

Varietal and yield of soybean in Madhya Pradesh

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To meet burgeoning demand for edible oils and to reduce the huge burden on foreign exchequer in importing edible oil, there is an urgent need to increase the domestic production of oilseeds in the country. However, there is tremendous growth in area and production of oilseeds in India, productivity growth is not so encouraging. Oilseeds cultivation is undertaken across the country in about 27 million ha, mainly under rainfed conditions (more than 70%) with high fluctuation in yield and risk in investment. Among nine oilseeds soybean (41%), groundnut (23%), rapeseed and mustard (24%) contribute to about 88% of total oilseeds production. However, in vegetable oil production mustard, soybean and groundnut contribute 32, 28 and 22 %, respectively. However, the growth rates in production of oilseeds in the country is commendable (4.55%) during past decade, and is evidenced on the domestic availability of edible oils. The per caput consumption of edible oils has increased faster (5.65%) paving the way for higher rate of growth in imports of edible oils (7%) .

Key words: Production, Soybean, Variety, Yield

SOYBEAN (*Glycine max*), an important oilseed crop, accounted for 55.6 % of area under *kharif* oilseeds and 38% of area under total oilseeds in the country during Triennium average Ending (TE) 2012-13. The crop contributed to about 62.5 % of the *kharif* oilseeds production and 42.5 % of total oilseeds production in the country. About 28 % of the total vegetable oils and two-thirds of the oil-meals supply are contributed by soybean. The crop was introduced for commercial cultivation in India during early seventies. The area under soybean in India during 1970-71 was merely 30,000 ha producing about 10,000 tonne of soybean. During TE 2012-13, the soybean area in the country had increased to 10.183 million ha, of which 57.5 % is shared by undivided Madhya Pradesh, about 29% by Maharashtra, and 9% by Rajasthan. Total production of soybean in the country has increased to about 13.205 million

tonne during TE 2012-13, of which about 53 % was contributed by undivided Madhya Pradesh, 33% by Maharashtra, and nearly 10% by Rajasthan.

Productivity of soybean in the country has increased from 4.3 q/ha in 1970s to 13.53 q/ha in 2012-13. The varietal development programme led to maximum yield potential of released varieties was 25 q/ha achieved during 1970s to 35 q/ha in 1990s and 40 q/ha in 2000. The climatic potential of 30 to 35 q/ha and rainfed potential of 20 to 25 q/ha. The average simulated water non-limiting yield of soybean was found to be 30.2 q/ha, while water limiting potential was 21.7 q/ha. Under frontline demonstrations yield achieved with improved technology and farmers practice indicates a large gap in achievable and achieved yield levels. The yield level is well below the potential and almost stagnated at around 10 to 11 q/ha in the country during the recent decade. Looking at

the growing importance of crop, an attempt was made to understand varietal profile of soybean in Madhya Pradesh and district-wise yield profile. The mapping of districts according to yield profile and varietal profiling will help policy makers and researchers in devising strategies for improvement in yield and production of soybean in Madhya Pradesh.

Yield

The district-wise triennium average ending 2012-13 yield levels of soybean in Madhya Pradesh showed that it ranges from as low as 409 kg/ha in Umaria district to as high as 2,095 kg/ha in Chhindwara district. The strategy to increase total production of soybean in Madhya Pradesh may include: increasing yield levels in high soybean concentration districts by extension efforts, and efforts towards expanding area under the crop in the districts with high yield and low area under crop. Therefore, the distribution of districts

according to the different yield levels and the soybean area share was worked out and presented in Table 1. For enhancement in the production of soybean in Madhya Pradesh, the target for intervention should be low yielding districts with high area concentration, and high-yielding districts with low area concentration.

The area-wise distribution of soybean growing districts indicated that there were nine districts with higher area share (accounting for 50.4 % of the total soybean area and 53.7 % of total soybean production in Madhya Pradesh). There were 14 districts under extreme low area share accounting for merely 1.5% of soybean area and 1.2% of production in Madhya Pradesh. There are five districts with soybean yield level above 15 q/ha, among them the districts like Narsingpur, Balaghat and Gwalior have low area under soybean. Thus, the soybean area expansion strategies need to be intensified in these districts. The area expansion is also possible in the districts of Jabalpur, Morena and Sheopur with higher soybean yield but extreme low level of soybean area.

