mixed and intercropping, as they help maintaining the soil fertility, soil erosion, supply additional fodder for cattle and provide raw material to various industries (Dal / Roasted grain / Papad industry etc.) Pulse crops are one of the most sustainable crops a farmer can grow. It takes just little water to produce same mass, compared with other crops. They also contribute to soil quality by fixing nitrogen in the soil. With the introduction of improved varieties and promotion of better management techniques, pulse crops can continue to be an excellent choice for farmers in the developing world. Pulses provide a number of nutritional benefits that positively impact human health, pulse crops produce a number of different compounds that feed soil microbes and benefit soil health. Pulse crops have a significant impact on soil biology, increasing soil microbial activity even after the pulses are harvested [1].Pulses

have also been shown to exude greater amounts and different types of amino acids than non-legumes [2, 3] and the plant residues left after harvesting pulse crops have a different biochemical composition (e.g. Carbon:Nitrogen ratio) than other crop residues [4]. Crops grow better in soils that are more "alive" with a diverse array of soil organisms, as these organisms break down and cycle nutrients more efficiently, feeding the crops as they grow. In addition, a large, diverse population of soil organisms acts to 'crowd out' disease-causing bacteria and fungi, making for healthier plants. Growing pulse crops in rotation with other crops enables the soil environment to support these large, diverse populations of soil organisms [5]. The ability of pulses to feed the soil different compounds has the effect of increasing the number and diversity of soil microbes [2, 5]

Major Constraints of Pulse Production: Poor genetic potential / varietals constraints, poor HI, poor in partitioning the photosynthates from the vegetative parts to seeds, indeterminate growth habit, inadequate availability of quality seed, marginal soils, approx. 85% area under rainfed, unfavourable weather conditions, abnormal soil conditions.

Agronomical Constraints: Varieties having indeterminate growth habit (results in non-synchrony in maturity), Seed constraints (poor quality / inadequate availability of good seeds / untimely supply / high price) [Even if 25% of the total pulse area is covered with good quality seed of HYV, 20% additional production can be expected [6]. Improper sowing time, Improper seed rate, Defective sowing method, Inadequate intercultural, Inadequate nutrition, Lack of irrigation, Problem of Pests (Weeds / Insects / Diseases), Lack of appropriate implements / machinery, Use of seeds with inadequate vigour and quality leads to low seedlings emergence and poor stand.

The Major Thrust Areas to be Addressed: Replacement of cereal or other crops in the prevailing rice-wheat or rice-oilseeds cropping systems with high yielding varieties of pulses; Inclusion of short duration varieties of pulses as catch crop; Development of multiple disease and pest resistant varieties; Reducing storage loses and improving market information and infrastructure; Linking MSP to market prices can bridge the gap between demand and supply; Developing high nitrogen fixing varieties or efficient Rhizobium strain, which will play a crucial role in sustainable agriculture.

Cultivation of Pulses in Non-conventional Areas: A vast area remains fallow during post-rainy season after harvesting of rice, this area can be brought under pulse cultivation - as relay cropping (paira cropping) or line sown sole cropping or intercropping.

6 'P's in Pulse Production: Proper Planting Time and Planting Method; Proper variety and Proper quality of Seeds; Proper Plant Population; Proper amount of Phosphorus; Proper Pest Management; Proper Post-harvest Handling are important for obtaining better production of pulses.

Pulse Crop and N_2 Fixation: Pulses derive 5-83% of their N requirement by fixing atmosphere N_2 under field conditions and remaining from the soil N pool. However, there are some constrains such as defective inoculant technology, substandard strains and inoculants and poor and variable response to Rhizobium inoculation (may be due to strong competition between inoculated and native Rhizobia for nodulation sites on host).

Importance of Adhesives: Survival of inoculated rhizobia on seed in large numbers is necessary for effective nodulation. Adhesive binds the inoculum to seed for maintaining the required intimate contact between rhizobia and newly emerged roots. Immediately after inoculation, rhizobia are

often subjected to harsh soil conditions (mostly due to desiccation). Inoculum population on seed decreased up to 4th day (ranging from 40-75% in comparison to the initial population). Mostly used adhesive is 10% molasses / jaggery solution / sugar solution. But this type of adhesive has some disadvantages on difficulty in slurry preparation at sowing time**,** supports fungal growth and attracts ants. Adhesives like Methyl cellulose and Gum Arabic are commercially available. Methyl cellulose (1%) or Gum Arabic (1%) maintained maximum population of Rhizobium on seeds or radical even up to 10 DAS as a result nodulation and nodule activity are significantly better.

