

# **Directorate of Soybean Research**

**Khandwa Road, Indore (M.P.) -452 001**

## **Strategic Plan 2011-2016**

### **Introduction**

Soybean has turned out to be a major oilseed crop in India subsequently efforts put in by the stakeholders of production system. The growth in area and production has been unparalleled during last 40 years. The horizontal expansion from merely 30000 ha in 1970 to projected 9.3 million ha in 2010 tells about the success story of soybean in India. On productivity front as well the growth has been nearly 3.0 times; from 426 kg/ha to 1361 kg/ha during this period. The crop has been playing an important role in resolving the edible oil deficit situation in India. As on today it supplements about 25% of edible oil produced in the country. In addition, the crop has been fetching more than Rs.74000 million annually, from the export of de-oiled cake, a byproduct of oil extraction plants. This earning helps in offsetting the import bill of edible oils in the country. By introduction and subsequent rapid commercialization of soybean in India, the greater share of benefit goes to soybean growers positioning them at higher socio-economic status. In a country like India where more than 40% population suffers from energy-protein mal-nutrition, the crop can serve as an excellent source of high quality protein. Since soybean is considered as functional food, its inclusion in routine diet is capable of providing overall health security to the Indian masses and the advantage thereof can be taken.

The National Research Centre for Soybean was established in 1987. In view of spectacular growth of the crop and its role in oil and national economy in addition to improvement in socio-economic status of farmers and also its potentials to ameliorate the wide spread energy protein mal-nutrition and to provide functional and health benefits, in the XI Plan, NRC for Soybean has been upgraded to a status of **Directorate of Soybean Research** to provide adequate support to R&D in soybean to harness the benefits.

At present, two schemes namely Directorate of Soybean Research (DSR) and All India Coordinated Research Project on Soybean (AICRP on Soybean) are operative on soybean R&D. The DSR provides leadership at national level and is mandated to conduct basic and strategic research and to empower and enable cooperative centres under AICRP on Soybean. The AICRP on Soybean operates through its 22 cooperative centres located in different agro-climatic zone of the country and undertakes location specific adoptive/applied research and production of breeder seed of improved soybean varieties.

### **Section 1: Vision, Mission, Objectives and Functions**

#### **Vision**

Oilseed production and productivity in the country is one area that has not yet yielded very rich dividends to research inputs so far. The vision, that drives DSR, Indore, is to contribute through its research efforts to edible oil pool and energy-protein malnutrition eradication programme of the country.

## **Mission**

To make country self sufficient in edible oil production, soybean has to play a key role as the most important oilseed of the country. The mission for DSR, Indore is to enhance and sustain soybean production and productivity in the country through relevant crop improvement, production and protection technologies.

## **Objectives**

1. Strengthening frontier research for enhancing soybean production and productivity
2. Conservation of genetic resources/ germplasm for sustainable use
3. Production management and disease diagnostics/management and value addition
4. Commercialization of technologies developed and promoting public-private partnership
5. Enhancing input use efficiency (soil and water).
6. Development of web-based expert systems for enhanced in plant protection advisory services.
7. Monitoring of climate change and adaptation to mitigate its adverse effects on soybean production systems.
8. Harnessing conventional and modern scientific knowledge, tools, and cutting-edge of science for development of improved soybean varieties/hybrids and their seeds, suited to diverse agro-ecologies
9. Efficient, economic, eco-friendly and sustainable soybean production and protection technologies
10. Improving impact of extension system
11. Human resource development and capacity building in frontier areas of agricultural research.

## **Functions**

With a vision to contribute to edible oil pool and energy-protein malnutrition eradication programme of the country through enhanced and sustainable production and productivity of soybean following are the mandates of the DSR.

