Oil crops: proceedings of the three meetings held at Pantnagar and Hyderabad, India, 4 – 17 January 1989
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OIL CROPS:
PROCEEDINGS OF THE THREE MEETINGS HELD AT
PANTNAGAR AND HYDERABAD, INDIA, 4-17 JANUARY 1989

1. The Brassica Subnetwork-II
2. The Other Oil Crops Subnetwork-I
3. The Oil Crops Network Steering Committee-I

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The Government of India has been concerned about the slow progress in production of oilseeds in the country and the resort to large scale imports. 47 million rupees of edible oils in the last five years. Next to mineral oils, edible oils have been the single largest item of import, despite the country. about 19 million ha under oilseeds.

The basic objective of the mission was set in Feb. 1986, when the Prime Minister, in his address at the Indian Agricultural Research Institute, New Delhi, defined the scope and strategy of the mission as follows:

"One of our biggest problems today in the agricultural sector is oilseeds. We are setting up a thrust Mission for oilseeds production. When we talk of a mission, we mean an exercise starting from the engineering of the seeds and finishing with the finished products of the vegetable oil which could be delivered to the consumer. We would like to put one person in-charge of such a mission with full funding, with no restrictions on him whether bureaucratic or otherwise. The only limits will be certain achievements which must come within a certain time frame. This will cut across a number of Ministries where we find a lot of hassles and we find our projects getting stalled because the interaction is not smooth enough."

The mission basically adopted a four-pronged strategy as indicated below:

- **Firstly**, improvement of oilseeds crop technology for stepping up yields and profit to the farmers;
- **Secondly**, improved processing and post-harvest technology which can increase the oil yield from traditional and non-conventional sources of oil, at present about 500,000 tons of oil are annually lost owing to inefficient processing;
- **Thirdly**, strengthening services to the farmers, particularly to supply technology, seeds, fertilizers, pesticides, irrigation, credit, etc.; and
- **Fourthly**, improving institutions for post-harvest services including price support to farmers and financial and other support to the processing industry.

While devising the strategy, strengths and weaknesses were assessed as follows:

**Strength:**
- Well-tested strategy which has worked for wheat, rice and cotton.
- A good network of research organizations.
- A well-established infrastructure for supply of inputs and services.
- Proven success of oilseed co-operatives on the Anand pattern.

**Weakness:**
- Eighty-five percent of the oilseed crops are grown in...
rainfed lands mostly having poor soils.
- A large majority of oilseed farmers are small and marginal.
- Susceptibility to pests and diseases.
- Technology not as profitable as that of wheat and rice.
- Technology not as profitable as that of wheat and rice.

- Exploitation by middlemen and speculators.

**Structure:**
To facilitate co-ordinated action, the mission at both the national and state levels has been divided into 4 mini-missions for the 4 important thrust areas. The structure of the National Mission is illustrated below:

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**Achievements**

I. Crop production technology

The mandate to evolve viable, profitable, feasible and easily adoptable crop production and protection technologies for various regions, seasons, situations and cropping systems were vested in the Indian Council of Agricultural Research as an apex body for agricultural research, education and frontline technology transfer in the country. The Council in consultation with its partners identified 136 research activities for 9 annual oilseed crops and coconut and oilpalm which were rated as long-term potential oil yielding plantation crops.

The major emphasis was laid on: a) scaling up yield potential for greater productivity, b) reducing crop duration for fitting oilseeds into multiple cropping systems, c) increasing oil content in the seed to realise higher oil yields per

...
various field operations and catering to the post-harvest requirements of oilseeds. The research activities on a time scale were devised on a mission mode pattern for 1, 2, 3, 4, 5 and more years. As many as 5, 6, 14, 19, 17 and 55 activities were assigned for completion in respective periods.

During the mission period, as many as 59 promising varieties/hybrids of different oilseeds viz., Groundnut (11), Rapeseed-Mustard (10), Sunflower (9), Linseed (8), Soybean (7), Sesame (7), Safflower (3), Niger (3), Castor (1) were identified/released/notified. The development of these varieties has fulfilled the targets envisaged. Productivity of each of the crops will be enhanced in different regions, seasons, situations and systems few folds, if potential of these varieties is realised exploited, i.e.:

- Groundnut cv. 'Girnar-1' exhibited multiple resistance to foliar diseases and drought and ICGS-11 recorded as much pod yield/ha as 52.72 q under ideal conditions. The average yield of all the newly evolved varieties was at least two fold to the national average yield.

