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Production Potential and Economics of Soybean, *Glycine Max (L). Merill* Based Crop Sequence in Vertisols of Andhra Pradesh

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Abstract: **A field experiment was conducted for three years from 2002-2004 to study the production potential of soybean based crop sequences in vertisols of Andhra Pradesh. The experiment was laid out in randomized block design. Treatments comprised of nine different *rabi* cropsgrown on residual moisture (Bengalgram, coriander, safflower, mustard, soybean, sunflower, redgram, blackgram and wheat) after *kharif* soybean. Among the nine crop sequences, soybean – coriander recorded maximum soybean equivalent yield, net returns and C:B ratio followed by soybean – mustard sequence.**

Keywords: **C:B Ratio, Cropping System, Net Returns, Soybean Equivalent Yield.**

I. INTRODUCTION

Among the oilseed crops, soybean occupied third place in the edible oil scenario of India next to groundnut and mustard. The wonder crop soybean with 40-42% protein and 20-22% oil has significant role to play in Indian Agriculture to meet protein and oil requirements. The demand for soybean in the country is almost double than that of total production which can be augmented by growing the crop in sequence with other crops. Apart from increasing its production, there are also reports that grain legumes play an important role in improving and maintaining soil fertility and increasing the growth and yield of succeeding crops.[2]

The area under soybean has increased tremendously as an alternative crop for cotton during recent years especially in Northern Telangana region of Andhra Pradesh and particularly in Adilabad district. In view of the facts, present study was conducted to find out the best sequence '*rabi*' crop after '*kharif*' soybean under rainfed conditions of vertisols for Adilabad district in Andhra Pradesh.

II. MATERIALS & METHODS

A field experiment was conducted at Agricultural Research Station, Adilabad, located in Northern Telangana Zone of Andhra Pradesh during three *kharif* and *rabi* seasons of 2002-05 on same plot in randomized block design replicated thrice. The soil of experimental site was black, clayey with pH 7.6, organic carbon 0.36%, available nitrogen 273 kgha^{-1}, 10.75 Kg P_2O_5 ha^{-1} and 347.2 Kg K_2O ha^{-1}. During *Kharif* soybean was sown in the last week of June as sole crop with the objective to find out the sequence rabi crop. Single super phosphate was the source of phosphorus for *Kharif* Soybean fertilized with 30:60:40 NPK kg ha^{-1}. Rabi crops were sown during October III week after harvest of *kharif* soybean. The fertiliser doses applied for rabi crops in kgha^{-1} of N, P_2O_5, K_2O were as follows: 20-50-0 for bengalgram, blackgram and redgram, 30-20-40 for coriander, 50-30-30 for mustard, 60-40-30 for sunflower and safflower, 50-20-20 for wheat and 30-60-40 for soybean. The crop varieties used for the trial were JS335 (*kharif* and *rabi*); ICCV-2 (Bengalgram); LBG-20 (Blackgram); Sadhana (Coriander), PT-303(Mustard),

KBSH-1(Sunflower);A-1(Safflower);Asha (Redgram); Sonalika (Wheat). All the rabi crops were grown under residual soil moisture. Rainfall received in *kharif* and *rabi* seasons during crop growth in 2002-03; 2003-04; 2004-05 was 586.4, 943.7 and 651.4 mm in 27, 49 and 32 rainy days, respectively. Final crop yields (k*harif* and *rabi*) were recorded and the total gross returns, net returns, C:B ratio were calculated on the basis of prevailing market prices of the produce. For comparison of cropping sequences, the yield of all *rabi* crops were converted into soybean equivalent yields on price basis.