The districts like Rajgarh, Sagar, Shajapur, Shivpuri, Raisen, Vidhsha, Khandwa and Hosangabad are high soybean intensity districts, but are with low (8 to 12 q/ha) or extreme low (less than 8 q/ha) productivity of soybean (Table 1). The intensive efforts should be in place to improve the average productivity level in these districts. This will boost the total production of soybean in Madhya Pradesh. Earlier studies indicated that there was low technology adoption by the soybean farmers leading to lower average yield realization. To achieve the higher production and productivity of the crop as envisaged above, the intensive extension efforts needs to be geared up along with intensive demonstration of improved crop production technology and ensuring quality input supply including seed of the required variety.

Distribution of soybean area in different yield levels

In Madhya Pradesh, major soybean producing state, soybean

Table 1. Distribution of districts in different yield levels and area share in Madhya Pradesh

Yield (TE 2012-13)				
Categories	High (>15)	Medium (12-15)	Low (8-12)	Extra Low (<8)
High (>4.50%)	Mandsaur	Dewas, Dhar, Guna old, Sehore and Ujjain	Rajgarh, Sagar, and Shajapur	
Medium (2.50-4.50%)	Chhindwara	Betul, Harda, Indore and Ratlam	Shivpuri, Raisen and Vidisha	Khandwa old, and Hosangabad
Low (0.50-2.50%)	Narsingpur	Damoh and Bhopal	Barwani, Neemuch, Seoni and Tikamgarh	Chhatarpur, Jhabua, Khargone, Satna and Rewa
Extra Low (<.50%)	Balaghat and Gwalior	Jabalpur, Morena and Sheopur	Panna and Shahdol old	Bhind, Datia, Katni, Dindori, Mandla, Sidhi and Umaria

yield hardly exceeded 1,000 kg/ha on nearly 86% of the area under cultivation during TE 1992-93 (Fig. 1). The major districts with productivity of soybean below 1,000 kg/ha in Madhya Pradesh during TE 1992-93 were Rajgarh, Betul, Ratlam, Mandsaur, Hosangabad, Sagar, Ujjain, Shajapur, Dhar, Dewas, Sagar, Raisen, Vidisha and Bhopal.

However, the major change was observed in yield increase in Madhya Pradesh, as nearly 86% of total soybean area in the state was yielding less than 10 q/ha during TE 1992-93 which has reduced to 15 % during TE 2012-13 (Fig. 1). Presently, about 34% of the total area under soybean is yielding between 10 and 12.5 q/ha and nearly 47% of the area is yielding 12.5 to 15 q/ha. Though, the high-yielding area (with yield levels more than 20 q/ha) has marginally declined from 4 % during TE 1992-93 to 3 % during TE 2012-13. This calls for diverting higher attention towards

increasing average yield levels in the high concentration districts to more than 15 q/ha levels. Concerted extension and policy support required to be intensified particularly in the low-yielding districts with high soybean area concentration, so that overall yield realization can be increased. Still significant area under soybean cultivation is yielding less than 1,250 kg/ha (about half of the area under soybean in Madhya Pradesh).

The district-wise change in yield of soybean during TE 2012-13 over TE 2000-01 was worked out, Fig. 2. During the last decade or so the highest increase in yield of soybean was observed in the districts of Chhindwara (13.16 q/ha increase) followed by Betul (8.6 q/ha), Damoh (7.22 q/ha), Narshimpur (6.8 q/ha), Balaghat (5.3 q/ha), Barwani (5.15 q/ha) and Guna old (5.05 q/ha). The decline in soybean yield was witnessed in seven districts, namely