- In rapeseed-mustard, the early (about 75 days) maturing toria variety Bhowani would revolutionize toria cultivation as a catch crop in the major toria growing belt and TL-15 with an average yield of 12.50 q/ha will bring additional area under toria as a summer crop in high altitude areas of Himachal Pradesh. Mustard variety NDR-8501 would go a long way under salt affected soil conditions due to in-built tolerance to salinity and alkalinity. Mustard varieties RH-781 and RH-7361 possess better tolerance to frost which causes serious damage to the mustard crop in frost prone areas.

Varieties RLM-514, RH-7361, RH-30 and RH-819 are high yielding and are suitable for Jammu Region of J&K, Himachal Pradesh, Punjab, Haryana and Rajasthan which are the major rapeseed-mustard producing areas in the country. Similarly, 'Vabhav' would go a long way in Uttar Pradesh and Madhya Pradesh which are also important areas for rapeseed-mustard production. For late sowing conditions, varieties Pusa Bold, Vardan, Sharma and RH-7859 are identified for popularizing cultivation of rapeseed-mustard in non-traditional situations. Varieties, RLM-619, RLM-514, Seeta and Vardan are found suitable for different regions in the States of Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu which are non-traditional rapeseed-mustard growing stages.

- The recently released sunflower hybrid, MSFH-17 has produced 16% and 23% higher seed and oil yield over the best hybrid available. LDMRSH-1 and LDMRSH-3 hybrids possess in-built resistance to downey mildew and are recommended for downy mildew endemic areas of Maharashtra. It is hoped that cultivation of these two hybrids would take care of the deadly disease which was introduced from foreign countries and crippled sunflower cultivation in the region. As the open pollinated varieties of sunflower will continue to dominate in the years to come, the release of early maturing (80-85 days) sunflower population S-55-59 would not only provide an option but also an edge over 'Morden', the only early maturing and most popular variety under cultivation in the country. With the release and notification of these varieties and hybrids now there are ample options available for the farmers for the cultivation of different varieties and hybrids of
sunflower depending on their specific needs in a crop which was introduced in the country only about a decade ago.

- For the first time, two double purpose linseed varieties (Gaurav and Jeevan) having fibre and seed yielding capabilities at par to the best fibre and seed types have been released and notified. With this, a long felt dream of 1930's is now fulfilled. Here, it may be mentioned that linseed in India was never used for fibre production and thus the country always remained dependent on fibre import which is considered indispensable in various industries and defence establishments. The first powdery mildew resistant variety, Jawahar-23 and the multiple disease resistant (wilt, rust and powdery mildew) variety Kiran which are released and notified would go a long way in Central and Peninsular regions of the country where these diseases are serious.

- In Soybean, PK-564 exhibited as much yield as 39.39 q/ha with an average productivity of 20.80 q/ha under rainfed situations. Variety PK-472 possessing tolerance/resistance to yellow mosaic virus, bacterial pustules, leaf spots and Girdle Beetle yielded an average of 25.00 q/ha. Because of the several potential varietal options, the area under soybean has started expanding tremendously in conventional and non-conventional regions and seasons. It is hoped that during 1989-90, the area would reach an all time record of 2 million ha with significantly enhanced productivity in a crop whose cultivation was not known about a decade ago in the country.

- Malviya Kusum-305 safflower is appreciated for its proven tolerance to salinity/sodicity. It is expected to cover large area under salt affected soils in the Indo-Gangetic Plains. The two released varieties during the mission period have now reached more than 16 vars which are available for cultivation in different drought prone regions of the country.

- New castors hybrid GCH-4 possessing in-built resistance to wilt has started revolutionizing castor cultivation in both irrigated and rainfed areas. On an average, it yielded 12.23 and 22.32 q/ha under rainfed and irrigated situations, respectively. However, it recorded 29.27 and 32.07 q/ha under rainfed and irrigated conditions under favourable environments. As compared to the national average yield of 5.37 q/ha, the potential of harnessing the worth of the hybrid is tremendous.

