**Status paper on Soybean**

## 1. Crop description:

Soybean (*Glycine max-Linn*.) is a leguminous and self pollinated crop belongs to family Leguminoceae sub- family Papilionoideae (fabaceae). Crop cultivars generally reach a height of around 1 m (3.3 ft), and take 80–120 days from sowing to harvesting. Soybeans, like most legumes, perform nitrogen fixation by establishing a symbiotic relationship with the bacterium *Bradyrhizobium japonicum* and capable of transforming nearly 60-100 kg atmospheric nitrogen into 30-40 kg nitrogen in the soil. It is categorized as an oilseeds rather than a pulse, despite being rich source of protein and used as food and feed by the human as well as livestock across the globe because soybean cannot be cooked as a normal pulse. Parts of plants like leaves, stalks and stems are also used as dry fodder for the animals.


**Soybean crop at maturity stage**

## 2. Centre of origin:

Domestication of soybean has been traced to the eastern half of North China in the eleventh century B.C. or perhaps a bit earlier. Soybean has been one of the main plant foods of China along with rice, wheat, barley and millet. According to early authors, soybean production was localized in China until after the Chinese-Japanese war of 1894-95. The first use of the word "soybean" in U.S. literature was in 1804. However, it is thought that soybean was first introduced into the American Colonies in 1765 as "Chinese vetches". For many years, most of the references to this crop were by people working in eastern and southeastern United States. Most of the early U.S. soybeans were used as a forage crop rather than harvested for seed. Most of the early introductions planted in these areas were obtained from China, Japan, India, Manchuria, Korea, and Taiwan.

## 3. Global scenario:

Soybean is cultivated across the continents except Europe and Australia over an area of about 120 million ha. USA, Brazil, Argentina, China, Paraguay and India contribute about 90% of the total soybean production in the world. The status of area, production and productivity of top 10 soybean growing countries is given in **Table-1**:

**Table -01: Area, production and yield of Soybean of top 10 Countries**

| S. No | Country | Area (Lakh ha) | | | Production (Lakh tonnes) | | | Yield (Kg/ha) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2013-14 | 2014-15 | 2015-16 | 2013-14 | 2014-15 | 2015-16 | 2013-14 | 2014-15 | 2015-16 |
| 1 | USA | 307.03 | 334.20 | 330.80 | 894.83 | 1068.80 | 1068.60 | 2915 | 3200 | 3230 |
| 2 | Brazil | 278.65 | 321.00 | 331.00 | 817.00 | 972.00 | 965.00 | 2932 | 3030 | 2920 |
| 3 | Argentina | 194.19 | 193.40 | 195.30 | 493.06 | 614.00 | 568.00 | 2539 | 3170 | 2910 |
| 4 | China | 66.00 | 68.00 | 71.00 | 125.00 | 121.50 | 116.00 | 1894 | 1790 | 1800 |
| 5 | India* | 117.20 | 110.90 | 116.65 | 118.60 | 105.30 | 85.92 | 1012 | 950 | 737 |
| 6 | Paraguay | 30.80 | 32.60 | 32.60 | 90.86 | 81.50 | 90.00 | 2950 | 2500 | 2760 |
| 7 | Canada | 18.20 | 22.40 | 22.00 | 51.98 | 60.50 | 62.40 | 2857 | 2710 | 2830 |
| 8 | Ukraine | 13.51 | 18.00 | 21.40 | 27.74 | 39.00 | 39.30 | 2054 | 2170 | 1840 |
| 9 | Uruguay | 12.00 | 13.30 | 10.00 | 32.00 | 32.90 | 20.00 | 2667 | 2470 | 2000 |
| 10 | Russia | 12.03 | 19.10 | 21.00 | 16.36 | 23.60 | 27.10 | 1360 | 1240 | 1300 |
| 11 | **Others** | **63.12** | **51.30** | **48.30** | **95.65** | **96.90** | **102.40** | **1640** | **1879** | **2120** |
| 12 | **World + (Total)** | 1112.73 | 1182.40 | 1199.40 | 2763.96 | 3197.80 | 3130.10 | 2484 | 3198 | 2610 |

**Source: Foreign Agricutural Service / USDA, * As per the estimates of DES, DAC & FW**

## 4. National scenario:

Soybean cultivation was in practice in Himalayan States including North-Eastern Region from ancient time, wherein, it is largely used as a pulse in Uttarakhand and Akhuni a fermented food in NE-States. However, commercial cultivation of soybean as an oilseed crop was commenced in 1970 with an area of about 12000 ha. It has been widely adopted as rainfed crop largely under Vertisols with an average rainfall of 750- 900 mm in the country. An area of >11.0 million ha under soybean is largely spread in the states of Madhya Pradesh, Maharashtra, Rajasthan, Karnataka and Telangana. Area from millets, upland paddy and cotton has been diverted to soybean. State wise area, production and productivity of 05 major soybean growing States during last three years is given in **Table-02**.

**Table -02: Area, production and yield of top 05 soybean growing States**

| S. No | States | Area (Lakh ha) | | | Production (Lakh tonnes) | | | Yield (Kg/ha) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2013-14 | 2014-15 | 2015-16 | 2013-14 | 2014-15 | 2015-16 | 2013-14 | 2014-15 | 2015-16 |
| 1 | MP | 63.10 | 55.80 | 59.06 | 52.40 | 63.50 | 49.08 | 831 | 1139 | 831 |
| 2 | Maharashtra | 35.20 | 38.20 | 37.74 | 47.50 | 24.90 | 21.01 | 1349 | 655 | 557 |
| 3 | Rajasthan | 11.80 | 9.20 | 12.05 | 9.70 | 9.60 | 9.99 | 829 | 1036 | 829 |
| 4 | Telangana | - | 2.40 | 2.43 | - | 2.60 | 2.52 | - | 1082 | 1037 |
| 5 | Karnataka | 2.20 | 2.60 | 2.42 | 2.70 | 2.30 | 1.35 | 1233 | 886 | 558 |
| | Others | 5.00 | 2.80 | 2.95 | 6.30 | 2.40 | 1.97 | 1260 | 857 | 668 |
| **All India** | | **117.20** | **110.90** | **116.65** | **118.60** | **105.30** | **85.92** | **1012** | **950** | **737** |

## 5. Potential districts:

More than 90% production of soybean comes from 03 States namely MP (>53%), Maharashtra (30%) and Rajasthan (9%). Details of 68 potential districts of soybean of MP (32) Maharashtra (21), Rajasthan (07), Chhattisgarh (03), Karnataka(03) and Telangana (02) is given at ***Annexure-I***.

