

Technology 1: Integrated Plant Nutrient Supply (IPNS) System for Soybean-Wheat System

Soybean-wheat system is commonly practiced in the semi-arid to sub-humid tropical Malwa and Vindhyan plateau regions of Madhya Pradesh state in 2.30 m ha. This belt contributes nearly to 80% of the total soybean produced in the India. The average productivity of soybean (0.9 t ha^{-1}) and wheat (1.3 t ha^{-1}) in this cropping system is very low, owing to low soil fertility. Earlier studies showed the deficiencies of Nitrogen, Phosphorus, Sulphur and Zinc in swell-shrink soils of this area. The Institute has developed an Integrate Plant Nutrient Supply Technology for enhancing and sustaining productivity and soil health in soybean-wheat system in Malwa region. The technology has got the flexibility of using different proportions of fertilizer and FYM depending on the availability of farmyard manure (FYM) with the farmer.

Based on the resources, for a yield target of 2 t soybean and 3.5 t wheat per ha the choices are :

- If a farmer has 4 t FYM, he needs to apply 130 kg N, 56 kg P, 40 kg S and 6 kg Zn annually to the cropping system. Thus, he can save about 30 kg N (65 kg urea), 23 kg P, 40 kg S (83 kg SSP) and 6 kg Zn (25 kg Zn SO_4), which are approximately worth Rs.1197/- (Table 1.1).
- If a farmer has access to more FYM, say 8 t, he can save 65 kg N, 30 kg P and 9 kg Zn and does not need to apply any S.
- If 16 t FYM can be applied to soybean, the farmer needs no fertilizer to be applied to soybean, he needs to apply only 60 kg N and 10 kg P to wheat, thus saving Rs.2566/-.

Table 1.1 : Ready reckoner of nutrients for soybean-wheat system and their economics

FYM t ha^{-1}	Fertilizer nutrients kg ha^{-1}								Input equivalent (Rs.) ha^{-1}	Saving (Rs.) ha^{-1}
	Soybean				Wheat					
	N	P	S	Zn	N	P	S	Zn		
0	35	39	40	12	140	40	40	0	5766	-
4	20	24	20	6	110	32	20	0	4569	1197
8	10	15	0	3	80	22	0	0	3440	2336
16	0	0	0	0	60	10	0	0	3200	2566

This technology has been further refined by assessing the farmers' resource base with regards to organic manures and water availability through PDCO (Participatory Diagnosis of Constraints and Opportunities) survey.

In the PDCO approach, the intervention of 4t FYM or compost along with the required amount of fertilizer as calculated from the targeted yield equations developed by Soil Test Crop Response project increased the profit of the farmers from Rs.4833/- to

14040/- per ha (Table 1.2) in the system. This intervention also improved pod bearing of soybean as compared to farmer's practice.

Table 1.2 : Yield benefit and profit to farmers due to soil test based INM intervention.

Farmers No.	Yield advantage (q ha ⁻¹)		Additional Profit (Rs.)		Additional profit in the system (Rs.)	Value/ cost ratio	
	S	W	S	W		S	W
1	1.8 (7.7)	1.0 (3.1)	1834 (13.9)	2999 (17.0)	4833	3.9	4.4
2	5.2 (29.5)	11.0 (35.5)	3912 (47.5)	8300 (34.9)	12212	3.0	4.4
3	7.1 (40.1)	6.0 (17.1)	7348 (109)	5163 (26.0)	12511	3.5	4.0
4	8.6 (55.5)	3.0 (9.7)	9565 (22.1)	4475 (27.6)	14040	3.6	4.2
5	3.5 (16.7)	7.0 (14.6)	4212 (44.4)	5250 (14.1)	9462	3.3	4.6

S = Soybean; W = Wheat, Data in parenthesis are % increase