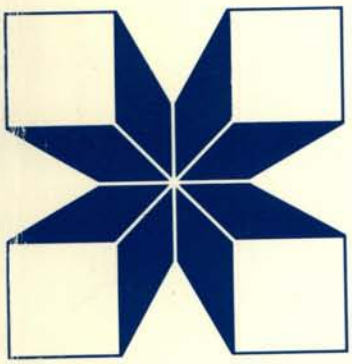
IDRC
CRDI
CIID



CANADA

OIL CROPS:
PROCEEDINGS OF THE THREE MEETINGS HELD AT PANTNAGAR AND HYDERABAD, INDIA, 4 – 17 JANUARY 1989

The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in six sectors: agriculture, food and nutrition sciences; health sciences; information sciences; social sciences; earth and engineering sciences; and communications. IDRC is financed solely by the Parliament of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are in Ottawa, Canada. Regional offices are located in Africa, Asia, Latin America, and the Middle East.

Le Centre de recherches pour le développement international, société publique créée en 1970 par une loi du Parlement canadien, a pour mission d'appuyer des recherches visant à adapter la science et la technologie aux besoins des pays en développement; il concentre son activité dans six secteurs : agriculture, alimentation et nutrition; information; santé; sciences sociales; sciences de la terre et du génie et communications. Le CRDI est financé entièrement par le Parlement canadien, mais c'est un Conseil des gouverneurs international qui en détermine l'orientation et les politiques. Établi à Ottawa (Canada), il a des bureaux régionaux en Afrique, en Asie, en Amérique latine et au Moyen-Orient.

El Centro Internacional de Investigaciones para el Desarrollo es una corporación pública creada en 1970 por el Parlamento de Canadá con el objeto de apoyar la investigación destinada a adaptar la ciencia y la tecnología a las necesidades de los países en desarrollo. Su actividad se concentra en seis sectores: ciencias agrícolas, alimentos y nutrición; ciencias de la salud; ciencias de la información; ciencias sociales; ciencias de la tierra e ingeniería; y comunicaciones. El Centro es financiado exclusivamente por el Parlamento de Canadá; sin embargo, sus políticas son trazadas por un Consejo de Gobernadores de carácter internacional. La sede del Centro está en Ottawa, Canadá, y sus oficinas regionales en América Latina, Africa, Asia y el Medio Oriente.

This series includes meeting documents, internal reports, and preliminary technical documents that may later form the basis of a formal publication. A Manuscript Report is given a small distribution to a highly specialized audience.

La présente série est réservée aux documents issus de colloques, aux rapports internes et aux documents techniques susceptibles d'être publiés plus tard dans une série de publications plus soignées. D'un tirage restreint, le rapport manuscrit est destiné à un public très spécialisé.

Esta serie incluye ponencias de reuniones, informes internos y documentos técnicos que pueden posteriormente conformar la base de una publicación formal. El informe recibe distribución limitada entre una audiencia altamente especializada.

IDRC-MR252e
February 1990

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

Edited by

Abbas Omran
Technical Adviser, Oil Crops Network

Organized by

Indian Council of Agricultural Research, New Delhi, India
G.G. Pant University of Agriculture and Technology, Pantnagar, India
Directorate of Oilseeds Research, Hyderabad, India
International Development Research Centre, Ethiopia/Canada

CONTENTS

Part 2. Other Oilcrops Subnetwork-I

Part 3. Oilcrops Network Steering Committee-I

CULTIVATION AND VARIETAL IMPROVEMENT OF LINSEED IN INDIA

R.N. Dubey

Linseed is an important oilseed crop on account of its drying oil which is an unparallel source of paints and varnish industries. The Linseed *(Linum usitatissimum)* displays great diversity in morphological and biochemical characteristics. The varieties of the same species, when cultivated for their seed, are called oil flax, seed flax or linseed and when grown for their fibre are known as flax. The seed flax or linseed varieties are dwarf, profusely branched having good seed yielding potentialities. Such type of varieties are under cultivation in warmer regions of the world viz., Argentina, Canada, India, part of the USSR and USA, etc. The fibre flax varieties are tall, scarcely branched having low yielding ability. This group of varieties is under commercial cultivation in the more temperate regions throughout the Northern hemisphere. In India, linseed is cultivated exclusively for seed. With an area of about 1.45 million hectares and 0.44 million tones production, India presently ranks first in acreage followed by USSR, Argentina, Canada and USA and third in production after Argentina and Canada on world map of linseed cultivation. Though India shares about 30% of the world acreage, the country contributes only 17% of the total world production because of its low productivity i.e., 299 kg/ha as against the average yield of 960 kg/ha of Canada, 913 kg/ha of Argentina, 819 kg/ha of USA and 552 kg/ha of the world. On acreage basis, the leading linseed growing states in this country, in their order of merit, are Madhya Pradesh, Uttar Pradesh, Maharashtra, Bihar and Rajasthan which together account for about 8.8% of the total linseed area and production. The low productivity of the major linseed growing states forms the basis of the low national average yield.