## 6. Scope for area expansion:

Soybean introduced during 1970-71 and adopted on a larger scale cultivation in MP, Maharashtra, Rajasthan and Telangana could be extended in other States like Bihar, Jharkhand, Eastern UP and Uttarakhand as a better substitute to upland paddy and intercropping with arhar with assured buy-back arrangement.

## 7. Yield gap:

Among the major soybean producing countries, India has an average yield of 899 kg/ha (2013-16) as against the world average yield of 2602 kg/ha and highest average yield of 3119 kg/ha of USA, which indicates a large gap of 189% over world average. The higher yield in the countries like Paraguay, Brazil, USA, Argentina and China may be because of high organic matter in their soil and longer crop duration.

Total of 26 varieties of soybean were demonstrated under FLD on farmer's field during Kharif-2013. Among these varieties, KDS-344 gave highest yield 2625 kg./ha followed by DSb-21 (2550 kg/ha) and MACS-450 (2458 kg/ha). An average productivity of 1661 kg/ha was recorded in 670 FLDs conducted over an area of 268 ha. in Madhya Pradesh, Maharashtra and Rajasthan during kharif 2013 as against the national average yield of 1012 kg/ha. This indicates an average yield gap 65% over state average yields of Madhya Pradesh, Maharashtra and Rajasthan as given below in **Table–03**.

**Table-03: State wise yield gap in soybean**

**(Yield in kg/ha)**

| State | Soybean | | |
|---|---|---|---|
| | Kharif-2013 | | |
| | SAY | FLD | Yield gap (%) |
| | | | Over SAY |
| MP | 831 | 1347 | 62% |
| Maharashtra | 1349 | 2213 | 64% |
| Rajasthan | 829 | 1469 | 77% |
| **Mean** | **1003** | **1661** | **65%** |

## 8. Cropping system:

Soybean based cropping systems followed in major soybean growing States are listed as under:

Soybean - Wheat/ Mustard/Safflower - MP.
Soybean - Jowar (Rabi)/Safflower / Linseed - Maharashtra.
Soybean - Wheat/Mustard – Rajasthan.
Soybean - Jowar/groundnut – Telangana.

Besides, the above mentioned cropping system intercropping of Soybean with arhar/ cotton/sorghum/ragi/maize are more popular in major soybean growing states.

## 9. Improved varieties:

All India Co-ordinated Research Project (AICRP) on Soybean was commenced in 1967, which was subsequently, upgraded as National Research Centre of Soybean/Directorate of Soybean Research at Indore an Institutions of ICAR. After inception of AICRP more than 100 varieties of soybean have been released for different agro-ecological situations. The seed supply position of soybean during Kharif-2011 given in **Table-04** indicates availability of only half a dozen of varieties like JS-335, JS 93-05, JS 95-60, JS 97-52, MAUS-47 and MAUS-71 under seed chain. The variety wise details of certified seeds given in **Table-5** also indicates that JS-335 released during 1994 is most prominent in all the soybean growing states.

**Table – 04 Variety wise certified seed distribution of soybean**

(Quantity in Qtls**)**

| **State** | **Variety** | **Release Year** | **Kharif -2011** |
|---|---|---|---|
| Karnataka | JS-335 | 1994 | 120722 |
| | JS-93-05 | 2002 | 3764 |
| | **Total** | | **124486** |
| MP | JS-335 | 1994 | 105609 |
| | JS-93-05 | 2002 | 68366 |
| | JS-95-60 | 2006 | 71886 |
| | JS-97-52 | 2008 | 338 |
| | MAUS-47 | | 162 |
| | **Total** | | **246361** |
| Maharashtra | JS-335 | 1994 | 630925 |
| | JS-93-05 | 2002 | 34342 |
| | JS-95-60 | 2006 | 4390 |
| | MAUS-71 | 2002 | 16576 |
| | **Total** | | **686233** |
| Rajasthan | JS-335 | 1994 | 28706 |
| | JS-93-05 | 2002 | 5988 |
| | **Total** | | **34694** |
| Telangana | JS-335 | 1994 | 39812 |
| | | **Total** | **39812** |
| | | **Grand total** | **1131586** |
| | | **Total of JS-335** | **925774** |
| | | **% share of JS-335** | **82** |

List of improved varieties of soybean, which are <15 year old and eligible for assistance under National Mission on Oilseeds and Oil Palm (NMOOP) is given in ***Annexure-II.***

## 10. Seed scenario:

Agricultural Statistics at a Glance- 2015 indicates SRR of 47% with supply of 38.28 lakh qtl. of certified seed of soybean for a total area of 108.4 lakh ha sown during kharif 2012. However, the SRR of soybean was declined to 33% during kharif 2014 mainly because of crop damage by heavy late kharif rain at the time of maturity. The year-wise SRR of soybean during last 3 years is given in **Table 05**.

**Table 05: Year-wise SRR of Soybean**

| Year | Area sown (lakh ha) | Total seed required @75 kg/ha | Seed supplied (lakh qtl.) | SRR (%) |
|---|---|---|---|---|
| 2012-13 | 108.40 | 81.30 | 38.28 | 47.0 |
| 2013-14 | 117.20 | 87.90 | 36.95 | 42.0 |
| 2014-15 | 110.90 | 83.17 | 27.33 | 33.0 |

## 11. Best practices:

### 11.1. Field preparation

Soybean can be grown in wide range of soils, however, a well drained sandy loam to clayey soils with medium water holding capacity, rich in organic carbon with near neutral pH is ideal for soybean cultivation. Deep ploughing once in a 03 year in summer for insect, pests, weed management and moisture conservation is recommended. BBF or Ridge & Furrow techniques have shown good impact in mitigation of climatic adversities and water management.

