

Significance of Summer Moong in Crop Diversification for Rice-Wheat Cropping System

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INTRODUCTION

Rice-wheat cropping system (RWCS) emerging as an important cereal production system helping in maintaining food security of India. Challenges of increasing food demands due to more population pressure combat through focusing potentially high yielding crops. During 1966-67, introduction of high yielding semi dwarf varieties of rice and wheat crop, facilities of irrigation and increased application of external chemical inputs leads to Green Revolution. High productive nature of both crops attracts more and more area under their cultivation.

Currently, rice wheat crop rotation practiced on area of about 10 Million hectare in Indo-Gangetic plains (IGP) of India. Farmers prefer RW systems more profitable option due to establishment of minimum support price (MSP) by government. However, the sustainability and productivity of RW cropping system is declining during recent years due to yield stagnation and decreasing applied fertilizer productivity. In the greed of maximizing crop production, farmers applied more fertilizer than recommending dose cause environmental and ecological impacts. The root cause of this situation resulting from inappropriate land and input use. The excessive use or misuse of natural resources results in decreasing soil fertility, soil micro organism, Organic Carbon, soil aggregates, PH, availability of nutrients, contamination of soil water, increasing incidence of insect pest, weed menace environmental pollution and loss of biodiversity.

Both rice and wheat are nutrient exhaustive crops depleting nutrient content of soil. Hence, to increase in cropping intensity and sustaining rice wheat cropping system, Inclusion of short duration legume (summer moong) in fallow period after harvesting of wheat crop is necessary for improving nutrition status of the people, supporting natural balance and maintaining soil health.

Further, productivity of rice wheat system increases after crop diversification through adding summer moong in crop rotation. Therefore, for achieving sustainable development of agriculture systems in India, Farmers should be aware about the importance of legume crops specially summer moong in rice wheat cropping system. Potential of growing of greengram in summer season prompt pulse revolution along with increasing areas under pulses.

Utilizing summer season for cultivating moong enables farmers to valuably use their natural resources (land and water) which otherwise remain fallow in rice wheat system. In addition, attacks of insect/pest and disease are less due to prevailing higher temperature in summer season advantaging crop for bumper growth and yield. Hence, Short-duration, photo-insensitive varieties of

summer moong which mature in 60-65 days are now available for the summer season. So, there is good scope for crop diversification with summer moong in rice wheat crop rotation for improving soil fertility.

Mung bean/Greengram (*Vigna radiata*) is a leguminous/pulse crop which is easily digestible having 25% protein content mostly used as dal. It is used for green manuring after picking of pods. It has a unique ability of fixing atmospheric nitrogen through the process of biological nitrogen fixation (BNF). Green gram fix nitrogen not only to meet its own requirement but also advantaging in economizing nitrogen in succeeding crop (rice). In the rice wheat system, incorporation of mung bean residue after picking pods, significantly increases rice yield and saves 60 kg N per ha.



S.N.	Season	Crop	Rice-wheat-Moong Cropping System
1	Kharif	Rice	<p>The diagram is a circular crop calendar. The months are arranged clockwise from the top: NOV, DEC, JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT. The crops are: Rice (Kharif) from Sep to Oct; Wheat (Rabi) from Nov to Feb; Mung bean (Summer) from Jun to Jul.</p>
2	Rabi	Wheat	
3	Summer	Green Gram	

Mungbean was sown in the last week of April after field preparation, and mature pods were picked in the last week of June. The green plants were incorporated into the soil by ploughing, followed by flooding and puddling in preparation for rice transplanting. This crop takes about 60 to 65 days from sowing to maturity. The area, production and productivity of moongbean in India are 3.38

Mha, 1.61 MT and 474 kg/ha, respectively (IIPR, Kanpur). Mungbean crop gives about 0.5 to 1 t ha⁻¹ grain pulse and offers manorial value when its plant residue is incorporated into soil. Moongbean also important from nutritional purpose as it contains 345 kcal energy, 25 % protein, 1.1g fat, 62.6 carbohydrate and 16.3 % total dietary fibre.

Table 3 : Package of Practices followed for raising summer moong crop in rice wheat system

Sr. No.	Parameters	Quantity
1	Climate 1. Temperature 2. Rainfall 3. Plant Type	Optimum- 30-35°C, Harmful- beyond 40°C 625-875 mm (well distributed) Short day plant (12-13 hours of photoperiod for flowering)
2	Soil 1. Type of soil 2. pH	Well drained loamy to sandy loams 6.5 – 7.5 pH
3	Field Preparation 1. Seed bed 2. Tillage	Fine Greengram can be grown after harvesting of wheat crop with minimum preparatory tillage.
4	Seed 1. Seed Rate 2. Spacing 3. Seed Treatment	25-30 Kg/ha 25 x 5 cm Bavistin @ 2g/kg seed and <i>Rhizobium</i> culture
5	Time of Sowing For Haryana State	Most suitable time period for summer sowing of mungbean in whole month of March
6	Varieties	Type-44(Pusabaisakhi), Pusa Visal, PS-7, PS-16, K-8 51 , Kopergaon and Muskan
7	Fertilizers Requirement 1. Nitrogen 2. Phosphorus 3. Zinc 4. Sulphur	15-20 Kg N/ha 40-60 Kg P ₂ O ₅ /ha 20 Kg/ha (Zinc Sulphate) 20 Kg/ha (Elemental Sulphur)
8	Irrigation Requirement In summer season (Moong grown after wheat)	Irrigation must be applied at 10-15 days interval depending upon situation, no irrigation should be given after 40-45 days of sowing.
9	Weed Management <i>Triantem amonogyna</i> , <i>Cyprus rotundus</i> , <i>Amaranthus viridi</i> , <i>Phylanthus niruri</i> , <i>Sorghum helepense</i>	Critical period of crop-weed competition-25 DAS Control- 1) Manually- Hand weeding(1 st -20-25 DAS, 2 nd - 40-45 DAS) 2) Chemical- Pre emergence application of Pendimethalin (Stomp) @ 1-1.5 kg /ha in 500 litres of water.

