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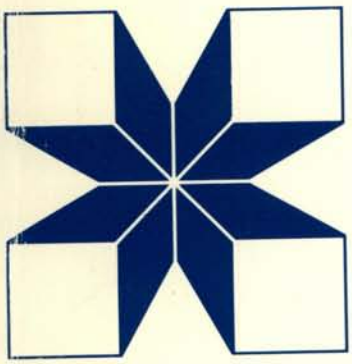

CANADA

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

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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.

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

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NIGERSEED IN INDIA: PRESENT STATUS OF CULTIVATION, RESEARCH ACHIEVEMENTS AND STRATEGIES

S.M. Sharma

Niger (*Guizotia abyssinica* Cass) is an important oilseed crop grown in many tropical and sub-tropical countries, India, Ethiopia, East Africa, West Indies and Zimbabwe are the important niger growing countries of the world. However, India and Ethiopia are the major producers of niger.

In India niger crop is cultivated mainly in the states of Madhya Pradesh, Orissa, Maharashtra, Bihar, Karnataka and Andhra Pradesh and to some extent in hilly areas of Rajesthan, Uttar Pradesh, Gujarat, and Tamil Nadu and also in some parts of eastern hilly states of the country (Table 1).

Table 1. Area, production and productivity of nigerseed in different states of India.

States	Area ('000 ha)		Production ('000 tons)		Productivity (kg/ha)	
	84-85	85-86	84-85	85-86	84-85	85-86
Andhra Pradesh	11.3	12.3	1.3	3.1	115	252
Bihar	36.0	37.0	13.7	13.6	381	368
Karnataka	64.5	54.9	11.4	9.4	177	171
Madhya Pradesh	219.1	217.3	34.3	47.1	157	217
Maharashtra	96.8	95.9	22.6	20.7	233	216
Orissa	156.5	201.2	62.3	94.0	398	467
West Bengal	5.4	5.4	2.3	2.3	426	426
Dadar & Nagar Haveli	0.4	0.3	0.1	0.1	250	333
All India	590.0	624.3	148.0	190.3	251	305

The important features of this crop are that it gives satisfactory seed yield even under poor growing conditions with little care, effort and expenditure. The crop is resistant to drought and is less attacked by birds, insect pests, diseases and stray and wild animals grazing freely in hill and forest areas.

Uses

Nigerseed oil is of good quality edible oil with pleasant nutty sweet taste. It is mainly used for oil extraction (about 76%) for culinary and anointing purposes. The oil is bluish white in color and is a good absorbant of fragrance of flowers due to which it is used as base oil by perfume industry. Lower grade oil is used for soap making and as illuminant. Nigerseed oil is also used as a paint oil to a limited extent. Nigerseed cake is utilized for feeding cattle or as manure. Nigerseed is a good bird feed and also consumed in certain regions as food (about 18%) and Chutny mixed with chilly and spices.

Climate and soil

Niger requires adequate rainfall in the growing period to get a good yield. A rainfall of 1000-1300 mm is considered to be the optimum. However, 800 mm rainfall, if spread over the growing period, will produce reasonably good yield. Growth is depressed in conditions of above 2000 mm rainfall. The peak flowering period of the crop should not coincide with the rainy period as the honey bees, which are the main pollinators of this crop,

are disturbed resulting in a very poor seeding, the crop being almost exclusively cross pollinated by honey bees.

Niger crop is extensively grown on marginal and sub-marginal lands in tribal areas mostly on hill slopes, although the crop does best on well drained clayey loam or sandy clay soils of good depth and texture. It is often grown on stony or lateritic soils mainly because comparatively more profitable crops are grown on better and fertile soils.

Varieties

Improved varieties of niger have been recommended for different niger growing states (Table 2).

Table 2. Recommended varieties of Niger.

State	Recommended varieties
Andhra Pradesh	Ootacamund, Gaudaguda Local
Assam	IGP-76
Bihar	No. 5, Ootacmund
Gujarat	IGP-76
Karnataka	No. 71 (KRN-1)
Madhya Pradesh	Ootacmund, No. 5
Maharashtra	IGP-76, N-12-3
Orissa	Phulbani local, IGP-76
Rajasthan	IGP-76
West Bengal	Ootacamund
Dadar, Nagar Haveli	Ootacamund

The yield potential and other important characteristics of these varieties are as follow:

1. Gaudaguda local: A local variety traditionally grown in coastal hilly tract (Vizianagaram district) of Andhra Pradesh. Plant height 140 cm, profusely branched. The crop matures in 95 days and it has average yield potential of 5.70 q/ha. Seed medium bold (4.2 g/1000 seeds) and black in color with 39% oil.