### 11.2. Manures and Fertilizers

Integration of 5-10 tonnes/ha of farm yard manure or 2.50 tonnes of poultry manure along with Basal application of N: P: K: S is suggested. The zone wise recommended dozes are given in **Table-6**:

**Table-6: Zone-wise recommended doses of NPKS**

| Zone | Recommended doses of N: P: K: S (kg/ha) | **Fertilizer sources** (kg/ha) |
|---|---|---|
| North East | 25:100:50:50 | 56 kg Urea + 625 kg SSP+ 84 kg MoP |
| North Plains | 25:75:25:37.50 | 56 kg Urea + 470 kg SSP+ 42 kg MoP |
| Central | 25:60:40:20 | 56 kg Urea + 375 kg SSP+ 67 kg MoP |
| South | 25:80:20:30 | 56 kg Urea + 500 kg SSP+ 34 kg MoP |

### 11.3. Selection of varieties

In order to avoid adverse impact of biotic and a-biotic stresses, farmer is advised to grow 3-4 soybean varieties with varying maturity period in the field. The state-wise list of varieties is given in ***Annexure-II.***

### 11.4. Seed treatment

Seed treatment with Thiram + Carbendazim (2:1) @3 g per kg seed or a mixture of Carboxin 37.5% + Thiram 37.5% @3 g per kg seed or Trichoderma viride @ 8-10 g per kg seed to avoid soil and seed born diseases. After seed treatment with fungicide, the seed may also be treated with bio-inoculants like *Bradyrhizobium japonicum* and PSB each @ 5 g per kg seed immediately before sowing. In case of new areas, higher quantity of these inoculants @ 10 g per kg may be used. In Yellow Mosaic Virus areas, the seed should also be treated with insecticide i.e. Thiamethoxam 30 FS @ 10 g per kg of seed.

### 11.5. Sowing time

Optimum sowing time is mid of June to end of June subject to receipt of minimum rainfall of 100 mm

**11.6 Seed rate** – 55 to 65 kg/ha with a spacing of 30 to 45 cm. The seed rate could be further reduced with use of BBF/Ridge-Furrow technique.

### 11.7 Water management

Soybean is totally a rainfed crop. However, in the event of long dry spell, life saving irrigation is beneficial at the stage of pod/seed filling. During long dry spell – spray of anti – transparent like $KNO_3$@1% or $MgCo_3$ or glycerol @5% is also recommended to minimize water loss from the crop.Excess rainy water is also injurious for plant growth. Therefore, BBF/Ridge-Furrow techniques is being preferred by the farmers for effective water management.

### 11.8 Weed management

Weeds are the serious problem in soybean and can result into losses upto 70% if not controlled. The crop should be weed free atleast till 45 Days After Sowing (DAS) either with manual weeding at 20 and 40 DAS or by application of pre-plant incorporation/pre emergence and post emergence application of weedicides given in **Table-07.**

**Table-07: Weedicides for management of weeds**

| Chemical name | Mode of application | Quantity of product |
|---|---|---|
| Fluchloralin | PPI | 2.22 ltr /ha |
| Trifluralin | PPI | 2.00 ltr /ha |
| Metolachlor | PE | 2.00 ltr /ha |
| Pendimethalin | PE | 3.25 ltr /ha |
| Imazethapyr | POE | 1.00 ltr /ha |
| Diclosulam | PE | 26 g/ha |
| Quizalofop ethyl | POE | 1 ltr./ha |
| Quizalofop-p-tefuryl | POE | 1 ltr./ha |
| Fenoxyprop-p-ethyl | POE | 1 ltr./ha |
| Chlorimuron ethyl | POE | 36 g/ha |

**PPI: Pre-plant incorporation, PE: Pre-emergence, POE: Post emergence**

## 11.9 Insect Management:

Stem fly (*Melanagromyza sojae*), Tobacco Cattterpillar (*Spodoptera litura*), Gridle Beetle (*Obereopsis brevis*), Green Semi-loopers (*Chrysodexis acuta* and *Diachrysia orichalcea*), Leafminer *(Aproaerema modicella),* White fly *(Bemisia tabaci)* and Podborer *(Helicoverpa armigera, Cydia ptychora)* are the major insects of soybean. Soybean Rust *(Phakopsora pachyrhizi),* Yellow Mosaic (Mungbean yellow mosaic virus), Bacterial Pustule *(Xanthomonas campestris* pv. g*lycines),* Collarrot *(Sclerotium rolfsi) and* Leaf Spot *(Myrothecium roridum)* are the major diseases occurring in soybean.

Besides, deep summer ploughing and seed treatment with fungicides, use of resistant varieties like **Stem-fly** : JS 335, PK 262, NRC 12, MACS 124, **Defoliators**: NRC 7, NRC 37, JS 80-21, Pusa 16, Pusa 20, Pusa 24, PS 564, PK 472, **Girdle Beetle** : JS 71-05, **Soybean Rust** : JS 80-21, PK 1029, PK 1024, Indira Soya 9, **Collar-Rot**: PK 262, PK 416, PK 472, PK 1042, NRC 37, **Myrothecium Leaf Spot**: Bragg, JS 71-05, **Bacterial Pustule**: PK 416, PK 472, PS 564, Bragg, **Soybean Mosaic**: Ankur, PK 327, PK 416, PS 564 and **Yellow Mosaic** : PK 416, PK 472, PS 564, PK 1024, PK 1029, PS 1042, PS 1092, SL 295.

Regular field scouting and pest monitoring could facilitate mechanical removal of plant parts/plants infested with Girdle Beetle, or gregarious phases of Tobacco Caterpillar or Bihar Hairy Caterpillar or Yellow Mosaic Virus disease. This also helps in knowing the Economic Threshold Level (ETL) of pests load. The details of ETL for starting management of pests by Biological / Mechanical / Chemical are given in **Table 08**.