Constraints to productivity

Linseed is rated as the second grade oilseed crop by the Indian farmer and is, therefore, religated to the marginal and sub-marginal lands under moisture stress condition using traditional low yielding varieties with low or no inputs resulting in low seed yield. Besides the prevailing practices of mixed cropping and intercropping, adoption of ages old Paira or Utera system of linseed cultivation in about 25% of the total area with an average yield of 1.0 q/ha is the single major factor to lower down the average productivity to a great extent. Though this is one of the best known dry land practices of utilizing residual paddy soil moisture when tillage is difficult, but due to compact soil structure which restricts root and shoot growth, high mortality of seedlings particularly at harvesting of paddy, complete lack of tillage and fertilizer use, substantial sharing of residual crop nutrients and soil moisture by weeds, very poor yields are recorded.

The traditional varieties, apart from their poor response to increased inputs in the form of fertilizer and irrigation, are prone to diseases and pests. Rust, wilt, powdery mildew and Alternaria blight among the diseases and linseed bud fly *(Dasyneura lini)* among the pests are the serious problems with varying intensity of infection and losses in different regions. Monitoring of the diseases and pests during the last few years by the AICORPO scientists

have revealed the dimensions of these problems in different regions. In north west region i.e., Jammu & Kashmir, Himachal Pradesh, Haryana, Punjab, and U.P. Hills, rust, powdery mildew, wilt and Alternaria blight have been the serious problem and merit in that order. Entire Gangetic alluvium of Uttar Pradesh, Bihar, West Benal including Assam have also the major problem of rust followed by Alternaria blight, powdery mildew and wilt. In Peninsular region and southern plateau comprising Bundelkhand region of Uttar Pradesh, Madhya Pradesh, Orissa, Karnataka, Maharashtra and Rajasthan, powdery mildew, wilt, rust and linseed bud fly cause losses to linseed crop. However, with the availability of the rust, powdery mildew and wilt resistant/tolerant varieties developed by the AICORPO centers, Alternaria blight and linseed bud fly are the only left serious problem to overcome.

Linseed breeding and varietal improvement

Linseed breeding was initiated in India in 1915 at the Imperial Agricultural Research Institute, Pusa, Bihar (now Indian Agricultural Research Institute, New Delhi). Later on, some state departments of agriculture and institutes at Kanpur, Indore, Pune, Bernampore, Kangrha, etc., also started improving linseed varieties for their situations. The research work was strengthened in 1947 by the Indian Central Oilseed Committee (ICOC) by way of sponsoring adhoc schemes to the state departments of agriculture and institutes. In view of the limited impact of ICOC schemes on linseed productions, Indian Council of Agricultural Research started All India Co-ordinated Research Project on Oilseeds (AICORPO) in 1967 with linseed as part of it having interdisciplinary approach, free exchange of breeding material, information and ideas, planning of technical programs and research methods in annual workshop meetings. The intensified work under AICORPO aimed at developing disease resistant, early maturing, high seed and oil yielding varieties and their production technologies for maximum production. Consequently, the concerted efforts of some centers particularly kanpur, Raipur, Jabalpur and Kangrha resulted in the development of as much as 19 varieties for different systems and situation including 9 mono/multiple disease resistant/tolerant varieties: namely, Pusa-2, Pusa-3, Himalini, Jawahar-23, Garima, Shubhra, Sweta, Laxmi-27 and Kiran released in 1985 and onward. All these varieties have a yielding ability of 8-10 q/ha under rainfed and 15-20 q/ha under irrigated situation. Some varieties such as Neelum, K-2, Jawahar-23, and Garima yielded 25-30 q/ha under ideal management.

Double purpose linseed

It is well known that linseed fibre is one of the oldest vegetable fibre to be spun and woven. In characteristics, it has been reported to be lustrous, stronger, less stretchy, more durable and better resistant to environmental fluctuations. The flax fibre has been highly regarded and rated indispensable particularly during war periods. In order to develop dual purpose varieties for high seed and fibre production, the efforts were made about 50 years back but unfortunately the matter could not be persuade in right perspective in the subsequent decades and the country is paying cost under the umbrella of a very heavy import. However, very recently, two double purpose varieties namely, Gaurav and Jeevan have been developed and released in 1987 for commercial cultivation.

