Soybean Research 12(2): 101-110 (2014)

Dynamics of Soybean Production in Different Districts of Madhya Pradesh

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Received: 01.07.2012; Accepted: 04.05.2014

ABSTRACT

Looking to the importance of soybean in the Madhya Pradesh, the present study on dynamics of soybean production in 16 major soybean growing districts of Madhya Pradesh was carried out based on the time series secondary data for the years starting from 1980 to 2010 to analyze the growth and variability in area, production and productivity of soybean. The whole study period was divided into 4 sub- groups, viz. *1981-1990 (1980s), 1991-2000 (1990s), 2001-2010 (2000s) and overall period (1981-2010) for the purpose of detail analysis. The growth of area was found to be positive and significant during all the periods in all the major soybean growing districts except in Raisen and Betul (1990s) and Indore and Sehore (2000s), The increase in production was also positive and significant in all the districts and in all the periods except in Dhar, Hoshangabad, Raisen and Ujjain (1990s) and Sehore and Hoshangabad (2000s). The districts with high productivity (greater than all India average) were identified as Chhindwara, Vidisha, Indore, Ujjain, Sehore and Dhar (1980s); Dewas, Chhindwara, Indore, Ratlam, Mandsaur, Raisen and Ujjain (1990s) and Dhar, Indore, Chhindwara, Sehore and Dewas (2000s). In overall period (1981-82 to 2009-10), high productivity was recorded in Sehore, Dewas, Indore, Dhar, Ujjain and Betul districts. The variability in production was found to be more during 1980s (77.02 %) and thereafter declined during 1990s (37.56 %) and 2000s (32.41 %) in all the major soybean producing districts. The soybean cultivation was found to be preferred by the farmers as it is more profitable over the other crops which resulted in change of cropping pattern and there is still scope of harvesting yield up to 1800 kg per ha at farmers' field. Hence, there is need to identify the focal point of intervention and thrust areas for breaking yield barriers at farmers' level. The enhancement of yield not only helps in increasing production at national level but also reduces the cost of production and makes it more competitive and cost effective at international market.*

Key words: Dynamics, Madhya Pradesh, production, soybean

India is the fifth largest producer of soybeans in the world, which is grown in area of 9,673 thousand hectares with the production of 9,720 thousand tonnes (SOPA, 2010). The average productivity of the crop is 1,021 kg per ha (Table 1), which is lower as compared to other soybean growing countries of the world. However, while comparing the productivity on per day basis, India's soybean productivity is not that much lower as the maturity period of soybean in India is only 90 days in comparison to other

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countries (120 days and above). Madhya Pradesh being "Soya-State" accounts for 54.96 per cent of area and 57.62 per cent of production of soybean in the country with an average productivity of 1, 052 kg per ha. Maharashtra state stands second in terms of soybean production in the country sharing 31.28 per cent of acreage and 29.39 per cent production, Rajasthan the third important state in terms of soybean production (7.48 %) in the country. These three states together accounted for more than 92 per cent of area and production of the soybean in the country (Table 1).

Table 1. Present status of soybean crop in India (Average TE- 2010)

Soybean growing states	Area sown (000, ha)	Perce-ntage to total	Yield (kg/ha)	Perce-ntage to total	Total production (000,t)	Perce-ntage to total
Madhya Pradesh	5317	54.96	1052	103.04	5601	57.62
Maharashtra	3026	31.28	988	96.83	2857	29.39
Rajasthan	724	7.48	941	92.16	702	7.22
Andhra Pradesh	174	1.80	1055	103.36	166	1.71
Karnataka	222	2.30	1022	100.10	208	2.14
Chhattisgarh	123	1.27	950	93.08	127	1.31
Rest of India	88	0.91	937	91.77	60	0.62
India	9673	100.00	1021	100.00	9720	100.00

Source: Directorate of Economics and Statistics, Department of Agriculture and Cooperation (2008, 2009), Department of Farmer Welfare and Agriculture Development, MP (2009-10)

Commercial cultivation of soybean was introduced in Madhya Pradesh during late seventies. A remarkable increase in area, production and yield of soybean was observed in Madhya Pradesh during the period from 1991-92 to 2000-01 over the period 1981-82 to1990-91, even after 1991-92 to 2000-01, the trend of increase in area, production and yield remained continued but at slower rate (Fig. 1). The area of soybean increased tremendously due to the shift of area from cotton, groundnut, cereals, *etc.* (Nahatkar *et al.*, 2005).