2. IGP-76 (Sahyadri): A selection from the population of N-12-3 variety from Maharashtra. Released in Maharashtra State. Plant height 170 cm. Fruiting begins from 4th to 6th node of main stem. Foliage green, rough due to coarse minute hairs. Flowers bright, canary yellow. Flowering begins after 70-75 days and the crop matures in 100-110 days. Plants bear 35-40 capitula per plant and with 25-27 seeds per capitulum. The average yield potential is 4.75 q/ha. Seeds bold (5g/1000 seeds), dark brown in color.

3. N-12-3: A local variety developed at Niphad (Maharashtra). Very similar to IGP-76. Seeds medium bold (4g/1000 seeds), black in color with 40% oil. Suitable for Vidarbha region of Maharashtra. With yield of about 4 q/ha and maturing in 110 days.

4. No. 5: Developed by selection from local material of Maharashtra. A photo- and thermo-sensitive variety, which matures in 95-105 days. Non-shattering, seeds bold (4.5 g/1000 seeds), black in color with 40% oil. Moderately susceptible to hairy catterpillar. The variety has average yield of 4.50 q/ha.

5. No. 71 (KRN-1): Developed by selection from local material at Raichur in Karnataka, released in 1981 in Karnataka. Plant height is 120 cm, single capitulum bearing, rarely double capitula, about 50 capitula per plant. It has average yield of 4.75 q/ha. Seed is small (3g/1000 seeds), black in color, with 39% oil, resistant to lodging and drought. The crop matures in 95 days.

6. Ootacmund: Developed by selection from indigenous material at Nagpur (Maharashtra), plant height 160 cm, profusely branched, about 75 capitula per plant. A photo- and thermo-sensitive variety, maturing in 110 days. Seeds bold (4.5 g/1000 seeds), black in color with 42% oil and

average yield of 5 q/ha.

7. Phulbani Local: A local cultivar, traditionally grown in Koraput area of Orissa. Plant height is 151 cm. The crop matures in 95-100 days. Seeds are small (3.4 g/1000 seeds), black in color with 40% oil. Suitable for crop rotation with Ragi, cowpea, frenchbean and little millet. It has average yield of 4 q/ha.

Production Technology

Time of Sowing:

Optimum time of sowing for kharif crop is from mid June to early August; whereas rabi crop can be sown in the month of September. Appropriate sowing time for different states is given below:

State	Optimum time of sowing
Madhya Pradesh	-Third week of July
Maharashtra	-June end early-August
Andhra Pradesh	-Second week of August
Bihar	-Second fortnight of August to September
Karnataka	-June-August

Seed treatment, seed rate and method of sowing

The seed treatment with thiram, captan or other mercurial fungicide @ 3g/kg of seed prior to sowing is recommended to protect the crop from seed borne and to some extent soil borne diseases also.

The seed rate depends on the method of sowing. Generally 5-8 kg/ha seed is required. The crop is broadcasted. However, line sowing has been found to be beneficial. The row spacing ranges from 20-30 cm. Close row spacing (20 x 10 cm) has been found beneficial for the States of M.P., Maharashtra and Orissa. While for Andhra Pradesh and Karnataka 30 cm spacing is advantageous. Thinning should be done to maintain the required plant population after about 2 weeks of sowing. Seed must be sown into the moist soil, but the level of available soil moisture, adequate to sustain germination and varies with soil type. A higher level is necessary in sandy soil than in clay. A seed bed temperature of 17-25^{0}C is the optimum, below 10^{0}C impairs germination and above 35^{0}C results in uneven emergence.