In agronomic trials, Gaurav has yielded more than 22 q/ha seed and 14 q/ha fibre. Both these varieties will go a long way in maximizing the linseed production as it has been proved time and again that improved varieties of linseed respond well to inputs and enherit high yield potentials. The salient features of the varieties released from time to time for commercial cultivation are given in Table 1 while the region-wise varietal recommendation is given below:

1. North west region: K2, LC-185, Himalini, Pusa-2, Pusa-3, LC-54, and Jeevan.

2. Gangetic alluvial region: Mukta, Noelum, T397, Neela, Garima, Sweta, Shubhra, Gaurav, and Jeevan.

3. Peninsular region; and southern plateau: Hira, Laxmi-27, T-397, Jawahar-1, Jawahar-7, Jawahar-17, Jawahar-552, Jawahar-23, C429, S-36 Chambal, Pusa-2 and Kiran.

Present activities for linseed improvement

Under Seventh Plan, the linseed improvement work has been strengthened by increasing the number of AICORPO centres considering the state-wise linseed cultivation, problems and existing AICORPO facilities. Some of the existing centres have been raised to the status of main centres providing the infrastructure for multidisciplinary approach while the others are to work as subcentre or joint centre with the provided staff under linseed and other crops at the centre under AICORPO.

With the technology mission on oilseeds in operation, the research work has been further intensified at some selected AICORPO centres on problem oriented activities assigned to them. The progress of work on such activities is regularly monitored. The centres are doing their best to achieve the time bound mandate assigned to them. These activities are listed below alongwith the centers working on them.

Research activity	Centres
1. Double purpose variety	Kanpur Kangrha
2. Alternaria resistance	Kanpur, Faizabad, Raipur, Mauranipur, Kangrha, Kanke, Akola
3. Budfly resistance	Kanpur, Mauranipur, Raipur, Akola
4. Wilt resistance	Kaipur
5. High yielding varieties (rainfed and irrigated conditions)	Faizabad, Kangrha
6. Short duration varieties	Mauranipur, Raipur, (Central and peninsular Akola, Kota, Raichur region)
7. Germplasm unit	Kanpur

Breeder seed production

The breeder seed of the improved varieties is produced under the direct supervision of the breeder to supply the multiplying agencies in order to make continued flow of quality seed to the farmer after multiplication in subsequent stages. Recently, a centrally sponsored scheme on production of breeder seed of annual oilseed crops started functioning since September 1988 with its seed producing centres and monitoring systematically the production and supply of the quality seed.

Linseed improvement work at C.S.A. University of Agriculture and Technology, Kanpur

Breeding: Aiming at developing rust resistant high yielding varieties of linseed initiated in 1023 resulted in the recommendation of T.1 and T.477 for Bundelkhand and alluvial tracts, respectively, of Uttar Pradesh in the fourties.

Table 1. Salient features of recommended varieties.

Variety	Duration (days)	Ave. yield (kg/ha)	Oil content	Suitability	Assistance
K.2	170.175	1100	46	Irrigated	Rust, Wilt
C.429	120-125	500	44	Rainfed	-
S.36	105-110	400	37	Rainfed/Inter-cropping	Wilt
T.397	120-125	1100	44	Rainfed; widely adoptable	Rust, Wilt, Drought
Hira	130-135	1200	43	Irrigated/rainfed	Rust, drought
Mukta	125-130	1200	45	Rainfed/irrigated	Rust, Wild
Neelum	135-140	1500	43	Irrigate/high fertility	Rust, Wilt
LC.185	165-170	500	46	Utera	Rust, Wilt
Himalini	155-170	1300	42	Rainfed/irrig. Utera	Rust, Wilt
LC. 54	155-170	1300	42	Irrigated	Rust
Jawahar-1	115-120	900	44	Rainfed/irrigated	Escapes linseed budfly,
Jawahar-7	115-118	300 Utera 300 R.f	43	Utera	Rust
Jawahar-17	115-120	800 R.f 1300 Irr.	43	Rainfed/irrigated	Rust
Jawhar-552	115-120	900	44	Raifed/irrigated Utera	Rust, wilt, powdery mildew
Naela	125-130	850	40	Rainfed	wilt
Cnambal	115-120	900	44	Rainfed/irrigated	-
Jawhar-23	115-120	1000	43	High fertility	wilt, Powdery mildew
Pusa-2	140-145	730 R.f 1300 Irr.	43	Rainfed/irrigated widely adoptable	-
Pusa-3	140-150	1350	42	High fertility	-
Garima	125-130	1500	42	Irrigated/high fertility/delayed sowing	Rust; tolerant to powdery mildew, wilt, Alternaria blight.
Shubhra	130-135	1400 Irr. 870 R.f	45	Irrigate/rainfed; excellent oil quality	Rust; Tolerant to wilt and Alternaria blight.
Sweta	130-135	880 R.f	44	Rainfed	Rust, powdery mildew; Tolerant to Alternaria blight.
Laxmi-27	110-115	1020 R.f	45	Rainfed/irrigated	Rust, wilt, powdery mildew.
Kiran	120-125	750 R.f	43	Rainfed	Rust, wilt, powdery mildew, Alternaira blight.
Double purpose varieties					
Gaurav	135-140	1050-Seed	43	Irrigated best suited to Gangetic alluvium	Rust, tolerant to powdery mildew and Alternaria blight
Jeevan	175-180	1090-Seed 1000-Fibre	46	Irrigated; best suited to North-west region	Rust, Wilt, Powdery mildew