III. RESULTS & DISCUSSION

Crop Productivity:

Soybean grown as kharif crop matured in 92,97 and 98 days respectively during 2002,2003 and 2004. Soybean yield was 1646,1481 and 1330 kg ha^{-1} respectively in 2002,2003 and 2004 with a mean yield of 1485 kg ha^{-1}. During rabi seasons, the productivity of safflower was highest followed by bengalgram and coriander in 2002 and 2003 while in 2004 coriander out yielded the other rabi crops (Table 1)

Table 1: Kharif and Rabi crop yields (kg ha^{-1}) in soybean based cropping system

Treatments	Soybean yield (kg ha^{-1})				Rabi seed yields (kg ha^{-1})				Soybean seed equivalents (kg ha^{-1})			
	2002	2003	2004	Mean	2002	2003	2004	Mean	2002	2003	2004	Mean
Soybean – Bengalgram	1646	1481	1330	1485	1145	1289	1192	1209	3004	2637	2522	2721

Soybean – Coriander	1646	1481	1330	1485	1060	984	1250	1098	3530	2974	2580	3028
Soybean – Mustard	1646	1481	1330	1485	998	914	1088	1000	3050	2742	2690	2827
Soybean – Blackgram	1646	1481	1330	1485	162	828	572	521	1814	2224	1949	1996
Soybean – Sunflower	1646	1481	1330	1485	370	362	1077	603	1975	1781	2675	2144
Soybean – Safflower	1646	1481	1330	1485	1343	1365	1058	1255	2705	2611	2388	2568
Soybean – Soybean	1646	1481	1330	1485	972	231	329	511	2618	1712	1659	1996
Soybean – Redgram	1646	1481	1330	1485	145	150	174	156	1817	1618	1514	1650
Soybean – Wheat	1646	1481	1330	1485	156	220	208	195	1761	1647	1469	1626
SEm ±									138	105	100	171
CD (P = 0.05)									415	316	301	513
CV %									9.7	8.2	8.0	13.0

The productivity of different sequences was expressed as soybean equivalent yield (SEY). Soybean – coriander sequence recorded maximum soybean seed equivalents followed by soybean-mustard sequence in 2002 and 2003 respectively. This may be due to the higher price of coriander and mustard in 2002 and 2003 (Table 1). In 2004, soybean – mustard sequence recorded maximum soybean seed equivalents of 2690 kg ha^{-1} followed by soybean-sunflower sequence with 2675 kg ha^{-1}. This is also due to higher market price of mustard and sunflower in 2004 (Table 1). However, mean of three consecutive years show that soybean – coriander sequence recorded maximum soybean equivalent yields (3028 kg ha^{-1}) followed by soybean – mustard (2827kg ha^{-1}) and soybean – bengalgram (2721kg ha^{-1}) sequence (Table 1). Soybean – wheat and soybean – redgram sequence recorded lowest mean equivalent yields of 1626 kg ha^{-1} and 1650 kg ha^{-1} (Table 1). Soybean – safflower and soybean – bengalgram were reported as profitable sequences in Vidarbha region of Maharashtra [3]. In Krishna-Godavari zone of Andhra Pradesh, soybean-mustard followed by soybean-bengalgram was reported as remunerative. [4]

IV. Economics

Gross Returns:

In 2002, maximum gross returns were obtained with soybean – coriander (Rs 47661 ha^{-1}) sequence followed by soybean – mustard (Rs 41183 ha^{-1}) and soybean – safflower (Rs 41023 ha^{-1}). In 2003 also maximum gross returns were obtained with soybean – coriander (Rs 54321 ha^{-1}) followed by soybean – mustard sequence (Rs 46695 ha^{-1}). However, in 2004, maximum gross returns were with soybean – mustard sequence followed by soybean – safflower sequence. Perusal of mean data indicated that soybean – coriander sequence recorded maximum gross returns of Rs 44312 ha^{-1} followed by soybean – mustard (Rs 40052 ha^{-1}) and soybean – bengalgram (Rs 35786 ha^{-1}). This can be attributed not only to their yields but mainly to the higher market price, which prevailed in 2002 and 2003 for coriander, and in 2004 for mustard and sunflower (Table 2).