Nutrient Management of Pulses: Efficiency of phosphate can be increase by Inoculation of PSB or integration of inorganic P fertilizer and organic manure (application of Liquid Manure / Compost / FYM), Deep placement of P fertilizer; there are several reports that pulses are responsive to application of P, S, B, and Mo. It is noticed that there is **synergistic effect of micronutrients** on the uptake of major nutrients like N, P, K, and S under balanced fertilization; as a result yield is increased**.**

Role of Micronutrients in Pulse Production

Micronutrient	Role	Dose and Time of application for rectification
Molybdenum (Mo)	Molybdenum is an important constituent of Nitrogenase enzyme which helps in nitrogen fixation by the Rhizobium in root hair cells of the legumes.	In Mo deficient soils, Ammonium molybdate or Sodium molybdate is to be applied in soil @ 2-3 kg/ha as basal or 0.1-0.3% of ammonium molybdate solution as foliar spray.
Boron (B)	Boron helps in protein synthesis in meristematic tissues through its involvement in uracil, an essential component of RNA. Uracil is also a precursor of a vital enzyme in the formation of sucrose. Boron deficiency affected nodule activity.	In B deficient soils, borax @ 10 kg/ha as basal soil application or 0.5% solution as foliar spray at flowering stage is advised.
Cobalt (Co)	Cobalt is a beneficial micronutrient; it is essential for nitrogen fixation, synthesis of vitamin B_{12} and Rhizobium growth. The onset of N-fixation is delayed by several weeks because of poor Rhizobium infection in cobalt deficient soils.	Cobalt sulphate is to be applied in soil @ 150-200 g / ha or 0.02-0.04% as foliar spray at pre-flowering or flowering stage is advised.
Iron (Fe)	Iron is an important part of leghaemoglobin protein that has a high affinity to absorb oxygen from the surrounding of the cells and slowly releases to the bacteriods.	In Fe deficient soils, ferrous sulphate @15 kg/ha as soil application is recommended.
Zinc (Zn)	Zinc is required for the secretion of the plant hormone IAA, protein	In Zn deficient soils, basal application of zinc sulphate @10 kg/ha/year (or

	synthesis, seed quality as well as utilization of phosphorus and nitrogen in plants.	20 kg / ha in alternate year) is found beneficial.

Beneficial effects of SSP compared to other P-fertilizers have frequently been ascribed to its S (12%) and Ca (21%) content. Positive responses to application of SSP / Gypsum to pulses might be due to its S and Ca content. The yield of the pulses can be increased by foliar application of Urea (1-2%), Liquid Manure, Organic Nutrients (Humic acid, Win-A-Crop).

Water management: Rabi pulses are subjected to terminal drought. Several trials revealed that rabi pulses are benefited by irrigation - 15-20% increase in yield may be obtained. Scheduling of irrigation has to be done intelligently. Irrigation / rain at the time of flowering is harmful; Seeds lose their vigour and viability if water is applied at the time of maturity.

Weed Management: Application of 60 kg P_2O_5 / ha (instead of 40 kg) was found promising to reduce the weed density and enhanced the yield of pulses by improving water use efficiency. Foliar application of **liquid manure** was found promising to reduce the weed density and enhanced the yield of pulses.

Conclusion: It may be summarised that farmers should be motivated to introduce more pulses in existing cropping sequences with proper management practices on the basis of agronomical, socio-economical and agro-ecological conditions. Recently Government of India started several projects on pulses. Different research institutions, KVKs, Universities have taken initiatives for increasing the area, production, productivity of pulse crops. International Year of Pulses - 2016 is being celebrated by different institutions. Still lack of awareness is prevailing among the farmers. If proper marketing policies, good agricultural practices, mass awareness and developmental training programmes are taken, pulses will be a boon to Indian agricultural economy in near future.

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