Manures and Fertilizers

The crop is mostly cultivated on marginal and sub-marginal lands having low fertility status and is rarely fertilized. It is mostly raised on residual fertility from previous crops. However, experimental evidences are available to show that niger responds to fertilizer application and on the basis of fertilizer trials recommendations are made. In general, 4 tons of farm yard manure and 20:20 NP/ha is recommended for major niger growing states. Half of the nitrogen and full dose of phosphate fertilizer should be applied at sowing and the remaining half of the nitrogen is top dressed at 30-35 days after sowing. Use of bio-fertilizer on niger crop need to be investigated.

Weed control

Niger grows rapidly once the seedling are established. It is a good competitor with weeds, provided pre-planting operations have removed the majority of the weeds. Two weedings are generally practiced. The first weeding should be done at the time of thinning i.e., about 15 days after sowing. If required, second weeding is done before top dressing with nitrogenous fertilizer.

Dodder (*Cuscuta chinesis* L.) has

become, in some area, a problematic parasitic weed. The weed emerges along with the germinating seedlings and parasitises them soon by attaching itself to the host and bringing down the seed yield by 60-65%. As a precautionary measure, seeds should be obtained from cuscuta-free areas and if cuscuta seed is found mixed with niger, sowing should be done after separating the weed seed by sieving.

Trials were conducted at Bhubaneshwar and Paltangi (Orissa) using selective herbicide pronamide as pre-emergence soil treatment on the next day of sowing and as post-emergence foliage treatment at 20 days after sowing. The results revealed that the control of dodder was about 90-99% by application of pronamide without damaging the associate crop of niger. The yield increase was 109-262% over untreated control with pronamide application, the highest (262.5%) being with foliage treatment at 2 kg a.i./ha.

Irrigation

Niger is invariably grown in the rainy season and it is rarely irrigated. There are indications, from the trial at Jabalpur, that niger yields can be doubled under irrigated condition. There is no information on water requirement and consumptive use of water in niger.

Soil moisture stress at seedling stage affects the growth of niger more severely than other stages. Niger can withstand high soil moisture levels. It has shown some tolerance to saline water also.

Pest Control

Among the many insect pests that feed on niger, about half a dozen pests are economically important. A brief description of each pest along with its nature of damage and control schedule is presented in Table 3.

Disease Control

The major diseases that affect the niger crop and their control measures are given in Table

4. Harvesting

The crop should be harvested when the leaves dry up and the head turns blackish in colour. After drying in sun for about a week by stacking on the threshing floor, the crop is threshed by beating with sticks.

Expected yield

With improved varieties and production technology, yield of about 5-7 q/ha may be expected.

Some New Promising Varieties

Some new varieties have been found promising in the All India Coordinated Trials (Table 5). Testing of these varieties in adaptive trials will reveal their suitability for release for general cultivation.

A Scheme for Breeding Synthetic Varieties of Niger

1. Select single plants on phenotypic basis from available material. Collect open pollinated seed. Divide the seed into two halves.

2. Grow replicated progeny rows from one half of the seeds. Record observations and work out parent progeny correlation (half sibs) and determine genetic correlations between pairs of characters and estimate additive and dominance variance. Screen parental selections on the basis of selection indices. Select

plants with good scores and mix their seed (second half of the stored seed of step-1) in equal quantities.

3. Grow the mixed seed in isolation rogue out undesirable plants before flowering. The seed harvested is a synthetic. Divide the seed of synthetic into two parts. Use one part to provide the base population for the next cycle and the other half for testing against local. This should be done from second cycle onwards.

Table 3. Insect pests of niger and their control.