Amongst different major oilseeds cultivated in Madhya Pradesh, coverage of soybean in terms of the total area was found to be maximum (79.10 %) followed by rapeseed and mustard (10.7 %), sesame (3.8 %), groundnut (3.1 %), linseed (1.7 %) and niger (1.6 %).

Similarly share of soybean (79.07 %) in production of oilseeds also recorded maximum followed by rapeseed and mustard (10.66 %), sesame (3.77 %), groundnut (3.08 %), linseed (1.68 %) and niger (1.58 %). It is also clear from the data that the acreage as well as production of major oilseeds was found maximum in *kharif* (87 %) and *rabi* (13 %) (Table 2).

To analyse the trend in growth and variability in area, production and productivity of soybean in different districts

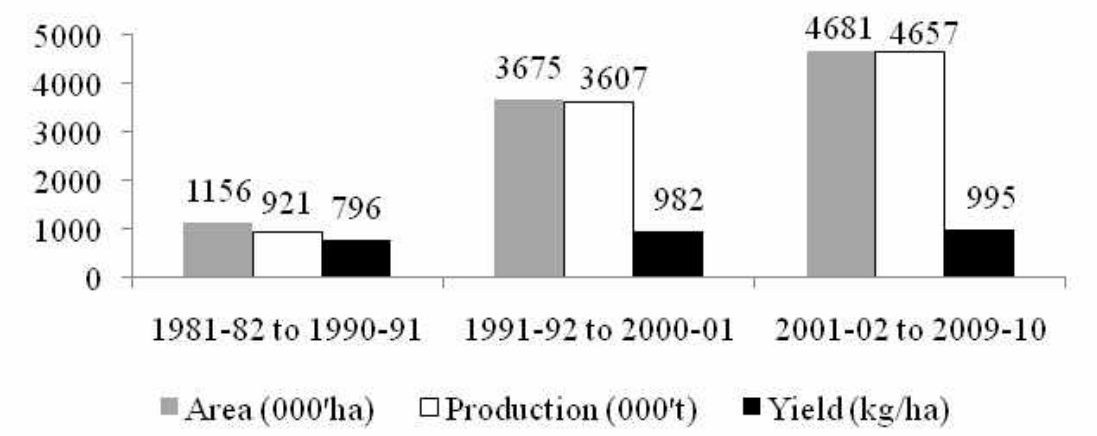

Fig. 1. Average area, Production, and yield of soybean in Madhya Pradesh from 1951-52 to 2009-10

Source: www.mpkrishi.org and Commissioner Land record, Gwalior (M.P)

Table 2. Share of selected oilseeds: TE 2009-10

Oilseeds	Share of different oilseeds (%)	
	Area	Production
Groundnut	3.1	3.08
Soybean	79.1	79.07
Rapeseed-mustard	10.7	10.66
Sesame	3.8	3.77
Sunflower	0.0	0.00
Safflower	0.0	0.00
Niger	1.6	1.58
Castor seed	0.0	0.02
Linseed	1.7	1.68
Total oilseeds	100.0	100.00
Kharif	87.4	87.42
Rabi	12.6	12.58

Source: Department of Farmer Welfare and Agriculture Development, Compendium 2010 and www.mpkrishi.org

of Madhya Pradesh, this study was formulated considering different periods, *i.e.* 1990s, 2000s and 2010s.

To analyse the trend in growth and variability in area, production and productivity of soybean in different districts of Madhya Pradesh, this study was formulated considering different periods, *i.e.* 1990s, 2000s and 2010s.

MATERIAL AND METHODS

The study is based on the decade-wise time series secondary data on area,

production and productivity of soybean in different districts of the state for the years 1980 to 2010. The study period was divided in to 4 sub-group, *viz*. 1981-90 (1980s), 1991-2000 (1990s), 2001-2010 (2000s) as well as whole period 1981-2010 (1980s-2000s). The growth and variation of area, production and productivity has been analyzed to draw conclusions. However, the study confined to 16 major soybean growing districts of Madhya Pradesh (Table 3), which covered 83.56 per cent of total soybean area of the state.