The production of cereal grains is increasing through applying chemical fertilizers at inappropriate rate in cereal-based cropping

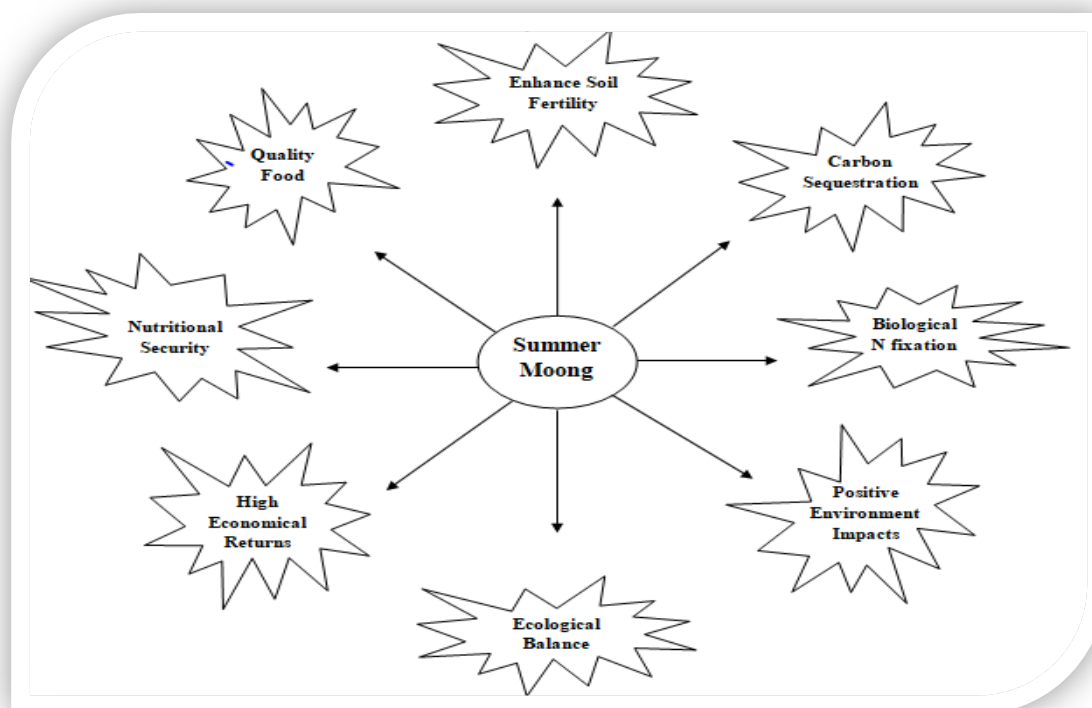
pattern but at the same time also destroy soil quality at a faster rate. Therefore, to minimize the ill effects of cultivating rice wheat systems,

summer moong addition in existing crop rotation is viable option for the welfare of physical, chemical and biological properties of soil. It helps in increasing the yield of component cereal crops along with system productivity. India has vast food grains stock mainly of rice and wheat fulfill only food requirement of every household but main concern is about providing nutrition rich quality food that only solve through focusing on legume crop (green gram). So, diversifying rice wheat cropping systems with moong can enhance soil fertility and significantly increase level of NPK, micronutrients and organic carbon. Similarly soil organism, microbial

activity and enzymatic activities also found significantly higher in moongbean growing soils.

Benefits of summer mungbean inclusion in rice wheat system

- 1) Pulse inclusive rotations improved the water-stable macro-aggregate (WSMA) in both surface (0-0.2) and subsurface (0.2-0.4) soil depths and active C pool (8.5-18.1%), SOC (5.9-16.8%) over RW rotation.
- 2) It helpful is improvement the rice and wheat yield in zero tillage with residue retention in rice wheat mungbean system as compared to rice wheat rotation.



- 3) Rice–wheat–mungbean cropping systems enhanced the available P, K, S, Zn and Fe over rice–wheat system.
- 4) Continuous implementation of Conservation agriculture in R–W–Mb system led to significant enhancement in

non–labile C in surface soil causing higher sequestration of C in soil over rice– wheat system.

- 5) Residue addition of mungbean also enhances the rice and wheat grain yield over no– residue and residue burning.