- To serve as National Repository of soybean germplasm and its utilization in basic, strategic and applied research.
- To conduct basic, strategic and applied research on environmentally eco-friendly technologies and value addition.
- To coordinate multi location interdisciplinary soybean research through AICRP for soybean.
- To facilitate transfer of research emanated technologies and to conduct impact analysis through socio-economic research.
- To produce breeder seed of improved varieties of soybean

## **Section 2: Assessment of the situation**

### **2 A. What external factors will impact DSR, Indore?**

#### **a. Political**

1. Issues pertaining to food safety (GMO Soybean) and quality assurance.
2. Commitment of the government to fund R&D in the soybean sector.

3. International cooperation and coordination especially in the soybean growing regions to deal with various transboundary issues including germplasm sharing.
4. Globalization with unequal opportunities adversely affecting terms of soybean trade.
5. Policies of state governments including centre-state coordination.
6. Political will to reduce import duty structure would adversely affect competitiveness.

**b. Economic**

1. Input pricing in terms of fertilizers, seeds, feed and agrochemicals.
2. MSP regime for soybean.
3. Backward/forward market linkages, to have free access to market and assured price.
4. The rate of economic growth in agriculture is a critical factor in its development and poverty reduction.
5. The agricultural subsidy, paid to farmers and agribusinesses for supplementing their income, manage the supply of agricultural commodities and influence the cost and supply of such commodities. This is essential to attract people from weaning from farm activity.

**c. Socio-cultural**

1. Varying regional requirements and preferences.
2. Farming not an attractive/preferred career option.

**d. Technological**

1. Willingness to adopt new technology.
2. Fragmented farm holding, leading to diversified technological options.
3. Diversified agro-eco regions, cultivation practices, leading to development of eco-region specific modules.
4. Gap between lab and land, leading to technology mis-match calling for on farm research.
5. Inadequate use of communication channels other than verbal.

**e. Environmental**

1. Delayed monsoon and un-evenly distributed rainfall.
2. Water stress: Depleted ground water, poor quality of water affecting crop production and productivity.
3. Heat stress: Identification of newer varieties and development of adaptation strategies.
4. Soil fatigue: Excessive/inadequate use of fertilizers imbalancing the soil nutrients.
5. Biotic and abiotic stress in terms of pests, disease, etc.
6. Green house gas emission: Mitigation strategies to reduce methane and CO<sub>2</sub>.
7. Increased atmospheric carbon levels-development of alternate plants C<sub>3</sub> to C<sub>4</sub>.

**f. Legal**

1. Marketing and trade laws relating to export/import of soybean products.
2. Labour laws for regulating farm employment and wage issues.
3. Weak regulatory mechanism for various agricultural inputs.
4. Sanitary and phyto-sanitary standards.
5. IPR issues related to plant varieties, the rights of farmers and plant breeders

## **2 B. Who are our stakeholders?**

1. Farmers, State Agricultural Universities, Processing Industries, Marketing Federations, seed corporations and policy makers.
2. Sister organizations like DBT, DST, CSIR, DRDO, MoEF, NGOs and private industries etc.
3. International organizations (including CGIAR) are our other stakeholders with whom the department has collaboration to address the challenges in agriculture sector.

## **2 C. What are our strengths and weaknesses?**

### **Strengths**

1. Diverse agro-ecological situations.
2. Strong research network.
3. Strong first-line extension system.
4. Strong public sector network for seed production.
5. Strong HRD facilities.
6. Initiatives from oil industry.

### **Weakness**

1. Dependence on vagaries of monsoon.
2. Lack of adequate seed multiplication.
3. Lower seed replacement ratio.
4. Production under energy starved conditions.
5. Vulnerability to pests and diseases.
6. Gap in resistance breeding.
7. Resource poor farmers.
8. Weak infrastructure.
9. Technical inefficiency of oil industry.
10. Weak transfer of technology.
11. Lack of regulatory and trade policy support.

### **Opportunities**

1. Biotechnological options for genetically enhanced germplasm.
2. Huge exploitable yield reservoir.
3. Exploiting niche areas of oilseeds cultivation.
4. Value addition to oilseeds, oils and by-products.
5. Scope for improving efficiency of oilseed processing.
6. Exploiting supplementary sources of oil.
7. Extension of retail boom to oilseeds.