Table 3. Major soybean growing districts of Madhya Pradesh

Districts	Area (000'ha)	Percentage to total
Betul	183.8	3.47
Chhindwara	166.6	3.15
Dewas	298.9	5.65
Dhar	252.2	4.77
Guna + Ashoknagar	282.7	5.34
Hosangabad + Harda	360	6.81
Indore	221.5	4.19
Mandsaur + Nimach	385.2	7.28
Raisen	147.4	2.79
Rajgarh	290.2	5.49
Ratlam	210	3.97
Sagar	328.6	6.21
Sehore	308.8	5.84
Shajapur	337.4	6.38
Ujjain	444	8.39
Vidisha	203	3.84
Total Selected Districts	4420.3	83.56
Madhya Pradesh	5289.8	100.00

Source: Department of Farmer welfare and Agriculture Development, Compendium 2010 & www.mpkrishi.org

RESULTS AND DISCUSSION

Growth in area, production and yield

The growth in area of soybean was found to be positive and significant in all the periods as well as in all the major soybean growing districts of Madhya Pradesh except in Raisen and Betul (1990s) and Indore and Sehore (2000s) where it was found to be positive and stagnating. However, in Chhindwara, the growth in area of soybean was found to be negative and stagnate during 1990s (Table 4).The classification of districts according to growth in production of soybean (Table 5) showed that it was positive and significant in all the districts and in all periods except in Dhar (1990s), Hoshangabad (1990s and 2000s), Raisen (1990s), Ujjain (1990s) and Sehore (2000s), where it was found positive but non-significant. In Madhya Pradesh, the growth of production of soybean was found to be negative only in Betul, but non-significant in 1990s.

Table 4. Growth in area of soybean in major soybean growing districts of Madhya Pradesh

Particulars	1980s	1990s	2000s	1981 -82 to 2009 -10
Significant positive growth in area	Betul, Chhindwara, Dewas, Dhar, Guna + Ashoknagar, Hosangabad + Harda, Indore, Mandsaur + Nimach, Raisen, Rajgarh, Ratlam, Sagar, Sehore, Shajapur, Ujjain, Vidisha	Dewas, Dhar, Guna + Ashoknagar, Hosangabad + Harda, Indore, Mandsaur + Nimach, Rajgarh, Ratlam, Sagar, Sehore, Shajapur, Ujjain, V idisha	Betul, Chhindwara, Dewas, Dhar, Guna + Ashoknagar, Mandsaur + Nimach, Raisen, Rajgarh, Ratlam, Sagar, Shajapur, Ujjain, Vidisha	Betul, Chhindwara, Dewas, Dhar, Guna + Ashoknagar, Hosangabad + Harda, Indore, Mandsaur + Nimach, Raisen, Rajgarh, Ratl am, Sagar, Sehore, Shajapur, Ujjain, Vidisha
Significant negative growth in area	_	_	_	_
Positive stagnant area	_	Raisen, Betul	Indore,	_
Negative stagnant area	_	Chhindwara	_	Sehore

As far as the productivity of soybean during different periods and in different major soybean growing districts (Table 6) of Madhya Pradesh is concerned , the districts like Chhindwara, Vidisha, Indore, Ujjain, Sehore, and Dhar were found to have high productivity as these districts had recorded productivity above national average, while districts like Betul, Dewas, Guna, Hosangabad, Mandsour, Raisen, Ratlam, Sagar, Shajapur and Rajgarh were under low productivity districts in the period 1980s. Among all these districts, the growth in productivity was found to be positive and significant in Chhindwara, Vidisha, Indore and Ujjain districts; positive and stagnate in

Sehore, Dhar Betul, Dewas, Guna, Hosangabad, Mandsour, Raisen, Ratlam, Sagar and Shajapur, and negative and stagnate in only Rajgarh district in period 1980s. (Table 6)

Table 5. Growth in production of soybean in major soybean growing districts of Madhya Pradesh