**Table 08: Economic Threshold Level (ETL)**

| Insect pests | Crop stage | ETL |
|---|---|---|
| Blue Beetle | Seedling | 4 beetle/m row |
| Green semiloopers | Flowering Podding | 4 larvae/m row, 3 larvae/m row |
| Bihar Hairy Caterpillar | Pre-flowering | 10 larvae/m row |
| Tobacco Caterpillar | Pre-flowering | 10 larvae/m row |
| Pod borer | Podding | 5 larvae/m row |

Based on the ETLs, one foliar spray of any one of the insecticides Triazophos 40EC @ 0.8 l/ha, Chlorpyrifos 20EC @ 1.5 l/ha, Quinalphos 25EC @ 1.5 l/ha, Ethion 50EC @ 1.5 l/ha, Methomyl 12.5L @ 2.0 l/ha, Ethofenprox 10 EC @ 1.0 l/ha is to be given preferably at the time of flowering.

- One spray of any of the microbial pesticides: Dipel *(Bacillus thuringiensis)* @ 1 l/ha or Biobit *(Bacillus thuringiensis)* @ 1 kg/ha) or Dispel *(Beauveria bassiana)* @ 1 l/ha should be given 15 days after the spray of chemical insecticide for the control of defoliators.

### 11.10 Disease Management

- For the management of foliar diseases *viz. Myrothecium Cercospora* and *Altemaria* Leaf Spot diseases and *Rhizoctonia* Aerial Blight, two sprays of Carbendazim or Thiophenate methyl @ 0.5 kg/ha at 35 and 50 days after sowing may be used for the control of Bacterial Pustule disease. For the control of yellow mosaic disease, spray of methyl dematon 25EC @ 0.8 l/ha or Thiomethoxam 25WG @ 100 g/ha is recommended for the control of vectors. In order to build up and conserve naturally occurring Biocontrol agents/ fauna *viz.* Coccinellid Beetles, *Chrysoperla* etc., biodiversity should be created in the form of intercropping. In rainfed areas, intercropping soybean with maize, sorghum or short duration pigeonpea (in 4:2 row ratio) is beneficial.

- In rust prone areas, prophylactic sprays of Hexaconazol, Propiconazol, Triadimefon @ 0.8 kg/ha is recommended.

### 11.11 Harvesting:

Timely harvesting of the crop, when pods turn pale yellow, is recommended to avoid shattering. More mechanical damage is occurred with combine harvesting in over mature crop. Manual threshing may be used for retaining seed for sowing purpose.

## 12. Marketing Support:

Soybean is covered under Minimum Support Price (MSP), which is announced well before the harvesting of crop. National Agricultural Cooperative Marketing Federation of India Ltd. (NAFED) is the Nodal agency to undertake procurement of

soybean under Price Support Scheme (PSS). Year wise details of MSP and Average Market Price of soybean during peak seasons of last three years given in **Table-9** indicates that the price of soybean never falls below MSP mainly because of large demand of raw material by Solvent Extraction Plant and global completion for export of soybean de-oiled cakes. This has facilitated faster growth in area expansion of soybean.

**Table-9: MSP v/s Average Market Price (AMP) of Soybean.**

| State/MSP | Avg. Price of November and December | | |
|---|---|---|---|
| | **2013** | **2014** | **2015** |
| MSP (Rs. / qtl.) | 2560 | 2560 | 2600 |
| MP | 3300 | 3025 | 3462 |
| Maharashtra | 3233 | 3126 | 3300 |
| Rajasthan | 3470 | 3138 | 3397 |

## 13. Nutritive Values:

The unique chemical composition of soybean seed which includes about 20% oil and 40% protein**,** besides number of nutraceutical compounds such as isoflavons, tocopherol and lecithin has made it one of the most valuable agronomic crops in the world. Owing to its oil and protein profile, this crop has an important role in nutritional security. However, the food uses of soybean in the country are meager (5-6%). Currently, almost 100% of the oil extracted from soybean is consumed in the country rather a large quantity (about 3.0 million tonnes) of soybean oil is also imported. A variety of soya food products given below are being popularized and promoted:

- **Soyamilk**: Soybean milk can be used in the same way as dairy milk.
- **Tofu:** It is made by coagulating the hot soya milk and used as a substitute of dairy paneer.
- **Soya Nuggets:** These are protein rich (>50%) products made of soybean.
- **Bakery Products:** Soybean can be fortified with wheat flour for making bakery products.
- **Noodles**: Noodles and vermicelli are a form of pasta and popular in India.
- **Soya Flour**: Full fat soya flour obtained by grinding whole soybeans with heat treatment / toasted to minimize enzyme action or defatted flour produced after complete removal of oil from soybeans.
- **Soya Protein**: The defatted soya flakes (after oil extraction) are the basis for different soybean products like soya flour, soya concentrate and soya protein highly digestible source of Amino Acids.
- **Substitute for pulses:** Soybean is traditionally used as pulses in Uttarakhand and as fermented food in North-Eastern region.
- **Soya Lecithin**: Lecithin is obtained from degumming of soya oil.

## 14. Import of soybean oil

To meet the domestic demand, huge quantities of vegetable oils are being imported by the country. The import of vegetable oil has touched the level of >14 million tonnes during 2014-15 with an exchequer of Rs. 68,000 crore. This imported oil includes about 3 million tonnes of soybean oil.

## 15. Export demand:

The market prices of soybean had always been much higher than the minimum support price of soybean largely because of the demand of raw material by the huge soybean processing industry and demand of DoC of soybean in the international market. Being non-G produce, the Indian DoC fetches a higher price of 100 US$ per tonne. Details of DoC and other products of soybean exported during last 03 years is given in **Table-10**. The quantity of DoC has been sharply declined during 2014-15 mainly because of lesser production of soybean in India.