Fertilizer requirements, irrigation schedules and various other facts of crop management are standardized for different situations. Efficient intercropping, relay cropping, sequential cropping, Paira or Utera cropping systems for different crops and regions are standardized. The production technology package for input-intensive and input-scarce situations are developed. The technology packages for each of the crops were published and widely distributed for their adoption. A number of viable intercropping combinations and efficient crop geometry are worked out and are found to be highly remunerative. The intercropping combinations, if adopted, can stabilize production and enhance net monetary returns in biotic and abiotic unfavourable environments.

The management practices are developed for the control of root wilt and Ganoderma disease of coconut. Seven varieties are released and notified in the last
three years. These varieties are capable of yielding 2.10 - 2.74 tons of edible oil/ha as compared to 1.6 tons/ha as realised in tall varieties. A number of hybrids from Tall X Dwarf types have shown great promise. The integrated farming systems with coconut are developed where cattle farming is also taken as the integral part of the whole system. This system gave Rs. 20,000 /ha and fuel to the family as against Rs. 14,000/ha with coconut alone. The technology was perfected and tenera hybrids in oilpalm were evolved. These promising materials are under evaluation and have shown yielding ability of about 4 tons/ha of edible oil.

The technology for the production of tissue culture materials in coconut has been standardized. The non-destructive excision of leaflets from the shoot tips has been standardized on seven trees. All these palms have survived and recouped. Callus from leaf base culture was of two types, filamentous and compact. Embryos produced from leaflets ex-plants had a separate shoot pole but a developing root pole. The perfection of the technique for commercial exploitation in coconut is quite cumbersome, tedious and lot of time demanding. Accordingly, the time targetted for the completion of the activity is considered to be further time demanding.

In oil palm, a non-destructive method has been perfected for excising young leaflets from near the shoot apex for in-vitro culture. Through such ex-plants from tenera sources, about 35 in-vitro ex-plants have been transferred to soil. Many more are in the test tubes. Attempt to culture dura and pisifera materials have not been successful. So far callus initiation has been possible from mature ellite palms but embryo genesis has to be achieved. Using ex-plants, about a dozen of plants have been regenerated. However, the response of cultured young inflorescence appears very promising since there is no colour intervention and direct embryo genesis has been observed.

Development of Farm Implements and Machinery

Multi-purpose tool frame (Bullock Drawn): Various designs of tool frame with and without wheels have been developed. The main objective being provision for attaching suitable tillage, sowing and weeding tools as and when desired. The wheeled-types have the advantage of low friction force but at a higher cost. The capacity of the area coverage by a pair of animals is increased by 1½ - 2 times.

Seed drills or seed-cum-fertilizer drills (manual and bullock drawn): Seven designs of seed drills and seed-cum-fertilizer drills were initiated for testing and evaluation of oilseeds (seed rate, 3-5 kg/ha).

The CIAE 3 row seed-cum-fertilizer drill has been recommended for medium size grains like soybean, safflower, sunflower and covers about 0.75-1 ha/day. The unit is commercially available and costs about Rs. 1400-1500. For smaller seeds like mustard 'CIAE two row mustard seed-cum-fertilizer drill was developed. It also covers about 0.75 ha/day and costs approximately Rs. 1000. Besides, Birsa seed-cum-fertilizer drill, IIFRI two-row seed drill and Pantnagar designs are also satisfactory and will be supplied to selected oilseed centres.

Manual weeder: A range of manual weeders have been identified for different regions. Some of these have been released by Release Committee. Most promising designs
are from CIAE, Bhopal (Wheel hoe and Peg type), PAU, Ludhiana (Wheel hoe) and TNAU, Coimbatore (Wheel hoe). The cost of these weeder varies from Rs. 125-150. A number of State Agro-Industrial Development Corporations have started commercial production of these designs. The capacity of manual weeder varies from 20 to 110 man-h/ha depending upon weed infestation and soil conditions.

Serrated sickles: These have been perfected and are now commercially available. Efforts are being made to train the farmers in their proper use.

Self-propelled vertical conveyor reaper and tractor drawn vertical conveyor reaper: The performance of available vertical conveyor harvest was tried in harvesting oilseed crops like soybean, mustard and linseed with limited success. It is being supplied to oilseed centres for their evaluation.