Particulars	1980s	1990s	2000s	1981 -82 to 2009 -10
Significant increase in production	Betul, Chhindwara, Dewas, Dhar, Guna + Ashoknagar, Hosangabad + Harda, Indore, Mandsaur + Nimach, Raisen, Rajgarh, Ratlam, Sagar, Sehore, Shajapur, Ujjain, Vidisha	Dewas, Guna + Ashoknagar, Indore, Mandsaur + Nimach, Rajgarh, Ratlam, Sagar, Sehore, Shajapur, Vidisha	Betul, Chhindwara, Dewas, Dhar, Guna + Ashoknagar, Indore, Mandsaur + Nimach, Raisen, Rajgarh, Ratlam, Sagar, Shajapur, Ujjain , Vidisha	Betul, Chhindwara, Dewas, Dhar, Guna + Ashoknagar, Hosangabad + Harda, Indore, Mandsaur + Nimach, Raisen, Rajgarh, Ratlam, Sagar, Sehore, Shajapur, Ujjain, Vidisha
Significant decline in production	_	Chhindwara	_	_
Positive trend but statistically non - significant	_	Dhar, Hosangabad + Harda, Raisen, Ujjain,	Hosangabad + Harda, Sehore,	_
Negative trend but statistically non - significant	_	Betul	_	_

Table 6. Growth of productivity of soybean in major soybean growing districts of Madhya Pradesh

Particulars	Significant increase in yield	Significant decline in yield	Stagnant yield with positive sign	Stagnant yield with negative sign
		1981-82 to 1990-91		
High productivity (> All India)	Chhindwara, Vidisha, Indore, Ujjain	_	Sehore, Dhar	
Low productivity	_	_	Betul, Dewas, Guna + Ashok-nagar, Hosangabad + Harda, Mandsaur + Nimach, Raisen, Ratlam, Sagar, Shajapur	Rajgarh,
		1991-92 to 2000-01		
High productivity	Dewas,	Chhindwara	Indore, Ratlam, Mandsaur + Nimach, Raisen, Ujjain	Betul
Low productivity	Vidisha	_	Sehore, Shajapur, Hoshangabad+Harda	Dhar, Sagar
	-	*2001 02 to 2009-10*		
High productivity	Dhar, Indore, Chhindwara		Sehore, Dewas	
Low productivity	Ujjain, Raisen, Betul, Vidisha, Guna + Asholnagar		Hoshangabad + Harda, Rajgarh, Ratlam, Sagar, Mandsaur+Nimach	
		1981-82 to 2009-10		
High productivity	Sehore, Dewas, Indore, Dhar, Ujjain		Betul	Chhind-wara
Low productivity	Raisen, Vidisha, Guna + Asholnagar, Hoshangabad + Harda, Rajgarh, Shajapur, Ratlam		Mandsaur + Nimach, Sagar	

During 1990s, districts *viz*. Dewas, Chhindwara, Indore, Ratlam, Mandsour, Raisen, Ujjain and Betul were found belonging to high productivity, whereas Vidisha, Sehore, Shajapur, Hosangabad, Dhar and Sagar were low productivity districts. Amongst all these districts, the growth in productivity of soybean was found to be positive and significant only in Dewas and Vidisha; negative and significant in Chhindwara; negative and stagnate in Betul and positive and stagnate in Indore, Ratlam, Mandsour, Raisen, Ujjain, Sehore, Shajapur

and Hosangabad districts (Table 6).

As per the data presented in table 6, during 2000s the districts like Dhar, Indore, Chhindwara, Sehore, Dewas falls under high productivity districts, where as Ujjain, Raisen, Betul, Vidisha, Guna, Hosangabad, Raigarh, Ratlam, Sagar, and Mandsour found their place in low productivity districts. In this period, none of the district showed negative growth in productivity of soybean. Further, the districts like Dhar, Indore, Chhindwara, Ujjain, Raisen, Betul, Vidisha and Guna recorded positive and significant growth, while Sehore, Dewas, Hosangabad, Raigarh, Ratlam, Sagar, and Mandsour districts showedpositive and stagnate growth of soybean in Madhya Pradesh.

While comparing the productivity in 2010s, the districts, *viz*. Sehore, Dewas, Indore, Dhar, Ujjain, Betul, and Chhindwara were under high productivity districts, while Raisen, Vidisha, Guna, Hosangabad, Rajgarh, Shajapur, Ratlam, Mandsour, and Sagar were under low productivity districts. Above all, none of the districts recorded significant decline yield of soybean in Madhya Pradesh. The districts like Sehore, Dewas, Indore, Dhar, Ujjain, Raisen, Vidisha, Guna, Hoshangabad, Rajgarh, Shajapur and Ratlam showed significant increase in yield of soybean in Madhya Pradesh, while districts like Betul, Mandsaur and Sagar showed positive and stagnate productivity levels, beside Chhindwara showed negative and stagnate yield of soybean in 2010s in Madhya Pradesh (Table 6).