**Table-10: Export of Soybean and its products**

**(Quantity in tonnes and value Rs. in crores)**

| Products | 2012-13 | | 2013-14 | | 2014-15 | |
|---|---|---|---|---|---|---|
| | Qty | Value | Qty | Value | Qty | Value |
| De-oiled Cake | 4795687 | 14361.61 | 4235413 | 14438.95 | 1630461 | 5568.74 |
| Soybean oil | 386 | 4.44 | 457 | 5.27 | 463 | 4.36 |
| Soya sauce | 329 | 1.74 | 535 | 3.78 | 596 | 3.21 |
| Soya milk | 15 | 0.04 | 239 | 1.89 | 51 | 0.50 |
| **Total** | **4796417** | **14367.83** | **4236644** | **14449.89** | **1631571** | **5576.81** |

**Source: Oilseeds statistics – A compendium – 2015 from ICAR- IIOR**

## 16. Researchable Issues:

- Varieties with low linolenic fatty-acid to improve the shelf life of soybean oil.
- Varieties with less beany flavours and Lipoxygenase (enzyme) lacking varieties (Kyushu-III-Japan) for increasing domestic consumption of Protein Rich Soya Foods.
- Varieties with bold pods/seeds for use as vegetable.
- Resistance varieties for Yellow Mosaic Virus.
- Short duration varieties for dry land areas.
- Technology for safe storage and transport of soybean seed without loss of seed viability.

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***Annexure-I***

## Potential Districts of Soybean

| Sl. No. | District | Area (hectares) | | | Production (tonnes) | | | Yield (kg/ha) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2011-12 | 2012-13 | 2013-14 | 2011-12 | 2012-13 | 2013-14 | 2011-12 | 2012-13 | 2013-14 |
| **Madhya Pradesh** | | | | | | | | | | |
| 1 | Ujjain | 456600 | 458800 | 457600 | 632900 | 673100 | 357800 | 1386 | 1467 | 782 |
| 2 | Sehore | 289800 | 308700 | 292300 | 357900 | 381600 | 141500 | 1235 | 1236 | 484 |
| 3 | Dewas | 324300 | 340500 | 333400 | 418000 | 544200 | 254100 | 1289 | 1598 | 762 |
| 4 | Dhar | 277500 | 277800 | 278800 | 363000 | 442500 | 431400 | 1308 | 1593 | 1483 |
| 5 | Shajapur | 355400 | 371100 | 250000 | 395900 | 498000 | 193000 | 1114 | 1344 | 772 |
| 6 | Sagar | 318000 | 335200 | 329000 | 316800 | 438500 | 140200 | 996 | 1308 | 426 |
| 7 | Vidisha | 242200 | 289800 | 270000 | 290500 | 321900 | 274400 | 1199 | 1111 | 1015 |
| 8 | Harda | 180200 | 178800 | 175400 | 258700 | 216000 | 47000 | 1436 | 1208 | 268 |
| 9 | Indore | 226400 | 228200 | 228200 | 262900 | 331800 | 229800 | 1161 | 1454 | 1007 |
| 10 | Rajgarh | 313100 | 326200 | 362100 | 268000 | 400600 | 208900 | 856 | 1228 | 577 |
| 11 | Chhindwara | 146700 | 153700 | 163400 | 264400 | 382600 | 126100 | 1803 | 2489 | 772 |
| 12 | Betul | 206900 | 236000 | 241300 | 262500 | 436700 | 152500 | 1269 | 1850 | 632 |
| 13 | Mandsaur | 270500 | 277800 | 281100 | 374000 | 493600 | 312900 | 1383 | 1777 | 1113 |
| 14 | Hoshangabad | 220700 | 223700 | 203800 | 141500 | 192800 | 20200 | 641 | 862 | 99 |
| 15 | Guna | 213000 | 234500 | 240700 | 298600 | 299300 | 145000 | 1402 | 1276 | 602 |
| 16 | Ratlam | 216900 | 224500 | 232600 | 273300 | 336800 | 256700 | 1260 | 1500 | 1101 |
| 17 | Raisen | 174900 | 196500 | 120600 | 127000 | 181800 | 29100 | 726 | 925 | 242 |
| 18 | Bhopal | 107700 | 110500 | 107600 | 128800 | 160500 | 68600 | 1195 | 1453 | 637 |
| 19 | Narsingpur | 75700 | 94100 | 94200 | 123300 | 168400 | 37200 | 1630 | 1789 | 395 |
| 20 | Shivpuri | 166500 | 162800 | 159000 | 169600 | 148400 | 100300 | 1019 | 911 | 631 |
| 21 | Seoni | 122100 | 119000 | 52500 | 122100 | 147700 | 23900 | 999 | 1241 | 259 |
| 22 | Neemuch | 123000 | 126200 | 137000 | 102100 | 198500 | 146700 | 830 | 1572 | 1071 |
| 23 | Khandwa | 169400 | 182300 | 189800 | 94000 | 158900 | 152900 | 555 | 872 | 806 |
| 24 | Ashoknagar | 108000 | 118800 | 168100 | 127300 | 247800 | 157900 | 1178 | 2085 | 939 |
| 25 | Damoh | 50500 | 102700 | 102200 | 65100 | 129900 | 51700 | 1288 | 1265 | 506 |
| 26 | Tikamgarh | 39200 | 54200 | 72700 | 31400 | 38400 | 40500 | 799 | 710 | 557 |
| 27 | Jhabua | 49000 | 52000 | 58300 | 33400 | 51300 | 45800 | 682 | 987 | 785 |
| 28 | Khargone | 41100 | 49000 | 49800 | 23700 | 47700 | 38500 | 577 | 973 | 772 |
| 29 | Satna | 50600 | 55300 | 70000 | 26400 | 28100 | 15000 | 521 | 509 | 215 |
| 30 | Chhatarpur | 60900 | 73200 | 77400 | 25400 | 61800 | 46400 | 416 | 831 | 600 |
| 31 | Rewa | 35500 | 36000 | 67200 | 18200 | 21000 | 63400 | 514 | 583 | 944 |
| 32 | Barwani | 35400 | 37500 | 37500 | 12300 | 76900 | 39400 | 348 | 2051 | 1050 |