Soybean harvester: The CIAE Bhopal has developed a tractor drawn side mounted soybean harvester. The machine has been taken up for commercial manufacture by local industries. It harvests soybean in the field in the form of bunches. These are then picked up manually and transported for threshing. The machine can harvest about 3 ha in a day and costs Rs. 15,000. This is considered promising as shattering is a serious problem in soybean.

Multi-crop thresher: Two designs of multi-crop threshers (5 h.p. and 7.5 h.p.) have been developed and perfected by CIAE Bhopal for threshing oilseed crops like soybean, safflower and sunflower. The capacity varies from 200 to 1300 kg/ha depending upon crop and size of power. The basic design is adopted from axial flow with spike tooth threshing cylinder and aspirator-blowers for grain cleaning. The threshers are provided with safe feeding devices. The cost varies from Rs. 10,000 - 12,000. In addition, groundnut threshers are being commercially manufactured but are not very popular. Efforts will be made to select few designs and supply to selected centers for demonstration and popularization.

Groundnut digger (animal drawn): Three designs of animal drawn groundnut diggers have been tested and perfected for popularization. The CIAE design is identical to piped frame of Gujarat supported on two wheels. The implement is suitable for digging groundnut and the pods are manually picked. This can also be used for digging potatoes. The cost of the machine is approximately Rs. 1,200. It can cover about 0.4 ha in a day. TNAU, Coimbatore design is similar to CIAE Bhopal except that it is provided with large wheels, a platform for the operator to sit and blade lifting device. CTAE, Udaipur design is basically a modified plough fitted with share and lifter rods. The implement is suitable for soils. The cost may vary between Rs. 300 - 350.

Groundnut decorticator (manual): This is a light weight rocking type manual decorticator for separation of groundnut kernels from the pod. It consists of a hopper and rubbing shoes. The bottom of the hopper is provided with suitable sieves to allow the crushed groundnut to pass through and then winnowed. It can shell about 60-70 kg pods/ha. This is one of the most popular machine. It has already been commercialized by a number of State AIDC's, and costs Rs. 250 - 400.

Breeder Seed Production

During 1984-85, only 2112.24 q of breeder seed of 9 annual oilseeds was produced. In the subsequent years, the production of breeder seed was stepped up as much as
2762.00, 3100.30, 5021.36 and 8600.00 q of breeder seed was produced in respective years. As such, the breeder seed production went up over four fold in a period of 4 years.

II. Post Harvest Technology

The mini-mission addresses itself to the development of suitable post-harvest technology for oilseeds. The objectives are to develop:

- modern integrated processing technology,
- technology for minor and unconventional oil-bearing materials,
- technology for better oil recovery, and
- improvement of ghanis and expeller units and hence the quality of cakes and extractions.

These involves identifying the technological problems associated with oilseeds and oils, and removing these gaps in the technology.

A project on 'Design of Modern Oil Expellers' has been undertaken by the Central Mechanical Research Institute which will bring down the residual oil in the cake from 9-12% to 4-6%. A 20 tons/day capacity is to be made available for users by December 1988 followed by a 10 tons/day capacity unit.

Rapeseed/mustard is the second most important oilseed crop after groundnut but most of the material is crushed without removal of husk. This imparts a dark color to the oil and meal, increases crude fibre in the cake and leaves behind 14-16% unextracted oil. The newly developed expeller takes away the bitter and toxic elements in the expelled oil and meal. The bland high-protein mustard concentrate can be utilized in various protein-rich foods, since its quality is comparable to that of milk protein.

The Central Food and Technology Research Institute (CFTRI) has developed a technology for decortication of sunflower seed which results in 5% more oil. The oil, being wax-free and lighter in color, has better marketability. A plant with a capacity to decorticat 250 kg/hr has been demonstrated.

The MERADO center of CMERI at Luchiana is working on improving the design of the sunflower decorticater developed by CFTRI to reduce the cost of the machine. The improved version will shortly be made available.

Production of crude palm oil with acceptable levels of free fatty acids (FFA) and moisture requires strict field and mill practices and stringent quality control measures. The Regional Research Laboratory, Trivandrum, has developed a mini palm oil extraction mill to produce high-grade raw palm oil, which can be consumed without further processing. This is in view of the fact that small-scale oil palm plantations may be required in India.