Common name	Latin name	Nature of damage	Management/control
Niger caterpillar	*Perigaea capensis*	The caterpillar (green with purple markings) feeds on leaves and defoliates the plants.	1. Proper weeding of fields reduces hiding places. 2. Dusting with 10% BHC or 5% Carbaryl or 5% Parathion @20 -25 kg/ha or spray Thiodon 35 EC @ 0.07%, Carbaryl 0.1% or Monocrotophos 0.05% or Dichlorvos 0.05%.
Cut worm	*Agrotis ipsilon*	The moth hides under dried twigs and leaves at day and lays eggs on leaves. Larvae attack the crop and eat plants at ground level.	1. Keeping grass bundles or crop refuges in cluster in fields for hiding the caterpillars during day and killing them by dusting 10% BHC or 5% Carbaryl or 5% Parathion dust. 2. Spraying with Carbaryl 0.01% or Monocrotophos 0.05% Dicholorvos 0.05%
Hairy caterpillar	*Diacrisia obliqua*	Major pest in Bihar. The caterpillars remain gregarious underneath leaves in early stages and cause serious loss in yield at 3rd and 4th instar	1. Collection and destruction of egg masses and early instars of caterpillars. 2. Spraying with Dicholorvos 0.05% or Carbaryl (.01% or Monocrotophos 0.05%. 3. Dusting with 10% BHC or 5% Carbaryl or Parathion @ 20-25 kg/ha.
Semilooper	*Achaea janata*	Major pest in Bihar. The caterpillar is slaty in color, moves by making its half loop, causes severe damage in association with other leaf feeders.	1. Same as in niger caterpillar
Surface grasshopper	*Chrotogonus* spp.	These are usually active in early stage of the crop. These grasshoppers being general feeders, also cause appreciable damage to the crop in its early stage.	1. Dusting with BHC 10% or Carbaryl 5% @ 15 kg/ha control the pest in early stage.

Table 4. The major diseases that affect the niger crop and their control measures.

Disease	Symptoms	Control measures
1. Powdery mildew (*Sphaerotheca* spp)	Small cottony spots on leaves which spread on the lamina followed by defoliation of affected plants in severe cases.	When the disease is noticed spray 0.03% solution of Wetsulf or Sulphur. Repeat after 15 days.
2. Cercospora leaf spot (*Cercospora guizeticola*)	Small straw to brown colour spots on leaves when severe, entire leaf may be covered followed by defoliation.	1. Seed treatment with 0.3% Thiram before sowing. 2. Two sprays with 0.2% Zineb at 15 days interval when disease appears.
3. Alternaria leaf spot (*Alternaria* spp.)	Concentric rings, brown in colour with gray centre, oval to circular or irregular in shape.	As above
4. Seed rot (*Rhizotonia bataticola* and *Sclerotium rolfsii*)	The infected seeds become discoloured. The seedling from such seeds die.	Seed treatment with 0.3% Thiram before sowing.
5. Root rot (*Macrophomina bataticola*)	The roots rot. Black dots appear on the roots.	As above

Table 5. Some promising varieties of niger identified for per-release.

Variety	Centre/State	Maturity (in days)	1000 seed Wt (g)	Yield kg/ha
ONS.4	Semiligude (Orissa)	120	3.06	500
CHH.3	Chhindwars (MP)	110	3.61	500
ONS.8	Semiliguda (Orissa)	120	4.23	500
GA.10	"	117	4.27	600
GA.11	"	115	4.20	500
RCR-140	Raichur (Karnataka)	110	3.96	500
CHH.1	Chhindwars (MP)	110	3.96	500
CHH.2	"	100	4.01	500
DHL.1	Dindori (Nasik) (MS)	102	3.99	500
REC.1	Kanke Ranchi (Bihar)	110	4.23	450
BNC.120	"	107	4.14	450

4. Preserve seed from each cycle. After third cycle, conduct trials of seeds from different cycles. When the last and penultimate cycles do not differ significantly, the adaptive peak has reached and no further selection would be fruitful.

   The synthetics besides being high yielders than the locals, can withstand better in any unfavourable conditions.

Problems that Need Immediate Attention and Proposals to Solve them

1. Niger varieties have low yield potential. Intensive efforts should be made to breed varieties with higher yield potential so that the crop becomes more remunerative and farmers get incentive to put

the crop in a better land and pay more attention to its management. Hybridization progrme should be intensified and synthetics and composites of higher yield potential should be developed.

2. The present varieties are based on narrow germplasm. Every effort should be made to collect germplasm from all parts of the country and abroad.

3. At the scientist level, basic information on the plant characteristics are lacking. Studies on genotype-environment interaction, quantitative components of yield, heritability of different characters and pollinating agents should be done.

4. The crop is essentially a cross pollinated one due to self-incompatibility and studies on seed setting should be done.

5. Improved agronomy of the crop for different agro-climatic regions should be worked out and package of practices should be developed.

6. Impact of improved varieties and improved agronomic practices should be demonstrated so that farmers could be convinced of the yield potential and profitability of this crop.

7. Availability of seed is a problem particularly in tribal areas. Production, procurrement and distribution of seed should be taken upon a top priority basis.