*Cont….Annexure-I*

| Sl. No. | District | Area (hectares) | | | Production (tonnes) | | | Yield (kg/ha) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2011-12 | 2012-13 | 2013-14 | 2011-12 | 2012-13 | 2013-14 | 2011-12 | 2012-13 | 2013-14 |
| **Maharashtra** | | | | | | | | | | |
| 33 | Amravati | 296700 | 309500 | 366400 | 373100 | 471800 | 352700 | 1257 | 1525 | 963 |
| 34 | Nagpur | 241200 | 237100 | 232800 | 157300 | 238600 | 99900 | 652 | 1006 | 429 |
| 35 | Latur | 265400 | 265400 | 308400 | 437200 | 625400 | 670400 | 1648 | 2356 | 2174 |
| 36 | Buldhana | 258800 | 279500 | 323200 | 374200 | 430300 | 479000 | 1446 | 1540 | 1482 |
| 37 | Yavatmal | 221400 | 236800 | 285600 | 298100 | 389100 | 156600 | 1346 | 1643 | 548 |
| 38 | Nanded | 183000 | 185000 | 213200 | 233800 | 283400 | 274400 | 1277 | 1532 | 1287 |
| 39 | Washim | 219100 | 200300 | 276300 | 290600 | 338200 | 232300 | 1326 | 1688 | 841 |
| 40 | Hingoli | 146700 | 150500 | 170000 | 204200 | 286700 | 186000 | 1392 | 1905 | 1094 |
| 41 | Akola | 140600 | 151000 | 187100 | 167700 | 290400 | 191900 | 1193 | 1923 | 1025 |
| 42 | Wardha | 173000 | 1767000 | 185600 | 150600 | 188700 | 121700 | 871 | 1068 | 656 |
| 43 | Kolhapur | 48500 | 49000 | 55400 | 123400 | 127500 | 132500 | 2544 | 2602 | 2392 |
| 44 | Chandrapur | 146800 | 142100 | 142100 | 129700 | 145100 | 88400 | 884 | 1021 | 622 |
| 45 | Sangli | 48500 | 49000 | 77100 | 123400 | 127500 | 159600 | 2544 | 2602 | 2070 |
| 46 | Parbhani | 129800 | 135300 | 139000 | 154500 | 186900 | 174500 | 1191 | 1382 | 1255 |
| 47 | Nasik | 58600 | 56000 | 52400 | 81500 | 87300 | 82700 | 1391 | 1559 | 1578 |
| 48 | Satara | 46100 | 38800 | 46700 | 75000 | 69300 | 95600 | 1627 | 1787 | 2046 |
| 49 | Ahemdnagar | 58600 | 56800 | 65900 | 122700 | 28100 | 74500 | 2094 | 494 | 1130 |
| 50 | Jalna | 60300 | 62400 | 74600 | 90000 | 43600 | 123600 | 1493 | 699 | 1657 |
| 51 | Beed | 76400 | 76400 | 93500 | 118100 | 127000 | 174200 | 1546 | 1662 | 1863 |
| 52 | Osmanabad | 90800 | 111700 | 133500 | 137400 | 101300 | 270400 | 1513 | 907 | 2026 |
| 53 | Nandurbar | 32300 | 24400 | 28000 | 57500 | 49200 | 33300 | 1782 | 2017 | 1190 |
| **Rajasthan** | | | | | | | | | | |
| | **District** | **2009-10** | **2010-11** | **2011-12** | **2009-10** | **2010-11** | **2011-12** | **2009-10** | **2010-11** | **2011-12** |
| 54 | Jhalwar | 243664 | 240086 | 252258 | 293778 | 316766 | 390504 | 1206 | 1319 | 1548 |
| 55 | Baran | 194417 | 195086 | 234324 | 221611 | 357107 | 444702 | 1140 | 1831 | 1898 |
| 56 | Pratapgadh | 99490 | 101124 | 105737 | 155618 | 136652 | 127505 | 1564 | 1351 | 1206 |
| 57 | Kota | 122293 | 112195 | 147002 | 145587 | 153568 | 220682 | 1190 | 1369 | 1501 |
| 58 | Bundi | 55461 | 55169 | 76131 | 37813 | 79778 | 96465 | 682 | 1446 | 1267 |
| 59 | Chittore | 37171 | 36310 | 48686 | 36688 | 46425 | 73574 | 987 | 1279 | 1511 |
| 60 | Banswara | 18958 | 19030 | 20429 | 15404 | 18316 | 15455 | 813 | 962 | 757 |
| **Chhattisgarh** | | | | | | | | | | |
| | **District** | **2009-10** | **2010-11** | **2011-12** | **2009-10** | **2010-11** | **2011-12** | **2009-10** | **2010-11** | **2011-12** |
| 61 | Rajnandgaon | 20150 | 21000 | 22150 | 15850 | 24890 | 18300 | 787 | 1185 | 826 |
| 62 | Kawardha | 28710 | 32680 | 35560 | 25350 | 41600 | 31550 | 883 | 1272 | 887 |
| 63 | Durg | 31680 | 37300 | 39660 | 26100 | 39290 | 29140 | 824 | 1053 | 735 |
| **Karnataka** | | | | | | | | | | |
| | **District** | **2011-12** | **2012-13** | **2013-14** | **2011-12** | **2012-13** | **2013-14** | **2011-12** | **2012-13** | **2013-14** |
| 64 | Belgaum | 77257 | 60203 | 66769 | 78385 | 49159 | 49159 | 1068 | 706 | 775 |
| 65 | Bidar | 81066 | 77187 | 109391 | 87640 | 115271 | 174900 | 1138 | 1572 | 1683 |
| 66 | Dharwad | 23219 | 21244 | 28677 | 17757 | 15984 | 28278 | 805 | 792 | 1038 |
| **Telangana** | | | | | | | | | | |
| | **District** | **2009-10** | **2010-11** | **2011-12** | **2009-10** | **2010-11** | **2011-12** | **2009-10** | **2010-11** | **2011-12** |
| 67 | Nizamabad | 44082 | 57852 | 58470 | 73088 | 73530 | 123079 | 1658 | 1271 | 2105 |
| 68 | Adilabad | 96223 | 92093 | 61932 | 118547 | 52677 | 84847 | 1232 | 572 | 1370 |