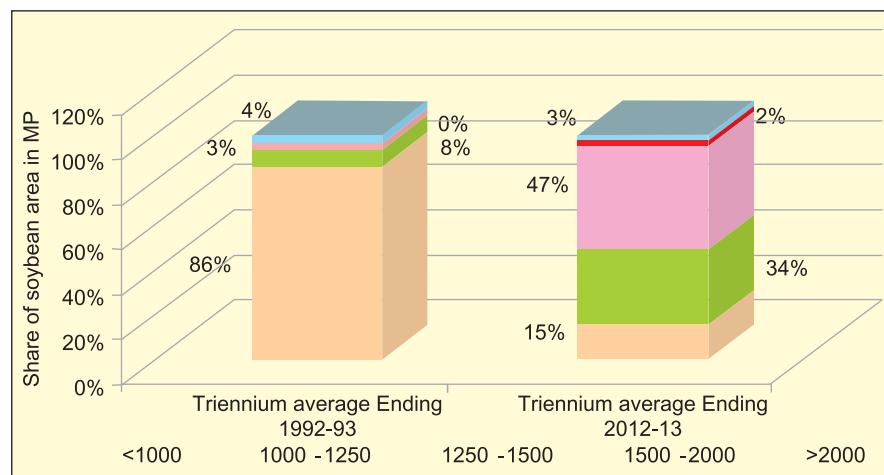


Fig. 1. Change in distribution of soybean area by yield level in Madhya Pradesh

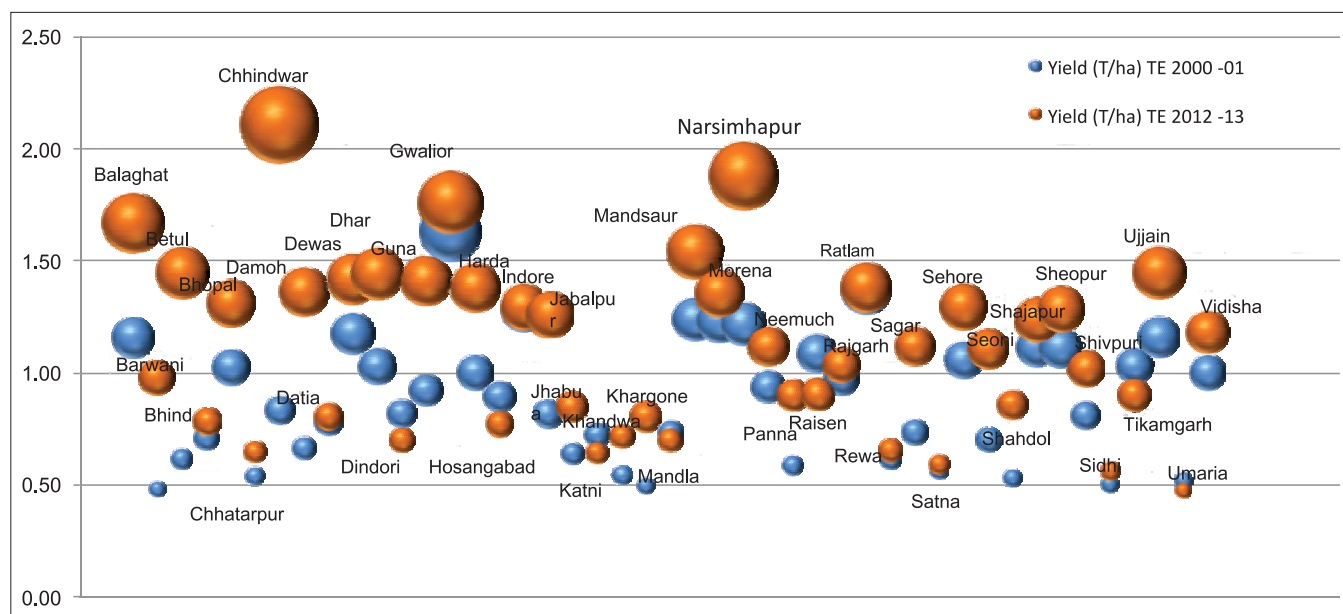


Fig 2. Changes in yield of soybean in Madhya Pradesh

Table 2. Distribution of districts under different growth rates of yield and area

CAGR in yield (Between 1998-99 and 2012-13)					
Categories	High (>5)	Medium (2-5)	Low (1-2)	Stagnant (<1)	Negative
CAGR in Area (1998-99 to 2012-13)	High (>5%)	-	Guna, Panna, Sagar, and Shivpuri	Chhatarpur and Vidisha	Mandla and Satna Dindori, Gwalior and Umaria
	Medium (2-5%)	Betul, Chindwara, and Damoh	Bhopal, Jhabua, Mandsaur, Rajgarh, Seoni and Shahdol	Barwani and Rewa	Raisen Katni
	Low (1-2%)	-	Harda, Khandwa, Ratlam and Sehore	Dewas, Morena, Neemuch and Shajapur	-
	Stagnant (<1%)	-	Dhar, Khargone, Ujjain	Indore	Hosangabad -
	Negative	-	Jabalpur and Narsinghpur	Balaghat and Sidhi	Bhind and Sheopur Datia and Tikamgarh

Table 3. Soybean seed requirement and availability in Madhya Pradesh (average of 2010-11 to 2014-15)