### **Threats**

1. MSP support for competing crops.
2. Continuous mono-cropping.
3. Aberrant weather.
4. Alarming demand for edible oil.
5. Lack of linkage to assured market.
6. High standards in the liberalized international trade.

## **2 D. What do we need to learn?**

India has a diverse agriculture system well adapted to equally diverse agro-climatic conditions and is largely concentrated with small holders with low productivity. Research efforts need to be concentrated for production and effective use of economically viable technological interventions benefiting small holders to increase per unit productivity in line with growing population and demand for quality. In the meanwhile, the increasing threats like global warming, increased Green House Gas emission also needs to be suitably addressed by developing future prediction modules with requisite technological arrangement using modern tools for sustainable production.

To attend the goals of enhanced soybean production and productivity along with the associated mission objectives of bolstering Indian farmers' economic status and eradication of maladies of protein-energy malnutrition; the concerted strategies have been formulated to focus on:

1. Impact assessment and development of management strategies for current and future climate variability in soybean in terms of responsive varieties, production and protection technologies including suitable farm machinery and quality traits matching future consumer preferences.
2. Enhancement of genetic resources and evaluation for desirable traits to combat the emerging problems.
3. Crop improvement using functional genomics, MAS, transgenic and allele mining approaches
4. New strategies like exploring the possibility of harnessing hybrid vigour and accumulation of yield related QTLs to overcome genetic yield barriers
5. Development of specialty soybeans for increased food uses and industrial exploitation
6. To develop sustainable organic farming in specific areas/regions to cater to the needs of premium local and foreign markets
7. Management of Biotic and abiotic stress scenario
8. To facilitate knowledge imbibition amidst clientele through aggressive and efficient extension tools
9. To promote and develop technology for soybean based secondary agriculture
10. Institutional capacity building through intensive HRD to meet the future research challenges

### **Section 3: Outline of the strategy**

#### **Purpose of the strategy**

- To play the mandated role in safeguarding oil economy security in the long run.
- To adapt to newer challenges and changing environment.
- To address the concern of other line departments including farmers for sustainable soybean growth in the country.

#### **Long term outcome goals**

- To carry out the mandated role in maintaining a long term growth in soybean productivity.
- To promote secondary agriculture, through value addition.

- To minimize losses due to pests and diseases in order to reduce greater instability in oilseed production.
- To maintain and enhance human resources in the agricultural research system.

### SWOT analysis

As covered in Section 2C

### Proposed solutions and policy options

- Increase productivity.
- Improve production system management.
- Improve health management.
- Protect, conserve and enhance germplasm.
- Encourage and enlarge protected cultivation.
- Increase investment in infrastructure and capacity building.
- Increase investment in post production management and value addition.
- More technology refinement and assessment centres.
- R&D in collaboration with private sector.

### Prioritization

S. No.	Strategy	Prioritization of Programme			
		Low	Medium	High	Rating %
1.	Identification of novel genes and their utilization			√	15
2.	Efficient germplasm management and utilisation for enhancing productivity			√	10
3.	Climate change management strategies			√	10
4.	Production of nucleus, breeder and quality seed			√	10
5.	Efficient cultivation technologies		√		7.5
6.	Plant Protection modules			√	15
7.	Human resource development			√	15
8.	Strengthening of technology assessment and refinement			√	10
9.	International linkages		√		7.5

### Implementation framework

The strategy is to be implemented by assigning responsibilities to Scientists of DSR and Co-operating centres of AICRP on Soybean. More sustained linkages with the State Governments and sister departments, as also with international organizations are an important element of the implementation framework. Greater involvement of other stakeholders, especially the private sector, is yet another pillar. Regular monitoring and review at institute and ICAR level is proposed as follows:

- Regional Committee meetings
- Annual Directors' Conference
- Six Monthly Review of R&D Work done by each scientist
- Quinquennial Review
- Research Advisory Committee overseeing the research programs
- Interface meetings with line departments and sister organizations

#### **Section 4: Implementation plan**

The basic and strategic research will be carried out primarily by the specific divisions in the Directorate of Soybean Research. Research output will be validated through the All-India Coordinated Project on Soybean and the Network Projects. Basic research as well as coordinated and network projects will also be partly implemented through the State Agricultural Universities. Efforts will be made to commercialize technologies for their large-scale application. Land use plan and soil fertility maps will be prepared and supplied to all the stakeholders.