***Annexure-II***

**Details of >15 years old varieties of Soybean (*Glycine max*)**

| Soybean variety | Year of release | Releasing Centre | Yield potential (kg/ha) | Oil content (%) | Recommended states/regions situations | Salient features/ traits |
|---|---|---|---|---|---|---|
| Samrudhi (MAUS 71) | 2002 | MAU, Parbhani | 2000-2500 | 18.24 | North Eastern Zone | Semi determinate, purple flowers, glabrous leaves, yellow seed with black hilum, maturity 93-100 days. |
| Pratishta (MAUS 61-2) | 2002 | MAU, Parbhani | 2000-2500 | 19.66 | Central zone | Semi determinate, purple flowers, glabrous leaves, yellow seeds, brown hilum maturity 100-105 days |
| Pratikar (MAUS 61) | 2002 | MAU, Parbhani | 2600-2800 | 18.77 | Southern zone | Semi determinate, purple flowers, grey pubescence, yellow seed with brown hilum, maturity 95-100 days. Resistant to Myrothecium leaf spot |
| JS 93-05 | 2002 | JNKVV Jabalpur | 2000-2500 | 18.15 | Central zone | Semi determinate, violet flowers, four seeded pods, glabrous stem & pods, non shattering, black hilum, maturity 90-95 days. Resistant to major diseases and insect pests. |
| MAUS 81 (Shakti) | 2003 | MAU, Parbhani | 3300 | 17.34 | Central Zone | Semi determinate plants with dark green glabrous leaves, purple flowers, yellow oblong seed and brown to blackish hilum, maturity 93-97 days. Tolerant to common diseases and pests |
| Palam soya(P-30-1-1) | 2003 | HPKVV, Palampur | - | 19.12 | Himachal Pradesh and Uttaranchal | Resistant to frog eye leaf spot |
| Pant Soybean 1241 | 2003 | GBPUA&T, Pantnagar | 1800-2000 | 16.57 | Uttaranchal | Semi determinate with yellow seed and black hilum, 100 seed weight 14 to 15 gs, maturity 121 days.Resistant to YMV, fungal complex and tolerant to *rhizoctonia.* |
| TAMS 38 | 2003 | PDKV, Akola | 2200 | 16.09 | Maharashtra Vidarbha region | Determinate plants with white flower, brown hairs present on stem and pods, cream colour seeds with grey hilum, maturity 95 days |
| SL 525 | 2004 | PAU, Ludhiana | 2300 | 17.33 | Northern Plain Zone | Determinate plants with white flower, brown hairs present on stem and pods, cream colour seeds with grey hilum, oil 21.2% and protein 38.9%, maturity 121 days. Resistant to YMV, tolerant to stem blight and root knot nematode. |

***Cont.....Annexure-II***

| Soybean variety | Year of release | Releasing Centre | Yield potential (kg/ha) | Oil content (%) | Recommended states/regions situations | Salient features/ traits |
|---|---|---|---|---|---|---|
| Phule Kalyani (DS 228) | 2005 | MPKV, Rahuri | 2400 | 19.08 | Maharashtra | Determinate plants with white flower, brown hairs present on stem and pods, cream colour seeds with grey hilum, maturity 95-100 days. |
| CO 3 | 2005 | TNAU, Coimbatore | 1400 | 16.65 | Tamil Nadu | Medium duration photo insensitive variety with high oil and protein content, maturity 85-90 days.Resistant to YMV |
| PRS 1 | 2005 | GBPUA&T, Pantnagar | 2000 | 17.76 | Uttaranchal mid hills | Determinate, pink flower colour, 100 seed weight: 13 g., maturity 100 days. |
| DS 97-12 | 2005 | IARI, New Delhi | 2200-2500 | 18.01 | North Plain Zone | Determinate growth habit, light green leaves, white flowers and non shattering type, maturity 116 days.Resistant to YMV and moderately resistant to stem fly. |
| JS 95-60 | 2006 | JNKVV, Jabalpur | 1800-2000 | 16.60 | Madhya Pradesh | Determinate, extra earliness, high seed germ inability and longevity, lodging and shattering resistance erect plant, flower color violet, glabrous pods with 4 seeds per pod, seed size bold, hilum color grey, maturity 82-88 days. Resistant to stem fly and defoliators and moderately resistant to girdle and blue beetles, resistant/tolerant to root rot, bacterial pustule, RAB, TLS |
| PS 1347 | 2006 | GBPUA&T, Pantnagar | 3100 | 15.54 | North Plain Zone | Determinate compact plant type, tawny pubescence and yellow bold seeds, maturity 123 days. Resistant to YMV, rhizoctonia aerial blight, bacterial pustule, SMV and charcoal rot. |

## Status paper on Soybean

***Cont…….Annexure-II***

| Soybean variety | Year of release | Releasing Centre | Yield potential (kg/ha) | Oil content (%) | Recommended states/regions situations | Salient features/ traits |
|---|---|---|---|---|---|---|
| DS 98-14 | 2006 | IARI, New Delhi | 1900-2200 | 16.89 | North Plain Zone | Determinate growth habit with average plant height and white flowers, maturity 125 days. Resistant to YMV, SMV, pod blight and moderately resistant to stem fly. |
| Pratap Soya 1 (RAUS 5) | 2007 | MPUA&T, Udaipur | 3000-3500 | 17.98 | North Eastern Zone | Determinate, purple flower, yellow seed, hilum light to dark brown, maturity 96-104 days.Resistant to girdle beetle and moderately to stem fly and defoliators. |
| Pratap Soya 2 (RKS 18) | 2007 | MPUA&T, Udaipur | 2300 | 17.13 | Southern & North Eastern Zone | Determinate variety with medium plant height. Purple flower. The plant is glabrous. Seed light yellow in colour round in medium size, Hilum gray to black, maturity 91 days. Moderately resistant to BP, girdle beetle and leaf miner but susceptible to rust. |
| TAMS 98-21 | 2007 | PDKV, Akola | 2200-2600 | 18.08 | Maharashtra | Determinate, erect, purple flower, brown pubescence, yellow seed with hilum brown, gray pod, maturity 95-100 days. Moderately resistant to rust, leaf spot disease and insects |
| PS 1225 | 2007 | GBPUA&T, Pantnagar | 3000-3200 | 18.01 | Tarai and Bhabar Region of UP and Uttarakhand | Grey pubescence, light brown hilum, Improved seed longevity. Shattering and lodging resistance, maturity 125 days. Multiple disease resistance. Resistant to resistant YMV, bacterial pustule, collar rot anthracnose, pod blight and SMV. |
| JS 97-52 | 2008 | DSR Indore and JNKVV, Jabalpur | 2500-3000 | 17.48 | Central Zone and North Eastern Zone | While flower, tawny pubescence, large number of plant per plant, tolerance to excessive soil moisture, good seed longevity, maturity 100 days. Resistance to YMV and Collar rot, moderately resistant to Rhizoctonia aerial blight, moderately resistance to insects |