The Regional Research Laboratory, Hyderabad, has developed a process for screw press and pre-press extraction of cotton-seed for edible oil. Although 400,000-500,000 tons of edible oil can be potentially produced out of the available 3 million tons of seed. At present not more than 250,000 tons of oil is produced every year because of inadequate returns on by-products and hence profitable technology has been developed for low-gossypol, high protein cotton-seed meal/flour suitable for human consumption, poultry and pig feed.
III. Input and Service Support to the Farmers

The mini-mission deals with input and service support to the farmers. The strategy is to:

- strengthen the extension system for transfer of technology to the farmers, through the National Oilseeds Development Project (NODP) and the Oilseeds Production Thrust Project (OPTP);

- streamline the production supply and distribution of seeds, fertilizers, pesticides and implements, and

- arrange for distribution of credit through co-operatives, regional/rural banks and commercial banks.

The NODP covers 180 districts in 17 important oilseed-growing states. The government of India covers half the cost of components such as demonstration of improved technology, distribution of seeds and fertilizers, minikits, subsidy to the farmers on seeds, fertilizers, rhizobium culture, plant protection and farm equipment. The project also provides 100% assistance to ICAR for production of breeder seeds, for distribution to the states free of cost. Districts with increased production potential have been identified, and emphasis is given to improve the management of various services which would help the farmers to increase oilseeds production. During the 5-years of the Seventh Plan, an outlay of Rs. 170 billion has been provided of which the center’s share is Rs. 100 billion.

It will be noticed that 4 oilseed crops contribute about 85% of the total oilseeds production. Keeping this in view, a scheme called Oilseed Production Thrust Project (OPTP) has been initiated since 1987-88 to accelerate the production of 4 major oilseed crops namely: groundnut, rapeseed-mustard, soybean and sunflower. The project provides 100% GOI assistance to the state to strengthen the key components like seed production, plant protection, demonstration, application of sulphur and market support. Under OPTP, and outlay of Rs. 19 million was provided during 1987-88; and Rs. 35 million has been allocated in 1988-89. A total of 246 districts in 17 states, including 151 NODP districts, have been included.

During 1986-87, despite a 20% deficient monsoon over the previous year, the production registered an increase of about 6%. The area under sunflower and soybean in kharif 1987 went up by 40 and 17%, respectively over the previous kharif. In 1987-88, the country witnessed one of the worst droughts of the century, yet the farmers encouraged by the above scheme, took special measures to increase oilseed production which has been 12 million tons. It is hoped that production during 1988-89 would be around 17.5 million tons.

IV. Price Support Storage Processing and Marketing

The mini-mission is charged with the two-fold responsibility of ensuring that, oilseed farmers are given the benefit of price support, and the oilseed industry, whether in the co-operative, public or private sectors improve efficiency of storage, processing and marketing. To this end, the mini-mission strives to achieve:

- timely declaration of prices,

- efficient procurement operations, by designated agency,
- expansion and modernization of storage facilities for oilseeds and oil,

- creation and expansions of integrated modern processing facilities in the co-operative sector,

- modernization of existing processing facilities in the private sector, and

- modernization of marketing system and fair price to the consumer.

The mini mission provided all necessary support to ensure declaration of support prices adequately in advance of the sowing season.

National Agricultural Co-operative Marketing Federation (NAFED) was designated as the agency for implementing the price support scheme, under which the farmer is assured of a pre-determined minimum price for his produce. It was ensured that NAFED made all preparations in time and established its presence in all important mandates well before the arrivals. This lent, much needed support to stabilize the market sentiment. Actual procurement under the price support scheme has, however, not become necessary during the last 2 years in view of the ruling high prices.

In the co-operative sector, the National Co-operative Development Corporation (NCDC) and the National Dairy Development Board (NDDB) are the two important agencies to promote efficient processing and storage. For each of these organizations, specific activity milestones on a quarterly basis were specified and their progress continuously monitored.

As mission worked in a harmonious manner, the production target set for 1989-90, 18 million tons of oilseeds, is expected to be achieved. The import of oil is likely to be less than half the same could effectively be phased out within the coming 3-4 years. It is hoped that by the end of the century a production of 26 million tons of oilseeds would be achieved.