The output would be reviewed through six-monthly assessment of each scientist and through quarterly, six-monthly and annual reports from the Institute and interface meetings with the line departments.

#### **Stakeholder engagement:**

Through interaction with the State Governments and farmers in the regional Committees, through Institute Management Committees, through farm interface meetings, through Kisan Melas and Goshthis, regular interaction with the line departments and international institutions, as also with sister organisations, like DBT, DST, MOEF, ICAR-industry meet, a more interactive user-friendly website, annual conference of KVKs,.

#### **Learning agenda:**

The primary learning has to be about gap in the feedback loop, from the stakeholders to the Institution, and specifically the gap in the lab-to-land transfer of technologies. Learning gaps in inter-disciplinary research (including across various sciences) and state-of-art biotechnology have also to be filled.

#### **Resources required:**

There is strong need to develop talented scientists, effective science managers and enlightened farmers for better output. Though, under National Agricultural Research System, reasonably good infrastructure has been developed in the country for addressing research and development but to achieve faster growth rate there is a need to strengthen existing resources in terms of manpower, well equipped modern laboratories and sufficient budgetary provisions to manage them.

Trained human resource, sufficient budgetary provisions and modern infrastructure are the major resources. The strategic implementation protocol requires setting up and revamping the existing organizational set up, institutional change through appropriate incentives and monitoring mechanisms.

## **Milestones:**

Some of the thrust areas and activity milestones are given in Annexure.

## **Section 5: Linkage between strategic plan and RFD**

The Directorate of Soybean Research has well established linkage with sister institutions, state agricultural universities, other research organizations like DST, DBT, in order to have strong research support to develop robust technology for sustainable development of soybean in the country. Further strong linkages with private industries and foreign organizations particularly in the area of seeds, value added products, agriculture implements exist. Through its All India Coordinated project and network projects, the Directorate has developed a strong linkage with SAUs, SVUs and NGOs in addressing the region specific problems in a mission mode approach. The entire programme will be periodically monitored effectively through the mechanism already put in place as detailed at Section IV (v).

### **Linkage with RFD**

Directorate of Soybean Research has identified the following major objectives under RFD

1. Conservation, evaluation and documentation of germplasm
2. Genetic enhancement of soybean for productivity and quality
3. Enhancement of productivity of soybean through appropriate production and protection technologies
4. Demonstration and transfer of technologies
5. Production of breeder seeds
6. Efficient functioning of RFD system

The major programs reflected in the strategic plan will be fragmented into activities in the subsequent RFDs and would be achieved in a time frame. The priorities of the programmes would change depending on the various external factors as detailed in Section 2 and need mid course corrections in terms of activity milestones.

### Inter se Priorities among Key Objectives, Success indicators and Targets

Objectives	Weight	Action	Success indicator	Unit	Weight	Target/Criteria Value				
						Excellent	Very Good	Good	Fair	Poor
						100%	90%	80%	70%	60%
Conservation, evaluation and documentation of germplasm	10	Conservation (documentation) of germplasm	Conservation (documentation)	Number	5	4218 (10)	3796 (9)	3374 (8)	2953 (7)	2531 (6)
		Evaluation and identification of sources for desirable traits	Identification of genetic sources	Number	5	6	5	4	2	1
Genetic enhancement of soybean for productivity and quality	35	Generation of genetic material.	Populations developed	Number	20	20	18	16	14	12
		Selection of promising entries in evaluation trials/transformation events.	Promising entries made	Number	15	7	6.3	5.6	4.9	4.2
Enhancement of productivity of soybean through appropriate production and protection technologies	25	Cropping systems and input use efficiency	Technology tested	Number	10	2	1	1	-	-
		Weed control and Pest management	-do-	Number	10	2	2	-	-	-
		Identification of useful microorganisms for productivity enhancement	Microorganisms identified	Number	5	2	2	1	-	-