***Cont.....Annexure-II***

| Soybean variety | Year of release | Releasing Centre | Yield potential (kg/ha) | Oil content (%) | Recommended states/regions situations | Salient features/ traits |
|---|---|---|---|---|---|---|
| SL 688 | 2008 | PAU, Ludhiana | 2500 | 20.54 | North Plain Zone | Determinate and erect plants, brown pubescence, protein content 40.3% and oil content 19.4%, maturity 125 days. Resistant to YMV |
| VL Soya 59 | 2008 | VPKAS, Almora | 2600 | 20.04 | North Hill Zone | Low linolenic acid, better oil quality, protein content 39.15% and oil content 19.35%, maturity 135 days. Resistant to pod blight, target leaf spot |
| VL Soya 63 | 2008 | VPKAS, Almora | 2700 | 20.23 | North Hill Zone | Determinate and erect plants, protein content 41% and oil content 17.9%, maturity 130 days. Resistant to pod blight and target leaf spot, moderately resistant to frog eye leaf spot |
| VL Soya 65 | 2009 | VPKAS, Almora | 1500-1800 | | Uttarakhand hills | Moderately resistant to frog eye leaf spot, pod blight and leaf blight. |
| LSB-3 | 2009 | Adilabad | | | Andhra Pradesh | Resistant to bacterial pestule, pod blight & tolerant to bud blight |
| MAUS-158 | 2009 | MAU Parbhani | 2260 | 19.70 | Marathawada region | Tolerant to bacterial pustules, Rhizoctonia root rot & aerial blight, collar rot and charcoal rot. |
| Pusa 97-12 | 2009 | IARI | 2286 | 19.60 | Northern Zone | Resistant YMV, Charcoal rot |
| RVS 2001-4 | 2009 | RVS Gwalior | 2500 | | Madhya Pradesh | Tolerant to major leaf, pod & root diseases. Tolerant to girdle beetle & semi looper. |
| Birsa Safed Soybean-2 | 2009 | Ranchi | 2500 | | Jharkhand | Resistant to bacterial pastules, cercopsora leaf spot, blue beetle and bihar hairy cater pillar, moderately resistant to frog eye leaf spot. |

***Cont.....Annexure-II***

| Soybean variety | Year of release | Releasing Centre | Yield potential (kg/ha) | Oil content (%) | Recommended states/regions situations | Salient features/ traits |
|---|---|---|---|---|---|---|
| Pusa DS 9814 | 2006 | IARI | 1900-2200 | - | | Resistant to YMV and charcoal rot, Northern zone |
| PS-19 | 2010 | Pantanagar | 2121 | | Tarai Bhabar and hills of Uttarakhand | Resistant to major foliar diseases, YMV, Bacterial pustule & rhizoctonia aerial blight. |
| NRC-77 | 2010 | DSR, Indore | 2400 | | Southern zone Karnataka, Tamil Nadu, A.P., South Maharashtra | Resistant to charcoal rot, Rizoctonia root rot and moderately resistant to RAB and BP |
| MACS-1188 | 2013 | ARI, Pune | 2475 | 19.10 | Southern zone (Karnataka, Tamil Nadu, A.P., South Maharashtra) | High Oil content, early maturity, resistant to pod shattering and Rizoctonia aerial blight, bacterial pastules, charcoal rot, stem fly, pod borer, leaf folder, leaf minor and defoliators. |
| RKS-24 | 2011 | ZARS, Kota | 2200-2400 | 19 | Rajasthan | Resistant to shattering, Rhizoctonia aerial blight and bacterial pastules. |
| GC-00209-4-1-1 (Karune) | 2011 | UAS, Bangalore | 7000-8000 (green pods) | | South Karnataka | Vegetable type |
| DSb-1 | 2012 | UAS, Dharwad | 2500-3000 | 18.2 | Karnataka | Better germinability, Resistant to rust and tolerant pod shattering |
| SL 744 | 2012 | Ludhiana | 1840 | 21 | Northern Zone (Punjab) | Timely sown irrigated condition |
| RKS-45 | 2013 | ARS, Kota | 3000-3500 | 21 | ARS | |
| RVS 2001-4 | 2014 | RVS Gwalior | 2500 | 21.50 | Madhya Pradesh | Tolerant to major leave, pod and root diseases. |
| JS-20-29 | 2014 | JNKVV, Jabalpur | 2125 | 20.90 | Madhya Pradesh, Maharashtra, Rajasthan, UP | Resistant to YMV. |
| JS-20-34 | 2014 | JNKVV, Jabalpur | 2052 | 20.30 | Madhya Pradesh, Maharashtra, Rajasthan, UP | Extra early |
| MAUS-2 (Pooja) | 2014 | MAU Parbhani | 2500-3500 | 20.00 | Karnataka | Resistant to bacterial puspule |
| MAUS-162 | 2014 | MAU Parbhani | 2000-3000 | 21.37 | Maharashtra | Tolerant to charcoal rot |
| NRC-86 | 2015 | DSR, Indore | 2128 | 19.80 | MP, Rajasthan, Gujarat, Maha & UP. | Moderately resistant to bacterial puspule |

## Status paper on Soybean

***Cont.....Annexure-II***

| Soybean variety | Year of release | Releasing Centre | Yield potential (kg/ha) | Oil content (%) | Recommended states/regions situations | Salient features/ traits |
|---|---|---|---|---|---|---|
| KDS-344 | 2015 | | 2555 | 16.80 | Maharashtra, Karnataka, Tamil Nadu and Telangana | Tolerant to rust |
| PUSA-12 | 2015 | IARI | 2286 | 19.60 | North Plain Zone | Resistant to YMV |
| DSb-21 | 2015 | UAS, Dharwad | 2500-3000 | 18.20 | Southern Zone | Resistant to rust |