Table 2: Economics of soybean based cropping system

Treatments		Gross returns Kharif & Rabi (Rs ha^{-1})				Net Returns (Rs ha^{-1})				C:B ratio			
Kharif	**Rabi**	**2002**	**2003**	**2004**	**Mean**	**2002**	**2003**	**2004**	**Mean**	**2002**	**2003**	**2004**	**Mean**
Soybean	Bengalgram	40541	36503	30264	35786	25854	21128	22764	23248	2.76	2.37	4.03	3.05
Soybean	Coriander	47661	54321	30956	44312	35786	41821	26331	34646	4.01	4.34	6.69	5.01
Soybean	Mustard	41183	46695	32280	40052	29621	34445	27905	30657	3.56	3.81	7.37	4.91
Soybean	Blackgram	24489	31134	23392	26338	13427	19509	19641	17525	2.21	2.67	6.23	3.70
Soybean	Sunflower	26661	25071	32110	27947	10661	8446	23360	14155	1.66	1.50	3.66	2.27
Soybean	Safflower	41023	35035	28652	34903	28323	21660	23152	24378	3.23	2.61	4.51	3.45
Soybean	Soybean	35343	24289	19904	26512	21043	9079	12029	14050	2.47	1.57	2.52	2.18
Soybean	Redgram	24541	24125	18565	22410	11854	10938	13253	12015	1.93	1.82	3.49	2.41
Soybean	Wheat	23781	22708	17626	21371	8281	6458	9251	7996	1.53	1.39	2.10	1.67
SEm ±		1118	-	1364	4030	860	2435	1175	2938				
CD (P = 0.05)		3354	NS	4089	12081	2580	7299	3522	8808				
CV %		6.0	-	9.0	21.9	7.2	21.4	10.4	25.6				

Price of crops: (Rs/q): Soybean 1350/-(2002), 1450/-(2003), 1200/-(2004); Bengalgram 1600/-(2002), 1300/-(2003), 1200/-(2004); Coriander 2400/-(2002), 2200(2003), 1200(2004); Mustard 1900/-(2002), 2000/-(2003), 1500/- (2004); Sunflower 1200/- (2002, 2003), 1500 (2004); Safflower 1400/- (2002), 1200 (2003, 2004); Blackgram 1400/- (2002), 1300/- (2003, 2004); Wheat 1000/- (2002), 900/- (2003), 800/- (2004); Redgram 1600/- (2002, 2003), 1500/- (2004)

Net Returns and CB Ratio:

In 2002 and 2003 maximum net returns were obtained with soybean – coriander sequence (Rs 35786 ha^{-1} and Rs 41821 ha^{-1}) followed by soybean – mustard sequence (Rs 29621 ha^{-1} and Rs 34445 ha^{-1}) while in 2004, maximum net returns were with soybean – mustard sequence (Rs 27905 ha^{-1}) followed by soybean – coriander (Rs 26331 ha^{-1}). Pooled data of three years indicate soybean – coriander sequence as profitable with Rs 34646 ha^{-1} net returns followed by soybean – mustard with Rs 30657 ha^{-1} (Table 2). Soybean – pigeonpea and soybean – bengalgram were remunerative for black soils of Maharashtra [1] . Soybean – safflower and soybean – bengalgram sequences were found as profitable in

Vidarbha region of Maharashtra [3]. Yield and net returns were highest with soybean – bengalgram sequence for Vindhyan plateau of Madhya Pradesh. [5].

Perusal of pooled cost benefit ratio of three years under study indicated that soybean – coriander was remunerative crop sequence with maximum C:B ratio of 5.01 followed by soybean – mustard with C:B ratio of 4.91 (Table 2).

Thus from the present findings, it can be concluded that soybean – coriander followed by soybean – mustard was economically profitable crop sequence under rainfed conditions for black soils of Adilabad in Northern Telangana region of Andhra Pradesh.

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