Varieties of Soybean	Average seed requirement and availability ('000 q)		Share in total (%)	
	Requirement	Availability	Requirement	Availability
JS 335	601.90	1,205.17	36.67	62.42
JS 95-60	409.21	369.05	24.93	19.11
JS 93-05	495.49	347.43	30.19	17.99
JS 97-52	31.46	4.50	1.92	0.23
Ahilya 3 (NRC-7)	11.65	3.21	0.71	0.17
Ahilya 4 (NRC-37)	10.18	0.67	0.62	0.03
Pusa 9712 (DS 9712)	0.38	0.42	0.02	0.02
Pusa 16	2.88	0.20	0.18	0.01
Parbhani Sona (MAUS-47)	0.48	0.13	0.03	0.01
Ahilya 2 (NRC-12)	1.00	0.01	0.06	0.00
Ahilya 1 (NRC-2)	0.25	0.00	0.02	0.00
JS 90 41	24.54	0.00	1.49	0.00
JS 71-5	6.51	0.00	0.40	0.00
Pant Soybean 1024 (PK-1024)	0.25	0.00	0.02	0.00
Pant Soybean 1042 (PK-1042)	43.57	0.00	2.65	0.00
PK 472	0.98	0.00	0.06	0.00
SL 295	0.65	0.00	0.04	0.00
Total	1,641.40	1,930.78	100.00	100.00

Source: Seednet, Government of India, (calculated by authors)

Raisen (yield reduced by 1.83 q/ha), Tikamgarh (1.36 q/ha), Hosangabad (1.27 q/ha), Dindori (1.21 q/ha), Katni, Vidisha and Mandla. Although the area under soybean was negligible in these districts, but decline in

Hosangabad and Raisen is a matter of concern as these districts have higher soybean concentration.

Similarly the annual compound growth rate in soybean yield was found to be highest in Betul, Chindwara and Damoh districts (more than 5% per annum). While the soybean yield growth was stagnant in the districts of Mandla, Satna, Raisen, Hosangabad, Bhind and Sheopur (Table 2). Yield growth was found to be stagnant or low in major soybean growing districts such as Indore, Dewas, Shajapur, Vidisha, Hosangabad and Raisen. Stagnant yield growth in Raisen and Hosangabad is a cause of concern as these districts have higher soybean area. Hence higher yield growth in these districts with higher proportion of soybean area needs to be ensured through wider dissemination of improved soybean production technology and its higher adoption by farmers coupled with ensured

supply of quality inputs.

Varietal profile of soybean

In Madhya Pradesh, only six varieties, namely JS 335, JS 95-60, JS 93-05, PK 1042, JS 97-52 and JS 90-41, adds up to 95% of the total seed requirement Table 3. In seed supply the three varieties, namely JS 335, JS 95-60, JS 93-05, cover more than 99% of the total seed availability in the State (Table 3). Though, there is demand of seed of other varieties but the availability is not ensured. The soybean varieties such as JS 97-52, NRC 7, NRC 37, JS 90-41, and PK 1042 were in demand but the availability of seed of these varieties was not ensured, leading to farmers resorting to adopt other varieties. Thus, only nine soybean varieties are in the seed chain presently.

Of the three most popular soybean varieties in Madhya Pradesh,

JS 335 was notified in 1994 for cultivation in central zone. The yield potential of the variety is 25-30 q/ha, matures in 95 to 100 days and is resistant to bacterial pustule, bacterial blight and tolerant to green mosaic. JS 95-60 soybean is early maturing variety (82-88 days) with average productivity of 20 q/ha. The variety is resistant to root rot, bacterial pustules, myrothecium leaf spot, rhizoctonia aerial blight and target leaf spot diseases and stem fly, girdle beetle, defoliators and blue beetle insects. The third variety JS 93-05 soybean is early variety matures in 90-95 days with yield potential of 20-25 q/ha. The variety is resistance against several major diseases like bacterial pustules, myrothecium leaf spots, soybean mosaic virus, yellow mosaic virus, pod blight, root rot, powdery mildew diseases and tolerant to moisture stress conditions.

SUMMARY

Mapping of the districts according the yield level and soybean area concentration indicated that districts like Rajgarh, Sagar, Shajapur, Shivpuri, Raisen, Vidisha, Khandwa and Hosangabad had high soybean area concentration but marred with low to very low yield level. Efforts towards enhancing yield level in these districts should be the priority of the policy makers. Another set of districts with high yield level and low area under soybean are Narsingpur, Damoh, Bhopal, Balaghat, Gwalior, Jabalpur, Morena and Sheopur. In these districts area expansion under soybean should be targeted coupled with marketing support.

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