Variability in area, production and yield

The observed variability in area, production and productivity of soybean (Table 7) showed that during 1980s, amongst all major soybean growing districts, the variability was found maximum in Mandsaur (100.90 %) followed by Ratlam (85.71 %), Guna (82.99 %), Vidisha (70.66 %), Sagar (67.19 %), Ujjain (59.40 %) and Shajapur (54.16 %). During 1990s, the variability in area of soybean was found between 6.38 per cent (Indore) to 35.07 per cent (Betul), while in 2000 it ranged between 2.04 per cent (Indore) to 35.83 per cent (Sehore). In overall period, it ranged between 36.08 per cent (Indore) to 76.41 per cent (Mandsaur).

The variability of production of soybean was also found more in case of soybean as compared to its competitive crop, *i.e.* maize in all the periods and in all the major soybean producing districts of Madhya Pradesh. The variability in production of soybean was found to be more in 1980s (77.02 %) as compared to 1990s (37.56 %) and 2000s (32.41 %). In overall period (1980s-2000s), it was found to be 67.90 per cent and ranged between 55.20 per cent (Indore) to 89.92 per cent (Guna). During 1980s it ranged between 17.47 per cent (Hoshangabad) to 59.12 per cent (Chhindwara), while in the period of 1990s and 2000s it ranged between 13.63 per cent (Indore) to 50.77 per cent (Rajgarh) and 17.30 per cent (Indore) to 100.21 per cent (Ratlam).

The variability in productivity of soybean was found to be more during 1980s (27.28 %) as compared to 1990s (26.06 %) and 2000 (23.64 %). In overall period, it was found to be 30.54 per cent and ranged between 18.71 per cent (Sagar) to 49.24 per cent (Chhindwara). With regards to different districts, in 80s the maximum variability in yield of soybean was found in Chhindwara (48.36 %) in 1980s, 55.81 per cent 1990s and 34.24 per cent in 2000s.

Factors underlying changes in cropping pattern

Cropping pattern is governed by various factors such as price of input and output, agro-climatic conditions, market

Table 7. Variability in area, production and yield of soybean in major soybean producing districts of Madhya Pradesh

Districts	Area (000'ha)				Production (000't)				Yield (kg/ha)			
	90s	80s	2000s	80s-2000s	80s	90s	2000s	80s-2000s	80s	90s	2000s	80s-2000s
Betul	5291	3507	956	4127	6424	2754	2824	5432	1797	2329	2082	2863
Chhindwara	4136	1743	1911	4187	7493	5839	4565	5929	4836	5581	3183	4924
Dewas	3594	1821	473	4591	6763	3132	1334	6215	4002	1862	1125	3120
Dhar	5041	1340	458	4671	6843	4119	2496	6528	2305	3831	2145	3296
Guna + Ashoknagar	8299	2414	2104	7048	9401	4397	3819	8992	2653	3303	2626	3299
Hosangabad + Harda	3419	2677	285	4857	4550	4130	3044	6851	2572	2692	3065	3395
Indore	3794	638	204	3608	5938	2017	2830	5220	2366	1626	2759	2732
Mandsaur + Nimach	10090	3397	982	7641	12200	5175	2191	8269	2924	3067	2184	3495
Raisen	4826	3479	3139	4617	6974	4452	4407	6340	2660	2672	1728	2972
Rajgarh	6382	1916	479	5159	6260	4783	3118	7145	2230	3595	3051	3301
Ratlam	8571	1403	934	6096	11485	4017	3475	7569	3187	3123	3217	3637
Sagar	6719	3046	3302	7107	7156	3616	4112	7652	1760	1823	2169	1871
Sehore	5284	1203	3583	5039	7442	2222	4379	6599	2285	1322	1743	2562
Shajapur	5416	1437	327	4742	6430	2529	2255	5590	1812	1522	2136	2062
Ujjain	5940	1585	594	4928	8623	3149	3763	6474	2842	2363	3424	3157
Vidisha	7066	3276	2308	6945	9251	3766	3247	7833	3419	981	1179	2177
Average	5867	2180	1377	5335	7702	3756	3241	6790	2728	2606	2364	3054
MP	5151	1875	945	5164	6841	2405	2493	6054	1927	1200	1830	1973