On the inception of ICOC scheme, the intensified breeding work led to the release of T.126 in 1958 to replace T.477 and T.603 alongwith T.397 in 1960 to replace T.1. In 1964, three more rust and wilt resistant varieties, namely, Hira for Bundelkhand, Mukta for eastern and Neelum for central western part of Uttar Pradesh were released for commercial cultivation. Among these, T.397 and Neelum are still doing well in fields. T.397 has also been adopted by Bihar, Assam, Madhya pradesh and Rajsthan states. It is also being used as national check in AICORPO trials since 1976. On the inception of AICORPO in 1967, the research work was further intensified. The breeding work on resistance against rust, powdery mildew and wilt taken up in mid-seventies and on *Alternaria* blight in early eighties has resulted in the isolation of a large number of genotypes almost free from rust, and powdery mildew. Several promising genotypes tolerant to *Alternaria* blight and wilt were also developed. The varietal testing in early eighties resulted in the release of four seed varieties, namely: Garima, Shubhra, Sweta and Laxmi-27 and one double purpose variety i.e. Gaurav. Among these, Garima for irrigated, Sweta for rainfed, Shubhra for both the situations having excellent oil quality alongwith the double purpose variety. Gaurav has been recommended for Gangeticlluvial region of U.P. Bihar, West Bengal including Assam while Laxmi-27 has been recommended for Bundelkhand region of Uttar Pradesh. All these varieties have the yield potential of 20-25 q/ha under irrigated and 12-15 q/ha under rainfed situations with an oil content of 43-45%. The double purpose variety Gaurav has yielded more than 22 and 14 q/ha seed and fibre, respectively, in agronomic trials.

Breeder seed production: Under this program about 150q breeder seed was produced and supplied to the seed multiplying agencies for further multiplication in subsequent stages in order to make available the quality seed to the farmers.

Agronomy: Under this discipline, the agronomic requirements of the varieties released, from time to time, were standardized, perfected and recommended. The experiments conducted with latest identified/released varieties on fertilizer and irrigation requirement, sowing time, spacing, seed rate, etc. for seed and double purpose varieties resulted in the recommendation of sowing of improved varieties in second fortnight of October with 30 kg/ha seed rate in rows, 25 cm, apart at 80:40 kg and 40:20 kg/ha N = P_2O_5/ha under irrigated and rainfed conditions, respectively. In Budelkhand region, the optimum sowing time has been found to be the first fortnight of October and 30 cm row distance due to the specific soil structure. The fibre yield in double purpose varieties is increased with the increase in seed rate (45 kg/ha) with closer row spacing (20 cm). Intercropping of linseed with gram or lentil in row ratios of 1:3 to 3:1 and with potato adjusting its three rows in place of the fourth row of potato appeared more remunerative than sole cropping. Linseed gave the lowest cost benefit ratio of 1:2.51 as compared with other oilseeds and cereals viz., mustard (1:1.95), toria (1:1.76), safflower (1:0.55), sunflower (1:0.13), castor (1:0.59), wheat (1:0.59) and barley (1:0.22).

Plant protection: Rust, *Alternaria* blight, powdery mildew and wilt in diseases and bud fly in pests have been the major problems of this region. The natural sources for resistance to rust, powdery mildew and wilt have been identified and transferred to improved varieties.

Most of the varieties released from this institute are resistant/ tolerant to rust, wilt and powdery mildew. In screening, the cultures with E.C. Nos. 544, 15818, 1387, 19288, 41520, 41549, 41618, 41667, 41739, 41797, 158993, Fx165, KL169 and Chharpuran have been found to be resistant to *Alternaria* blight. Their resistance is being incorporated in the improved varieties. The screening of natural source of bud fly is in progress. However, the escaping varieties have been developed. The economic chemical control measures for the diseases and pests have been worked out and recommended accordingly.