Demonstration and transfer of technologies	10	On farm trials and technology demonstrations	Technology demonstrated	Number	5	<b>15</b>	<b>13</b>	<b>12</b>	<b>11</b>	<b>9</b>
		Training to extension officers/farmers	Training conducted	Number	10	<b>50</b>	<b>45</b>	<b>40</b>	<b>35</b>	<b>30</b>
Production of breeder seeds	9	Breeder seed production	Quantity of breeder seed produced	quintals	10	<b>250</b>	<b>225</b>	<b>200</b>	<b>175</b>	<b>150</b>
Efficient functioning of RFD system	11	Timely submission of draft for approval Timely submission of results	On time submission	Date	2	<b>16/3</b>	<b>18/3</b>	<b>23/3</b>	<b>26/3</b>	<b>31/3</b>
			On time submission	Date	3	<b>25/3</b>	<b>26/3</b>	<b>27/3</b>	<b>28/3</b>	<b>31/3</b>

**Section 6: Cross-departmental and cross functional issues:**

Directorate of Soybean Research has cross-functional linkages and issues with State Agricultural Universities, sister Departments, like DBT, DST, other departments, such as Planning and Finance, the State Governments, the Departments of Agriculture, and with international institutions, especially those in the CGIAR. It also has cross-functional issues with authorities dealing with issues of IPR and commercialization as well as import and export of germplasm.

Once DSR has provided inputs, the long chain of input availability, input quality, input pricing, weather forecasting, production system management, disease and pest management, post-production management, marketing and value addition starts. Though not directly linked with many of these activities, DSR nevertheless has issues with the departments and stakeholders involved in this process, especially in terms of both DSR's impact and the feedback loop.

**Section 7: Monitoring and review arrangements:**

The research output would be reviewed through six-monthly assessment of each scientist and through annual reports from the Institute and interface meetings with the line departments. Besides, the in-built review mechanism as detailed in Section 3 would also form part of monitoring system.

**Overall plan and milestones**

The milestone is to develop technologies which can sustain under unfavourable climate, have mass scale application, address the future needs of producer and consumer and provide both nutritional, livelihood and socio-economic security to the resource poor farmers. Considering the thrust areas of research based on the national and global need, the strategic plan document has been prepared for the next five year and the detailed activities are provided in the table below :

Milestones	Activity	Milestone				
		2010-11	2011-12	2012-13	2013-14	2014-15
Conservation, evaluation and documentation of germplasm	<ul style="list-style-type: none"> <li>• Conservation (documentation) of germplasm</li> <li>• Evaluation and identification of sources for desirable traits</li> </ul>	→	→	→	→	→
Genetic enhancement of soybean for productivity and quality	<ul style="list-style-type: none"> <li>• Generation of genetic material.</li> <li>• Selection of promising entries in evaluation trials/transformation events.</li> </ul>	→	→	→	→	→
Enhancement of productivity of soybean through appropriate production and protection technologies	<ul style="list-style-type: none"> <li>• Cropping systems and input use efficiency</li> <li>• Weed control and Pest management</li> <li>• Identification of useful microorganisms for productivity enhancement</li> </ul>	→	→	→	→	→
Demonstration and transfer of technologies	<ul style="list-style-type: none"> <li>• On farm trials and technology demonstrations</li> <li>• Training to extension officers/farmers</li> </ul>	→	→	→	→	→
Production of breeder seeds	<ul style="list-style-type: none"> <li>• Breeder seed production</li> </ul>		→	→	→	→

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