Source: Commissioner land Record Gwalior, Department of Farmer Welfare and Agriculture Development and Various Publications of Districts Statistical Hand book.

forces and technological development along with irrigated potential in the area, which determine their makeup. Soybean mainly grown in rain-fed areas is best suited to soils of Madhya Pradesh. The soybean cultivation is preferred by the farmers, being observed more profitable over other crops and also due to low input cost technologies adopted by most of the marginal and small farmers. These farmers with marginal lands and rain-fed cultivation prefer oilseeds instead of cereals and pulses in their cropping pattern (Sharma *et al*., 2000). The de-oiled cake (by-product of oilseeds) is also found remunerative and generate extra income which leads to enhance the profitability of the farmers, in general, and contribute significant role in the state economy in particular, as Soybean having tremendous export potential. There are various other soybean by-products available in the market, which fetches very good price in the international market leading to enhance export earnings and fulfilling the demand (Pandey *et al*., 2002).

It is clear that the higher growth in production of soybean in the different districts during different periods of the study was observed due to significant higher growth in area followed by moderately visible growth in productivity. Further growth in soybean production in the state is possible only through breaking yield barriers at farmers' field through introduction of recommended packages of practices, seed replacement and popularization of associated input including farm mechanization. The results of various field level demonstration revealed that there is scope of harvesting yield of soybean at least up to 1,800 kg per ha under farmer's field condition through adoption and management strategy (Tiwari *et al*., 2001). Similarly soybean shows positive relationship between rate of adoption and levels of yield (Sharma *et al*., 2001). Hence, there is need to identify the focal point of intervention and thrust areas for breaking yield barriers at farmers' level. The enhancement of yield not only helps in increasing production at national level but in also reduce the cost of production so that it can be made more competitive and cost effective at international market.

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Soybean Research 12(2): 111-116 (2014)

Performance of Soybean plus Maize Intercropping in Sehore District of Madhya Pradesh

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Received: 04.02.2013; Accepted: 24.12.2013

Key words: Intercropping, maize, soybean

Soybean [*Glycine max* (L.) Merrill) is an important economic leguminous oilseed crop and is considered as a good source of protein and edible oil for human being. Soybean has been a predominant crop in Madhya Pradesh especially in Sehore district which accounts for 84 per cent area (3, 25, 421 ha) under soybean cultivation during *kharif* season (Districts Statistics Book, 2010). The district Sehore falls under Vindhyan plateau zone of Madhya Pradesh and lies between 22^0, 31 to 23^0, 40 north and 76^0, 22 to 78^0, 08 east. It is established that soybean has been a predominant crop in Sehore district during *kharif* season and being cultivated as a mono-crop that leads to establishment of harmful dominated weeds flora and high infestation of insect-pests, which significantly reduces the yield of soybean crop. Though control of weeds and insect-pest infestation is possible by use of various chemical pesticides, however, it may gradually develop resistance against them. In such a situation, diversification of cropping system is necessary to get higher yield, net returns, maintain soil health, preserve environment and meet daily food and fodder requirement of human and animals (Padhi and Panigrahi, 2006). Thus, it is advised to change either the crop rotation or inclusion of short duration crop as an inter crop. The practice of intercropping explore efficient utilization of all given and available resources, which maintain stability in production and obtain higher net returns accordingly which is not possible through sole cropping system (Dutta and Bandyopadhyay, 2006; Singh *et al*., 2008). Apart from these, the practice of intercropping also reduces the population density of insect-pests as the intercrop may not serve as their host (Songa *et al*., 2007). Intercropping also demonstrate weed control advantages over sole crops as intercrops are more effective than sole crops in usurping resources from weeds or suppressing weed growth through allelopathy (Liebman and Dyck, 1993). In view of this, soybean with maize as an intercrop was evaluated for productivity and economic benefits in Sehore district of Madhya Pradesh.

In order to study the relevance of intercropping of soybean plus maize, the

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